

**KHURJA SUPER THERMAL POWER PROJECT
(2 X 660 MW)**

VOLUME – IIB

**TECHNICAL SPECIFICATION
FOR
CONDENSATE POLISHING UNIT**

SPECIFICATION NO.: PE-TS-475-155-A001 REV 00



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA**

714390/2022/PS-PEM-MAX



TITLE:

TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT

2X660 MW KHURJA STPP

BHEL DOCUMENTS NO.: PE-TS-475-155-A001

VOLUME IIB

SECTION –

REV. NO. 00

DATE:28.02.2022 (Typ.)

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PROJECT INFORMATION

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CLAUSE NO.	PROJECT INFORMATION		
			
4.03.00	AIRPORT The nearest commercial airport at Delhi is located at a distance of approximately 120 kms from the project site.		
5.00.00	LAND The land requirement for the project has been estimated as 1400 Acres for Main Plant, Balance of Plant including Coal Handling Plant, Ash Disposal Area, Ash Disposal Pipeline Corridors, Construction Stores & Offices, Laydown & Fabrication Yard, and Labor Colony etc. Land has already been acquired through UPSIDC. Additional patches of required land shall be acquired.		
6.00.00	WATER The Upper Ganga Canal passes near by the Khurja STPP. The makeup water for the project is proposed to be drawn from Upper Ganga Canal at a distance of about 13 kms. Quantity of make-up water required for 2X660MW would be about 3265 Cum/hr with ash water recirculation system and 4415 Cum/hr with once through ash water system. Make-up water is proposed to be used for condenser cooling, ash sluicing, coal dust suppression and other plant processes. Make up water shall be drawn from the canal by constructing suitable intake structures. A Raw Water Reservoir is envisaged. Govt. of UP has conveyed commitment for supply of required quantity of water for the project.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-A-0 PROJECT INFORMATION
			PAGE 2 OF 13

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CLAUSE NO.	 PROJECT INFORMATION 
7.00.00	COAL
7.01.00	Coal Requirement, Availability and Linkage The daily coal requirement for 2x660 MW units shall be about 15261 tonnes based on Gross Calorific Value of 4200 Kcal/kg and 2248 Kcal/KWh unit heat rate, considering 90% plant load factor. Annual coal requirement for the plant shall be about 5.57 MTPA considering PLF of 90% and the same is proposed to be met from Amelia Coal Mine in District Singrauli, Madhya Pradesh, allotted to THDCIL by Ministry of Coal, Govt. of India. THDCIL has entered into an agreement with Nominated Authority, Ministry of Coal for the development of Amelia Coal Mine in Synchronization with the implementation of Khurja STPP. The distance between Khurja STPP plant site and Allotted Amelia Mine at Singrauli, Madhya Pradesh is around 900 Kms.
7.02.00	Coal Transportation The envisaged mode of coal transportation from the coal mine to the power plant is through Indian Railways.
7.03.00	Coal Quality The primary fuel for the main steam generator shall be coal. The coal quality parameters indicated in Annexure-II are to be considered for steam generator design.
8.00.00	Fuel Oil The fuel oils to be used for start-up, coal flame stabilization and low load operation of the steam generator shall be Light Diesel Oils having the characteristics & and High Speed Diesel Oil having the characteristics given at Annexure-III & Annexure-IV respectively.
9.00.00	STEAM GENERATOR TECHNOLOGY The steam generators shall be based on super critical technology, once through type, water tube, direct pulverized coal fired, top supported, balanced draft furnace, single reheat, radiant, dry bottom type, suitable for outdoor installation. The gas path arrangement shall be single pass (Tower type) or two pass type.
10.00.00	FLUE GAS DESULPHURIZATION SYSTEM (FGD) & SCR: The project is envisaged with Flue Gas Desulfurization (FGD) system and Selective Catalytic Reduction (SCR) in compliance to the notification dated 07.12.2015 by Ministry of Environment, Forest & Climate Change. The Tentative Limestone characteristic to be used for design of FGD system shall be as per the characteristic given at Annexure-V .
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11.00.0	POWER EVACUATION SYSTEM Power Generated from each 660 MW unit would be stepped up to the evacuation voltage level through suitably rated Generator Transformer and will be evacuated through 400kV transmission systems. Associated Transmission System (ATS) of the project has already taken-up with PGCIL/CEA/UPPTCL and will be finalized soon.		
12.00.00	METEOROLOGICAL DATA The meteorological data from nearest observatory (Aligarh) is placed at Annexure - VI.		
13.00.00	PLANT WATER SCHEME The Plant water scheme is described below.		
13.01.00	Condenser Cooling (CW) Water System It is proposed to adopt a recirculating type cooling water system with cooling towers for the project. For the re-circulating type CW system it is proposed to supply clarified water as make up. Circulating water from CW pumps to TG area and from TG area to cooling tower will be carried through pipes/ducts. Cooled water from cooling tower will be led to CW pump house through the cold water channel by gravity.		
13.02.00	Equipment Cooling Water (ECW) System (Unit Auxiliaries) The plant auxiliaries of Steam Generator and Turbine Generator shall be cooled by Demineralized (DM) water in a closed circuit. The primary circuit DM water shall be cooled through plate type heat exchangers by Circulating Water tapped from CW system in a secondary circuit. The station auxiliaries such as Air compressors, Compressors of ash handling plant, compressor of mill reject system, FGD & SCR system etc. shall also be cooled by Demineralized (DM) water in a closed circuit. The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system. It is proposed to provide independent primary cooling water circuit for Steam Generator & auxiliaries and TG & its auxiliaries.		
13.03.00	Other Miscellaneous Water Systems CW system blow down water shall be used for the plant service water requirement, dust suppression system of coal handling plant, ash slurry pumps sealing, sealing of Vacuum pumps (if applicable) of Ash Handling plant, FGD system, make-up to fire water system. The service (wash water) water collected from various areas and coal handling plant shall be treated as per requirement and reused. FGD waste water shall be diverted to ash system after neutralization. The quality of clarified water & DM water is given in this sub-section at Annexure-VII-1 & VII-2.		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-A-0 PROJECT INFORMATION
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CLAUSE NO.	एनटीपीसी NTPC	PROJECT INFORMATION	
		VICINITY PLAN	ANNEXURE-I
	UTTAR PRADESH 1 2 3 4 5 SITE FOR PROPOSED KHURJA TPP DANPUR RAILWAY STATION NH-01 GT ROAD UPPER GANGA CANAL 1 - N28 08.946 E77 53.783 2 - N28 08.600 E77 54.215 3 - N28 08.632 E77 54.654 4 - N28 09.426 E77 55.413 5 - N28 09.926 E77 55.230 6 - N28 10.073 E77 54.104 VICINITY PLAN EXHIBIT-1		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-A-0 PROJECT INFORMATION	PAGE 5 OF 13

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	ANNEXURE-II COAL & ASH CHARACTERISTICS PROPOSED COAL CHARACTERISTICS FOR KHURJA (2X660 MW) <table><tr><th>S.No.</th><th>Characteristics (as received basis)</th><th colspan="3">Range of 95 % coal supplies</th><th>Range of 5 % coal supplies</th></tr><tr><th></th><th></th><th>Column - 1 Design</th><th>Column - 2 Worst</th><th>Column - 3 Best</th><th></th></tr><tr><td>10</td><td>PROXIMATE ANALYSIS</td><td></td><td></td><td></td><td></td></tr><tr><td>11</td><td>Total Moisture (%)</td><td>12</td><td>14</td><td>11.0</td><td>11-15</td></tr><tr><td>12</td><td>Ash (%)</td><td>32</td><td>35</td><td>28</td><td>28-36</td></tr><tr><td>13</td><td>Volatile Matter (%)</td><td>24</td><td>23</td><td>25</td><td>22-26</td></tr><tr><td>14</td><td>Fixed Carbon (%)</td><td>32</td><td>28</td><td>36.0</td><td>28-36</td></tr><tr><td>15</td><td>Total (%)</td><td>100</td><td>100</td><td>100</td><td></td></tr><tr><td>20</td><td>ULTIMATE ANALYSIS</td><td></td><td></td><td></td><td></td></tr><tr><td>21</td><td>Carbon (%)</td><td>42.9</td><td>37.81</td><td>48.01</td><td>35.21-45.4</td></tr><tr><td>22</td><td>Hydrogen (%)</td><td>3.2</td><td>2.8</td><td>3.3</td><td>2.9-4.2</td></tr><tr><td>23</td><td>Sulphur (%)</td><td>0.4</td><td>0.6</td><td>0.3</td><td>0.52</td></tr><tr><td>24</td><td>Nitrogen (%)</td><td>1</td><td>0.58</td><td>1.2</td><td>0.86</td></tr><tr><td>25</td><td>Oxygen(%) (By difference)</td><td>8.17</td><td>8.77</td><td>7.7</td><td>0.28</td></tr><tr><td>26</td><td>Carbonates (%)</td><td>0.27</td><td>0.38</td><td>0.45</td><td>0.3</td></tr><tr><td>27</td><td>Phosphorous(%)</td><td>0.06</td><td>0.06</td><td>0.04</td><td>0.04</td></tr><tr><td>28</td><td>Total Moisture (%)</td><td>12</td><td>14</td><td>11.0</td><td>22</td></tr><tr><td>29</td><td>Ash (%)</td><td>32</td><td>35</td><td>28</td><td>39</td></tr><tr><td></td><td>Total</td><td>100</td><td>100</td><td>100</td><td></td></tr><tr><td>2.10</td><td>GCV (Kcal/Kg)</td><td>4200</td><td>3650</td><td>4700</td><td>3600-4800</td></tr><tr><td>2.11</td><td>Hard Grove Index</td><td>60</td><td>52</td><td>65</td><td>50-65</td></tr><tr><td>2.12</td><td>YGP (mg/kg)</td><td>70</td><td>75</td><td>70</td><td>85-70</td></tr><tr><td>30</td><td>ASH ANALYSIS</td><td></td><td></td><td></td><td></td></tr><tr><td>31</td><td>Silica (%)</td><td>58.2</td><td>59.54</td><td>58.00</td><td>58.1-63</td></tr><tr><td>32</td><td>Alumina(%)</td><td>28</td><td>26.3</td><td>27.20</td><td>22.2-26.1</td></tr><tr><td>33</td><td>Iron Oxide (%)</td><td>6.1</td><td>6.4</td><td>7.60</td><td>8.3-11.5</td></tr><tr><td>34</td><td>Titania</td><td>1.85</td><td>1.72</td><td>1.80</td><td>0.82-1.2</td></tr><tr><td>35</td><td>Phosphoric Anhydride (%)</td><td>1.91</td><td>1.57</td><td>0.48</td><td>0.48-1.91</td></tr><tr><td>36</td><td>Lime (%)</td><td>1.7</td><td>3.2</td><td>3.30</td><td>1.78-3.5</td></tr><tr><td>37</td><td>Magnesia (%)</td><td>0.7</td><td>0.6</td><td>0.50</td><td>0.5-0.9</td></tr><tr><td>38</td><td>Sulphuric Anhydride (%)</td><td>0.29</td><td>0.25</td><td>0.40</td><td>0.12-0.43</td></tr><tr><td>39</td><td>Sodium Oxide (%)</td><td>0.3</td><td>0.1</td><td>0.30</td><td>0.1-0.32</td></tr><tr><td>3.10</td><td>Potassium oxide</td><td>0.95</td><td>0.32</td><td>0.42</td><td>0.1-0.43</td></tr><tr><td></td><td>Total</td><td>100</td><td>100.00</td><td>100.00</td><td></td></tr><tr><td>40</td><td>ASH FUSION RANGE</td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>REDUCING ATMOSPHERE</td><td></td><td></td><td></td><td></td></tr><tr><td>41</td><td>Initial Deformation Temp. (oC)</td><td>1200</td><td>1100</td><td>1150</td><td>1200</td></tr><tr><td>42</td><td>Hemispherical Temp. (oC)</td><td>1400</td><td>1300</td><td>1350</td><td>1400</td></tr><tr><td>43</td><td>Fusion Temperature (cC)</td><td>1400</td><td>1400</td><td>1350</td><td>1450</td></tr></table>				S.No.	Characteristics (as received basis)	Range of 95 % coal supplies			Range of 5 % coal supplies			Column - 1 Design	Column - 2 Worst	Column - 3 Best		10	PROXIMATE ANALYSIS					11	Total Moisture (%)	12	14	11.0	11-15	12	Ash (%)	32	35	28	28-36	13	Volatile Matter (%)	24	23	25	22-26	14	Fixed Carbon (%)	32	28	36.0	28-36	15	Total (%)	100	100	100		20	ULTIMATE ANALYSIS					21	Carbon (%)	42.9	37.81	48.01	35.21-45.4	22	Hydrogen (%)	3.2	2.8	3.3	2.9-4.2	23	Sulphur (%)	0.4	0.6	0.3	0.52	24	Nitrogen (%)	1	0.58	1.2	0.86	25	Oxygen(%) (By difference)	8.17	8.77	7.7	0.28	26	Carbonates (%)	0.27	0.38	0.45	0.3	27	Phosphorous(%)	0.06	0.06	0.04	0.04	28	Total Moisture (%)	12	14	11.0	22	29	Ash (%)	32	35	28	39		Total	100	100	100		2.10	GCV (Kcal/Kg)	4200	3650	4700	3600-4800	2.11	Hard Grove Index	60	52	65	50-65	2.12	YGP (mg/kg)	70	75	70	85-70	30	ASH ANALYSIS					31	Silica (%)	58.2	59.54	58.00	58.1-63	32	Alumina(%)	28	26.3	27.20	22.2-26.1	33	Iron Oxide (%)	6.1	6.4	7.60	8.3-11.5	34	Titania	1.85	1.72	1.80	0.82-1.2	35	Phosphoric Anhydride (%)	1.91	1.57	0.48	0.48-1.91	36	Lime (%)	1.7	3.2	3.30	1.78-3.5	37	Magnesia (%)	0.7	0.6	0.50	0.5-0.9	38	Sulphuric Anhydride (%)	0.29	0.25	0.40	0.12-0.43	39	Sodium Oxide (%)	0.3	0.1	0.30	0.1-0.32	3.10	Potassium oxide	0.95	0.32	0.42	0.1-0.43		Total	100	100.00	100.00		40	ASH FUSION RANGE						REDUCING ATMOSPHERE					41	Initial Deformation Temp. 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	ANNEXURE-III LIGHT DIESEL OIL CHARACTERISTICS AS PER IS 15770-2008 <table><tr><th>Characteristics</th><th>LDO</th></tr><tr><td>1. Pour Point (max)</td><td>21 °C & 12°C for Summer and Winter respectively</td></tr><tr><td>2. Kinematic viscosity in centistokes at 40 deg.C</td><td>2.5 to 15.0</td></tr><tr><td>3. Sediment percent by mass (max)</td><td>0.10</td></tr><tr><td>4. Total sulphur percent by mass (max)</td><td>1.5</td></tr><tr><td>5. Ash percentage by mass (max)</td><td>0.02</td></tr><tr><td>6. Carbon residue (Rams bottom) percent by pass (max.)</td><td>1.50</td></tr><tr><td>7. Acidity inorganic</td><td>Nil</td></tr><tr><td>8. Flash point (Min.) - Pensky Martens</td><td>66 deg.C</td></tr><tr><td>9. Copper strip corrosion for 3 hours at 100°C</td><td>Not worse than No. 2</td></tr><tr><td>10. Water content, % by volume (max)</td><td>0.25</td></tr><tr><td>11. GCV(kcal/kg)</td><td>10,000</td></tr></table>			Characteristics	LDO	1. Pour Point (max)	21 °C & 12°C for Summer and Winter respectively	2. Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.0	3. Sediment percent by mass (max)	0.10	4. Total sulphur percent by mass (max)	1.5	5. Ash percentage by mass (max)	0.02	6. Carbon residue (Rams bottom) percent by pass (max.)	1.50	7. Acidity inorganic	Nil	8. Flash point (Min.) - Pensky Martens	66 deg.C	9. Copper strip corrosion for 3 hours at 100°C	Not worse than No. 2	10. Water content, % by volume (max)	0.25	11. GCV(kcal/kg)	10,000
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KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-A-0 PROJECT INFORMATION	PAGE 7 OF 13																								

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	ANNEXURE-IV HIGH SPEED DIESEL OIL CHARACTERISTICS [AS PER IS 1460-2005 (BS-II)]																																																																																																																																										
	<table><tr><th>S. No.</th><th>Particulars</th><th>Unit</th><th>Value</th></tr><tr><td>1.</td><td>PHYSICAL PROPERTIES</td><td></td><td></td></tr><tr><td></td><td>a. Distillation volume recovery @ 350⁰C</td><td>% vol. (min)</td><td>85</td></tr><tr><td></td><td>b. Distillation volume recovery @ 370⁰C</td><td>% vol. (min)</td><td>95</td></tr><tr><td></td><td>c. Kinematic Viscosity @ 40 Degree C</td><td>cSt</td><td>2.0 – 5.0</td></tr><tr><td></td><td>d. Density @ 15 Degree C</td><td>kg/m³</td><td>820 – 860</td></tr><tr><td></td><td>e. Pour Point</td><td></td><td></td></tr><tr><td></td><td>- Summer</td><td>Degree C (max)</td><td>15</td></tr><tr><td></td><td>- Winter</td><td>Degree C (max)</td><td>03</td></tr><tr><td></td><td>f. Cold Filter Plugging Point</td><td></td><td></td></tr><tr><td></td><td>- Summer</td><td>Degree C (max)</td><td>18</td></tr><tr><td></td><td>- Winter</td><td>Degree C (max)</td><td>06</td></tr><tr><td></td><td>g. Flash Point (Abal)</td><td>Degree C (max)</td><td>35</td></tr><tr><td></td><td>h. Lubricity WSD 1.4 @ 60 Degree C</td><td>Microns (max)</td><td>460</td></tr><tr><td>2.</td><td>HEATING VALUE</td><td></td><td></td></tr><tr><td></td><td>a. Higher Heating Value (HHV)</td><td>Kcal/Kg</td><td>11,000</td></tr><tr><td></td><td>b. Lower Heating Value (LHV)</td><td>Kcal/Kg</td><td>10,300</td></tr><tr><td>3.</td><td>ACIDITY</td><td></td><td></td></tr><tr><td></td><td>a. Inorganic</td><td>mg KOH/g</td><td>Nil</td></tr><tr><td></td><td>b. Total</td><td>mg KOH/g</td><td>0.2 (max.)</td></tr><tr><td>4.</td><td>Copper Strip Corrosion 3 hours @100⁰C</td><td>No.</td><td>1 (max)</td></tr><tr><td>5.</td><td>RCR on 10% residue</td><td>% wt.</td><td>0.3 (max)</td></tr><tr><td>6.</td><td>CONTAMINANTS</td><td></td><td></td></tr><tr><td></td><td>a. Ash</td><td>ppm (wt.)</td><td>100 (max)</td></tr><tr><td></td><td>b. Sediments</td><td>% wt</td><td>0.05 (max)</td></tr><tr><td></td><td>c. Total Sulphur</td><td>% wt</td><td>0.05 (max)</td></tr><tr><td></td><td>d. Water Content</td><td>% volume</td><td>0.05 (max)</td></tr><tr><td></td><td>e. Trace Metals</td><td></td><td></td></tr><tr><td></td><td>- Na + K</td><td>ppm (wt)</td><td>0.30 (max)</td></tr><tr><td></td><td>- Vanadium</td><td>ppm (wt)</td><td>0.50 (max)</td></tr><tr><td></td><td>- Lead</td><td>ppm (wt)</td><td>0.50 (max)</td></tr><tr><td></td><td>- Calcium</td><td>ppm (wt)</td><td>2.0</td></tr><tr><td></td><td>- Ni + Zn</td><td>ppm (wt)</td><td>Nil</td></tr><tr><td>7.</td><td>Nitrogen content (FBN)</td><td>% wt.</td><td>0.015</td></tr></table>	S. No.	Particulars	Unit	Value	1.	PHYSICAL PROPERTIES				a. Distillation volume recovery @ 350 ⁰ C	% vol. (min)	85		b. Distillation volume recovery @ 370 ⁰ C	% vol. (min)	95		c. Kinematic Viscosity @ 40 Degree C	cSt	2.0 – 5.0		d. Density @ 15 Degree C	kg/m ³	820 – 860		e. Pour Point				- Summer	Degree C (max)	15		- Winter	Degree C (max)	03		f. Cold Filter Plugging Point				- Summer	Degree C (max)	18		- Winter	Degree C (max)	06		g. Flash Point (Abal)	Degree C (max)	35		h. Lubricity WSD 1.4 @ 60 Degree C	Microns (max)	460	2.	HEATING VALUE				a. Higher Heating Value (HHV)	Kcal/Kg	11,000		b. Lower Heating Value (LHV)	Kcal/Kg	10,300	3.	ACIDITY				a. Inorganic	mg KOH/g	Nil		b. Total	mg KOH/g	0.2 (max.)	4.	Copper Strip Corrosion 3 hours @100 ⁰ C	No.	1 (max)	5.	RCR on 10% residue	% wt.	0.3 (max)	6.	CONTAMINANTS				a. Ash	ppm (wt.)	100 (max)		b. Sediments	% wt	0.05 (max)		c. Total Sulphur	% wt	0.05 (max)		d. Water Content	% volume	0.05 (max)		e. Trace Metals				- Na + K	ppm (wt)	0.30 (max)		- Vanadium	ppm (wt)	0.50 (max)		- Lead	ppm (wt)	0.50 (max)		- Calcium	ppm (wt)	2.0		- Ni + Zn	ppm (wt)	Nil	7.	Nitrogen content (FBN)	% wt.	0.015		
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KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-A-0 PROJECT INFORMATION PAGE 8 OF 13																																																																																																																																								

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	ANNEXURE-V			
	<u>LIMESTONE CHARACTERISTICS</u>			
	Chemical Analysis(% by mass)			
	1.	CaO	%	47-51.0*
	2.	MgO	%	0.9-3.8
	3.	Fe ₂ O ₃	%	0.45-1.0
	4.	Al ₂ O ₃	%	1.19-2.1
	5.	Si ₂ O ₃	%	2.1-4.5
	6.	Mn ₂ O ₃	%	<0.12
	7.	P ₂ O ₅ ,	%	Traces
	8.	Cl ₂	%	<0.015
	9.	Na ₂ O	%	<0.16
	10.	K ₂ O	%	<0.01
	11.	TiO ₂	%	<0.02
	12.	Total Sulphur	%	<0.1
	13.	LOI	%	39.0-41.3
	Physical properties			
	1	Bond Index	kWh/t	13
	2	Granule size		Medium
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-A-0 PROJECT INFORMATION	PAGE 9 OF 13

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	ANNEXURE-VII-1 ANALYSIS OF DM WATER TO BE USED FOR MAKE-UP WATER TO CONDENSER <table><tr><th>S.No</th><th>Characteristics</th><th>Value</th></tr><tr><td>1.</td><td>Silica (Max.)</td><td>0.02 ppm as Sio2</td></tr><tr><td>2.</td><td>Iron as Fe</td><td>Nil</td></tr><tr><td>3.</td><td>Total hardness</td><td>Nil</td></tr><tr><td>4.</td><td>pH value</td><td>6.8 -7.2</td></tr><tr><td>5.</td><td>Conductivity</td><td>Not more than 0.1micro mho/cm excluding the effects of free CO2</td></tr></table>			S.No	Characteristics	Value	1.	Silica (Max.)	0.02 ppm as Sio2	2.	Iron as Fe	Nil	3.	Total hardness	Nil	4.	pH value	6.8 -7.2	5.	Conductivity	Not more than 0.1micro mho/cm excluding the effects of free CO2
S.No	Characteristics	Value																			
1.	Silica (Max.)	0.02 ppm as Sio2																			
2.	Iron as Fe	Nil																			
3.	Total hardness	Nil																			
4.	pH value	6.8 -7.2																			
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KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-A-0 PROJECT INFORMATION																		
			PAGE 12 OF 13																		

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	ANNEXURE-VII-2 DESIGN CLARIFIED WATER ANALYSIS <table><tr><th rowspan="2">S.No</th><th rowspan="2">PARAMETER</th><th rowspan="2">UNIT</th><th>Clarified Water Analysis</th></tr><tr><th>Calculated</th></tr><tr><td>1</td><td>pH .</td><td>-</td><td>6.8-7.3</td></tr><tr><td>2</td><td>Sp. Cond.</td><td>µs/cm</td><td>325</td></tr><tr><td>3</td><td>TDS</td><td>mg/l</td><td>230</td></tr><tr><td>4</td><td>Turbidity</td><td>NTU</td><td>10</td></tr><tr><td>5</td><td>Total hardness</td><td>mg/l As CaCO3</td><td>155</td></tr><tr><td>6</td><td>Calcium</td><td>mg/l As CaCO3</td><td>148.8</td></tr><tr><td>7</td><td>Magnesium</td><td>mg/l As CaCO3</td><td>45</td></tr><tr><td>8</td><td>Sodium</td><td>mg/l CaCO3</td><td>45</td></tr><tr><td>9</td><td>Potassium</td><td></td><td></td></tr><tr><td>10</td><td>P Alkalinity</td><td>mg/l As CaCO3</td><td>-</td></tr><tr><td>11</td><td>M Alkalinity</td><td>mg/l As CaCO3</td><td>125.3</td></tr><tr><td>12</td><td>Chlorides</td><td>mg/l As as CaCO3</td><td>42</td></tr><tr><td>13</td><td>Sulphate</td><td>mg/l As CaCO3</td><td>71.5</td></tr><tr><td>14</td><td>Silica (Total)</td><td>mg/l As SiO2</td><td>21</td></tr><tr><td>15</td><td>Silica (Reactive)</td><td>mg/l As SiO2</td><td>20</td></tr><tr><td>16</td><td>Silica (Collidal)</td><td>mg/l As SiO2</td><td>1</td></tr><tr><td>17</td><td>TOC</td><td>mg/l</td><td>6</td></tr><tr><td>18</td><td>COD</td><td>mg/l</td><td>45</td></tr><tr><td>19</td><td>BOD</td><td>mg/l</td><td>18</td></tr><tr><td>20</td><td>Fe</td><td>mg/l</td><td>-</td></tr></table> Note: Cooling water system is expected to operate at a design minimum cycle of concentration (C.O.C) of about 5 to 5.5.			S.No	PARAMETER	UNIT	Clarified Water Analysis	Calculated	1	pH .	-	6.8-7.3	2	Sp. Cond.	µs/cm	325	3	TDS	mg/l	230	4	Turbidity	NTU	10	5	Total hardness	mg/l As CaCO3	155	6	Calcium	mg/l As CaCO3	148.8	7	Magnesium	mg/l As CaCO3	45	8	Sodium	mg/l CaCO3	45	9	Potassium			10	P Alkalinity	mg/l As CaCO3	-	11	M Alkalinity	mg/l As CaCO3	125.3	12	Chlorides	mg/l As as CaCO3	42	13	Sulphate	mg/l As CaCO3	71.5	14	Silica (Total)	mg/l As SiO2	21	15	Silica (Reactive)	mg/l As SiO2	20	16	Silica (Collidal)	mg/l As SiO2	1	17	TOC	mg/l	6	18	COD	mg/l	45	19	BOD	mg/l	18	20	Fe	mg/l	-
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KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-A-0 PROJECT INFORMATION																																																																																					
			PAGE 13 OF 13																																																																																					

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TITLE:

**TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT****2X660 MW KHURJA STPP**

BHEL DOCUMENTS NO.: PE-TS-475-155-A001

VOLUME IIB

SECTION – I

REV. NO. 00

DATE:

**SECTION - I
SPECIFIC TECHNICAL REQUIREMENTS**

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	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT		BHEL DOCUMENTS NO.: PE-TS-475-155-A001	
	2X660 MW KHURJA STPP		VOLUME IIB	
			SECTION – I	
			REV. NO. 00	DATE:

SPECIFIC TECHNICAL REQUIREMENTS:

- 1.1 This specification is intended to cover design, engineering, manufacture, fabrication, assembly, inspection & testing at vendor's & sub-vendor's works, painting, forwarding, supply and delivery at site including start up and commissioning spares, mandatory spares, properly packed for transportation, unloading / handling and storage at site, in site transportation, assembly, erection and commissioning, trial run, preparation and submission of "As Built" drawings, site testing, carrying out performance guarantee tests at site and handover of **Condensate Polishing Units along with pre filters and common one number external regeneration systems** as per the details in different sections / volumes of this specification for **2X660 MW KHURJA STPP**.

The bidder's scope shall also include any other services, etc. if called for in the succeeding sections of the specification.
- 1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve them of the responsibility of providing such facilities to complete the supply, erection and commissioning of Condensate Polishing Units along with pre filters and common one number external regeneration system within quoted price.
- 1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgment is not in full accordance herewith.
- 1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- 1.5 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.
- 1.6 The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification are subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- 1.7 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Section-III of the specification as "PRE BID CLARIFICATION SCHEDULE". In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of BHEL/Customer shall prevail and shall be complied by the bidder without any commercial and delivery implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by BHEL/ Customer as and when brought to their notice either by the bidder or by BHEL/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.
- 1.8 Deviations, if any, should be very clearly brought out clause by clause in the enclosed schedule; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.
- 1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

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	TITLE: TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT		BHEL DOCUMENTS NO.: PE-TS-475-155-A001	
	2X660 MW KHURJA STPP		VOLUME IIB	
			SECTION – I	
			REV. NO. 00	DATE:

- 1.10 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 Customer as interpreted by BHEL in the relevant context. Please refer GCC/SCC for better clarity.
- 1.11 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.
- 1.12 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.

714390/2022/PS-PEM-MAX



TITLE:

TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT

2X660 MW KHURJA STPP

BHEL DOCUMENTS NO.: PE-TS-475-155-A001

VOLUME IIB

SECTION – IA

REV. NO. 00

DATE:

SPECIFIC TECHNICAL REQUIREMENTS FOR MECHANICAL

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1.0 GENERAL

The Condensate Polishing service vessels along with the pre filters with one (1) common set of external regeneration system and associated accessories shall conform to the technical specification for CONDENSATE POLISHING UNIT (CPU).

2.0 DESIGN CONDITIONS FOR CONDENSATE POLISHING UNIT

There shall be three numbers Condensate polishing service vessels (3X50% capacity) and two numbers back washable type cartridge pre filters (2x50% capacity) for each 660 MW unit. There are two 660 MW units. There shall be one complete set of external regeneration systems common for both the TG units Condensate Polishers.

3.0 BRIEF DESCRIPTION OF THE SYSTEM

The proposed condensate polishing units shall treat the entire condensate of the turbine generator of each unit of power station. The proposed schematic arrangement of the condensate polishing unit 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.

Condensate pre filters followed by polisher unit (service vessels) shall be located in the TG hall of corresponding units. Condensate polisher service vessels alongwith the pre filters will be provided on the discharge side of the high pressure condensate extraction pumps.

The regeneration systems 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.

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 SALIENT DESIGN DATA

4.1 A) NORMAL RUN (PRE FILTERS)

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.

PARAMETERS	INFLUENT	EFFLUENT
Crud, ppb	25	<5

Under the above operating and design flow through pre-filter, the pre-filter service run shall be not less than 30 days (720 hrs) of continuous operation while maintaining the above effluent quality. The effluent values indicated above shall be the maximum values.

B) NORMAL RUN (CONDENSATE POLISHER UNIT (SERVICE VESSEL))

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.

PARAMETERS	INFLUENT	EFFLUENT
Ammonia, ppb	100	---
Total solids, ppb	100	20

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Silica, ppb	30	5 (refer Note 1)
Iron, ppb	50	5
Sodium, ppb	10	2
Chloride, ppb	10	2
pH	8 – 8.5	--
CO ₂	50	5
Crud, ppb	25	<5
Effluent conductivity after removal of ammonia and amines (micro mhos/cm) at 25 deg. C.	--	0.1 or less

Note 1: Silica value shall be 7 ppb as per resin supplier recommendations in case the temperature of the condensate is 50degC & above.

Under the above operating and design flow through the polisher units, the un-ammoniated resins shall not reach “ammonia break-point” in less than 30 days (720 hrs) of continuous operation while maintaining the above effluent quality. Whenever specific conductivity starts increasing from 0.1 micro mhos/cm in the effluent, it is deemed that “ammonia break point” is reached. The effluent values indicated above shall be the maximum values.

4.2 START-UP CONDITION

4.2.1 START-UP CONDITION FOR PRE FILTERS

The condensate quality during start-up operation for Pre filters design shall be as follows:

PARAMETERS INFLUENT	PARAMETERS INFLUENT	PARAMETERS EFFLUENT
Crud, ppb (mostly black oxide of Iron)	1000 maximum	Recovery not less than 99.98% (At the outlet of Pre-Filter)

The pre-filter shall be designed for a crud loading of 1000 ppb. Service length of Pre Filter shall be minimum 50 hours.

4.2.2 START-UP CONDITION FOR CONDENSATE POLISHER UNIT (SERVICE VESSEL)

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

TDS, ppb	2000 maximum
Silica, ppb	150 maximum
Crud, ppb (mostly black oxide of Iron)	1000 maximum

For design purposes, average crud loading shall be considered as 500 ppb. Under such conditions, total crud content of the effluent shall not exceed 150 ppb.

Service run during start – up condition will be 50 hours.

- 4.3 The bed cross section shall be such that the velocity of condensate through it, shall not exceed 2 meters/min at the design flow rate. Internal diameter of the service vessels (excluding the rubber lining) of cylindrical type shall be selected meeting the above mentioned velocity criteria. For vessels of spherical shape, where the bed cross section vary, the diameter (excluding the rubber lining) of the vessel shall be selected considering velocity not exceeding 1.75 meters/minute. The effective depth of the mixed resin bed in the condensate polisher service vessels shall not be less than 1100 mm.
- 4.4 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 or as flakes. In no case, the regeneration levels cannot be lower than the values indicated below:

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- 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.

4.5 Rinse water outlet header of each condensate polishing unit shall be provided with a pressure reducing station with isolating valves, suitably designed to enable the water entry to the condenser hot well which is operating under vacuum. The 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.

4.6 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 described elsewhere in this specification. Pump recirculation with a regulating valve shall be provided for all the pumping system.

5.0 All the design parameters at clause no 4.0 (4.1 to 4.6) of this chapter, i.e. the effluent quality, the design flow, design service length, Chemical consumption for regeneration and Pressure drop across the resin bed in clean and dirty condition at rated design flow shall be guaranteed by the Bidder.

6.0 SYSTEM REQUIREMENT

- 6.1 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 as desired by BHEL/ Customer.
- 6.2 Pre filters (cartridge filter) shall be provided by bidder and same shall be vertical as per system requirement. The bidder shall offer only proven design in successful operation in previous installation at previous installation under similar working condition. Documentary evidence shall be submitted by the bidder during detailed engineering stage as desired by BHEL/ Customer for sub vendor acceptance with respect to pre-filter to establish this requirement.
- 6.3 The bidder shall include inert resin in the system if they feel that it helps in better resin separation.
- 6.4 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.

6.5 Exchange Resins

- a. The bidder shall include with the plant adequate resins for all the condensate polisher service vessels. In addition, separate charge of resin shall also be included for using the resins during commissioning stage of unit. The total number of resin charges to be supplied by bidder shall be as mentioned in scope of supply elsewhere in this specification.
- b. The resins 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 macroporous 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 : Non ionic, compatible with the above resin types.

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

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form.

c. Physical Properties:

- i. Particle size: The resins shall be in the form of spherical beads. All resins, when wet screened with U.S. standard sieves, shall pass through a No.14 sieve no more than 2 percent shall be retained on a no. 16 sieve, and more than 2 percent shall pass through a no. 40 sieve. The particle sizes and densities shall be carefully controlled to facilitate clear separation between the resins during regeneration process.
- ii. Bead Strength: The average force required to fracture individual beads of cation resins in hydrogen form, anion resins in hydroxide form, and the inert resins, shall exceed 350 grams. Not more than 5 percent of the beads tested in each batch shall get fractured by forces less than 200 grams.

d. Chemical Properties:

- i. Total wet volume ion-exchange capacities in equivalents/liter shall not be less than the following:
Cation in hydrogen form: 1.7
Anion in hydroxide form: 0.8
- ii. 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.
- iii. Cation-Anion resin ratio shall be 1.5 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 tank of the external regeneration facility.
- iv. Manufacturer: It is not the intent to pre-select any specific brand name for this application. Resins will be accepted by the BHEL/Customer strictly on their merits. The resins shall be of reputed manufacturer with adequate past record of successful service for not less than 3 years in similar application.
- v. Bidder shall submit all necessary data and information in this regard. Some of these possible resin terms are as follows:
 1. Duolite C -26 TR & A - 161 TR Rohm and Hass 252 C & TRA-900C.
 2. Dowex MSC-1, MSA-1 C grades.
 3. Inert resin – Duolite sec, Rohm & Hass 359 or Dow-buffer beads.

Above listing is by no means exhaustive, and shall not be construed to be a recommendation for their selection for this plant. Bidder shall fully satisfy himself as to the suitability of the resin system selected by him before offering during detail engineering.

- e. 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.

- 6.6 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:

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- (i) Mixed resin Storage vessel : 50%
- (ii) Resin separation vessel : 75%
- (iii) Cation regeneration vessel : 75%
- (iv) Anion regeneration vessel and activated carbon filter : 75%

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.

- 6.7 Design pressure of the condensate Polisher Service Vessels is indicated elsewhere. For all other Pressure vessels, the design pressure shall be at least 8 kg/sq. cm (g).
- 6.8 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.

6.9 Hot water tank (for alkali)

For heating of alkali diluent water, 2x50% electrical heating coil in a tank of mild steel rubber lined construction shall be provided. The capacity of 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 transmitter & indicator etc. The heater shall be controlled by the temperature transmitters provided on the tank. The heaters shall be sized for heating the water from a temperature of 15 deg C to 50 deg C at the outlet. The water shall be heated to the required temperature within 5 hours.

6.10 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 12 meters/hour. Depth of the filter material shall not be less than 1 meter.

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
Uniformity coefficient	:	1.9 or less
Abrasion number	:	70 minimum
Ash	:	8% maximum

Mean particle diameter shall be about 1.5-1.7 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.

6.11 Resin Injection Hopper

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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.

7.0 SCOPE OF SUPPLY (MECHANICAL) - (Please refer P&ID also)

Broad scope of supply (mechanical) for this package is detailed below and as indicated in relevant portion of this specification and same shall be in the scope of the bidder. Please refer Electrical and C&I specifications also for respective scope of Electrical and C&I items and same shall be in the scope of the bidder.

A. SERVICE VESSEL FACILITY

- 1) There shall be three numbers service vessels (3X50%) for each 660 MW TG unit each polishing 50 % of the condensate flow. Each Condensate polisher vessels shall be complete with condensate inlet and outlet connections, pre filter, 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.
- 2) There shall be two numbers (2x50%) back washable type cartridge pre filters at the upstream of condensate polishing service vessels along with all associated piping, valves, instrumentation etc. The pre-filters shall be designed for start-up period, commissioning period as first cleaning step as well as normal continuous operation.
- 3) Two (2) nos. (2X100%) capacity (1Working+1Standby) compressors to supply necessary air for backwashing the Pre filter for each 660 MW TG unit CPU. Each compressor shall be complete with motor, valves, instruments and other required accessories.
- 4) Backwash Waste water from Pre-Filter: Condensate water/ DM Water used for backwashing shall be collected in a RCC Pit with solvent free epoxy coating in Service Vessel area having holding capacity 1.5 times the capacity of Condensate water required for backwashing the one Pre filter and the same shall be pumped to Waste service water sump of ETP by means of two (2) numbers (1Working+1Standby) (2x100%) backwash waste water pumps for each TG unit. Additional pneumatic operated valves, piping, instruments, fittings etc. for this system as required shall also be in Bidder's scope for pre-filter facility.
- 5) External resin traps at the outlet of each of the polisher vessel, designed for in-place manual back washing.
- 6) Condensate inlet and outlet headers for each installation with pipe connections to each condensate polisher vessels.
- 7) Resin transfer headers and pipe lines connecting the external regeneration facilities to the condensate polisher vessels of each installation.

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- 8) Rinse water outlet headers from condensate polisher vessels of each installation up to the hotwell.
- 9) A common drain header for the condensate polisher service vessels of each unit up to the hotwell.
- 10) Gland sealing water piping for the valves in the rinse water line.
- 11) Emergency bypass system as mentioned in P&ID for the total system (i.e. Pre filters and Service Vessel) shall also be provided by the bidder. This emergency bypass system will open automatically in case of pressure differential exceeding 3.5 Kg/cm².
- 12) Emergency bypass between the condensate influent and effluent headers for condensate polisher vessels with a modulating automatic butterfly type control valve (double flanged/ lugged wafer), butterfly (lugged wafer) isolation valves (resilient material seated, to ensure bubble tight shut off) on both sides of control valve. The control valve can be of 2x50% or 1x100% configuration to achieve proper control under all operating conditions. Isolation valve shall be provided with geared operators for manual operation. 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% of flow when both working vessels are taken out of service. When condensate temperature exceeds 60 degree Celsius 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.
- 13) Two (2) nos. (2X100%) (1Working+1Standby) Pre-Filter Backwash Transfer Pumps with electric motor drives for Backwash Waste Transfer Sump along with its accessories.
- 14) At the design flow rate, the pressure drop in clean condition across the Pre filters including polisher service vessels shall not exceed 2.1 Kg/sq.cm. This pressure drop shall include losses due to pre filters, service vessel, entrance and exit nozzles, distributors, under drains, resins and the effluent resin traps. Maximum pressure drop under dirty conditions across the Pre filters and service vessels including pre filters, service vessel, entrance and exit nozzles, distributors, under drains, resins and the effluent resin traps will be restricted to 3.5 kg/sq.cm including the pressure drop across effluent resin traps
- 15) Two (2) nos. (2X100%) capacity (1Working+1Standby) oil free type, air blowers to supply necessary air for mixing the resins in the service vessels for each 660 MW TG unit CPU. 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.
- 16) All necessary valves and fittings for the installations with actuators necessary for their remote operation. These shall include suitable fool proof arrangement to prevent accidental over pressurization of the resin transfer pipeline, DM water line, DM waste water line, Blower line, instrument airline and regeneration facilities connected to it which are designed for pressure much lower than that of the polisher service vessels.
- 17) All necessary drains, vents and sampling points, with valves as specified and as required.
- 18) Complete Instrumentation and Control for automatic operation.
- 19) Nine (9) complete charges of resins. One charge will be defined as cation, anion & inert resin (if applicable) requirement for one service vessel. Further one Year's topping requirements or 10 % of first fill quantity, whichever is more shall also be supplied by bidder.
- 20) 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.
- 21) All the piping, valves, fitting, instruments, accessories etc. used in service vessel area (shall be based on the actual pressure rating to meet the system requirements but not less than 300 lb class) and shall be considered as high pressure side. Minimum instrumentation required as per enclosed P & ID included in this tender specification.
- 22) Operating platforms, ladders, supports and other structural works for each Condensate Polisher vessels and each pre filter to facilitate accessibility for operation and other equipment etc. shall be provided by the bidder

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- 23) All the analysers shall be capable for continuous operation at the temperature up to 55deg C.
- 24) All Sodium and silica analysers shall be provided by bidder in air conditioned panel/ cabinet. Air conditioning equipment required for sodium and silica analysers panel shall be in bidder's scope.

B. REGENERATION SYSTEM

Regeneration area shall be considered as low pressure area. One (1) common external regeneration systems for regeneration of the ion exchange resins from the condensate polishers for all the turbogenerator units shall be provided by bidder. One (1) common facility for regeneration of the ion-exchange resins from the condensate polishers of all the turbo-generator units shall be provided utilizing three (3) tank concepts and consisting of following:

- 1) Resin Separation & Cation Regeneration Vessel with internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs, manholes etc. and all other accessories as required.
- 2) Anion resin regeneration vessel with internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs, manholes etc. and all other accessories as required.
- 3) Two (2) Numbers Mixed resin storage vessels with internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs, manholes etc. and all other accessories as required.
- 4) The regeneration vessels arrangement shall be as per the supplier recommendation/ process utilising three (3) tank concept as defined above. However, there shall be two numbers identical mixed resin storage vessels. If the process envisage the chemical regeneration arrangement in mixed resin storage vessel then additional mixed resin storage should also have chemical regeneration arrangement.
- 5) All internals, fittings and appurtenances for these vessels.
- 6) Common waste effluent header with one (1) number resin trap, total one (1) number for station designed for in place manual backwashing.
- 7) One (1) number Resin injection hopper, total one (1) number for station complete with water ejector system for resin make up. Resin Make up hopper shall be sized to handle up to minimum 150 liters of as received new resins.
- 8) Two (2) nos. (2X100%) (1Working+1Standby) 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 etc all mounted on a single base.
- 9) Two (2) nos. (2X100%) (1Working+1Standby) DM water pumps with electric motor drives for water supply for chemical preparation, dilution water supply during dosing & regeneration etc. These DM water pumps will take suction from DM water storage tanks.
- 10) Two (2) nos. (2X100%) (1Working+1Standby) DM water pumps with electric motor drives for water supply and transfer of resin from service vessel to regeneration vessels and vice – versa. These DM water pumps will take suction from DM water storage tanks.

Waste water generated during regeneration: The DM water used for resin transfer operations shall be collected in a RCC pit with solvent free epoxy coating in regeneration area having holding capacity 1.5 times the capacity of DM water required for transferring the resins or 50 m³ (min) and the same shall be pumped to employer's CW channel for recycle/re-use by means of two (2) numbers (1W+1S) (2x100%) of waste water recycle pumps. The material of construction of pumps shall be SS-316 (casing, impeller and shaft). Additional pneumatic operated valves, piping, instruments, fittings etc. for this system as required shall also be in Bidder's scope for service vessel and regeneration facility.

- 11) One (1) number alkali preparation tank complete with electrically driven stirrer, dissolving basket, carbon dioxide absorber, overflow seal, integral pipe works, valves, instruments, ladders, platforms, lifting lugs etc. and all other required accessories.

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- 12) One (1) number alkali day tank complete with electrically driven stirrer, dissolving basket, carbon dioxide absorber, overflow seal, integral pipe works, valves, instruments, ladders, platforms, lifting lugs etc. and all other required accessories.
- 13) Two (2) numbers acid measuring tank, complete with fume absorber, overflow seal, integral pipe works, valves, instruments, ladders, platforms, lifting lugs etc. and all other required accessories.
- 14) One (1) number lime tank, complete with electrically driven stirrer, dissolving basket, carbon dioxide absorber, overflow seal, integral pipe works, valves, instruments, ladders, platforms, lifting lugs etc. and all other required accessories.
- 15) One (1) no. Activated carbon filter for alkali complete with internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs, carbon trap etc. and all other accessories as required.
- 16) One (1) no. hot water tank complete with heaters (2X50%), internals, integral pipe works, valves, instruments, ladders, platforms, lifting lugs etc. and all other accessories as required. Hot water tank shall be adequately insulated to restrict the outside temperature to 60 deg. C with 25 mm thick (mm) mineral wool insulation on all external surfaces, covered with 16 gauge galvanized iron sheet jacketing.
- 17) Two (2) nos. (2x100%) (1Working+1Standby) alkali solution transfer-cum-recirculation pumps of suitable capacity and head to meet the system requirements. These pumps shall be provided with a pulsation dampener at the outlet header of each pump along with necessary valves & instrumentation & accessories.
- 18) Two (2) nos. (2x100%) (1Working+1Standby) Acid dosing pumps for dosing hydrochloric acid (30% conc.) along with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump all other required accessories etc.
- 19) Two (2) nos. (2x100%) (1Working+1Standby) Alkali dosing pumps for dosing NaOH (48% conc.) along with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump all other required accessories etc.
- 20) All integral pipe works, valves, internals, fittings, hangers, supports and appurtenances etc for these vessels.
- 21) Safety equipment as indicated elsewhere in the specification.
- 22) There shall be Bulk Acid storage tanks (two numbers) and Bulk Alkali storage tanks (two numbers) along with acid unloading pumps (two numbers) and alkali unloading pumps (two numbers) for CPU Regeneration system and the same shall be under bidder's scope. Inlet piping from each bulk acid and bulk alkali storage tanks to regeneration area is in bidder's scope. Other details have been attached elsewhere in the tender technical specification
- 23) There shall be two numbers DM water storage tanks and the same shall be under bidder's scope. DM water inlet piping from each DM water storage tanks to each CPU resin transfer pumps and regeneration pumps shall be in bidder's scope. Other details have been attached elsewhere in the tender technical specification These Two (2) numbers of DM Tanks shall be provided and the tanks shall be of vertical cylindrical type in Mild steel construction internally painted with epoxy. The design features of the tanks & accessories shall be as per IS: 803. However, minimum thickness of shell plate, bottom plate and roof plate shall be 8 mm, 10 mm and 6 mm receptively. The tanks shall be provided with CO2 absorber and over flow seal pit. capacity of each tank shall be equivalent to 1.5 times the DM water required for one (1) regeneration operation of working vessels of one (1) TG unit including resin transfer operations from Condensate Polishing Plant to regeneration plant and regeneration plant to Condensate Polishing Plant and for preparation of chemicals for one (1) regeneration of working vessels of one (1) TG unit and also for back washing of Pre-Filters of one TG unit. However, the capacity of each DM water storage tank shall be 600 m3 minimum. Water inlet pipe shall led up to the bottom of DM tanks (preferably through perforated pipe) to avoid turbulence/agitation
- 24) Total two (2) numbers mixing tee for Acid and alkali dosing facility.
- 25) Grouting material required for equipment grouting.

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- 26) Neutralising pit of RCC construction with acid/alkali resistant tiles shall be provided to receive drains from the regeneration, bidder shall design the system so that pit shall be provided in two (2) sections and each section shall have a holding capacity of 1.5 times the waste effluent from each regeneration of each vessel. RCC Civil Scope shall be in the scope of BHEL.
- 27) Total three (3) numbers the waste recirculation/disposal pumps for Neutralising pit.

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 seamless carbon steel ASTM A-106 Gr B (OD 355.6 X 9.27 mm thick).
- 2) Service vessel outlet header shall be seamless carbon steel ASTM A-106 Gr B (OD 355.6 X 9.27 mm thick).
- 3) Rinse water outlet piping to Condenser Hotwell shall be seamless carbon steel ASTM A 106 Gr -B (OD 168.3 x 7.11 mm). The distance between CPU service vessel to condenser Hotwell shall be considered as 200 meters for each unit and this piping shall also be in bidder's scope.
- 4) The material of piping handling Pre filter backwash waste water shall be of stainless steel type 304 Sch.40 (Min). The piping distance between farthest service vessel and waste service water sump of ETP 1100 meters. Other details have been attached elsewhere in the tender technical specification. However, Pipe Length of 300 meters only is in Bidder's Scope, Total Pipe Length of 1100 meters is provided to calculate the Pump Head and other details accordingly.
- 5) Resin transfer piping shall be minimum 80 NB and of SS 304 Sch 40 (minimum) seamless. One way piping distance for resin Transfer Piping between farthest service vessel and regeneration area shall be 450 meters. Complete resin transfer piping shall be in bidder's scope. Other details have been attached elsewhere in the tender technical specification.
- 6) Piping handling DM water shall be Stainless steel SS 304 Schedule 40 (minimum). One way piping distance for DM water piping between farthest service vessel and regeneration area shall be 450 meters. Complete DM water piping shall be in bidder's scope. Other details have been attached elsewhere in the tender technical specification
- 7) The material of piping handling DM waste water generated during regeneration shall be of stainless steel type 304 Sch.40 (Min). The piping distance from CPU regeneration area to CW channel is 750 meters. Other details have been attached elsewhere in the tender technical specification. However, Pipe Length of 100 meters only is in Bidder's Scope, Total Pipe Length of 750 meters is provided to calculate the Pump Head and other details accordingly.
- 8) Pipeline handling Alkali shall be of stainless steel type 316 Sch.10 (minimum).
- 9) Piping for Acid service (HCl) shall be carbon steel Poly propylene lined/CPVC as per ASTM F441(Sch.80).
- 10) Piping for air service shall be shall be of hot dip galvanized (heavy grade) steel.
- 11) Piping for instrument air shall be hot dip galvanized (heavy grade) steel.
- 12) All piping within each of the above skids/equipment shall also be in bidder's scope.
- 13) There shall be a Neutralisation Pit (N pit) for CPU regeneration and the same shall be under BHEL scope. The regeneration waste from CPU regeneration area shall be led to this N-pit via drain.

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- 14) Service water piping in CPU service vessel area (used for cooling of condensate sample), Service water piping in each CPU regeneration area, instrument air piping for each CPU service vessel area & regeneration area and service air piping for each CPU service vessel area & regeneration area, potable water piping for each CPU regeneration area etc. shall also be in bidder's scope.
- 15) Similarly, all piping between each external regeneration facility and the skids for chemical dosing and acid/alkali preparation 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.
- 16) 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.
- 17) 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.
- 18) 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.
- 19) The resin transfer pipeline shall be sized for a flow velocity of between 2.3 and 3.0 meters/sec. For other services, design criteria shall be generally in line with design philosophy described elsewhere in technical specification.
- 20) 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.
- 21) All lined vessel connections and connections in unlined vessels (25 NB and larger) shall be flanged to ANSI 125 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.
- 22) 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.
- 23) Piping distance from Neutralisation Pit (N pit) for CPU regeneration to Bottom Ash Slurry Sump shall be 750 meters. However, Pipe Length of 100 meters only is in Bidder's Scope, Total Pipe Length of 750 meters is provided to calculate the Pump Head and other details accordingly
- 24) 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.
- 25) The condensate pipeline shall be sized for a flow velocity between 3 and 5 m/sec.

D. VALVES:

All the valves in service vessel area and regeneration area as indicated in P&ID and to meet the system requirement as mentioned elsewhere in the specification shall be in the bidder's scope of supply.

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- i. All valves shall be designed as per applicable AWWA/BID/BS or equivalent international standard / codes.
- ii. The isolation valves on the resin transfer line shall be of eccentric plug type/ball valve (full bore type) of stainless steel construction (SS 316).
- iii. Emergency bypass control valve shall be of double flanged/ lugged wafer butterfly type. Isolation valves of wafer (lugged) type butterfly valves (resilient material seated, to ensure bubble-tight shut off) shall be provided on the upstream and downstream sides of the control valve. Other Butterfly valves in Service Vessel Area shall be 300lb class (minimum) and end connection shall be lugged wafer (min.).
- iv. The material of construction of valves handling condensate in service vessel area shall be SS-316 (for body, disc and shaft). Seat/seat rings should be of Teflon/titanium back up rings. Seal shall be of Teflon or equivalent.
- v. Isolation Valves handling Acid(HCL), Alkali, Ammonia etc shall be diaphragm type in MSRL (Mild Steel Rubber lined) construction.
- vi. Isolation Valves handling DM water shall be Butterfly or gate or globe type and shall be of SS -304 construction.
- vii. Non-return valves shall be constructed of SS-304 for DM Water & SS316 for alkali. For Hydrochloric acid, non-return valve shall be dual plate/ swing check/ lift ball check type of suitable material or as per manufacturer's standard practice.
- viii. All valves in service vessels area where pressure may attain same as service vessel shall be designed for 300 lb class minimum.

E. Pressure Vessels, Atmospheric tanks & Miscellaneous Items

- i. Design of all vertical cylindrical atmospheric storage tanks containing water, acid, alkali and other chemicals shall conform to IS: 803.
- ii. 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.
- iii. 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 torospherical type.
- iv. All the atmospheric tanks shall have sufficient free board above the "Level High /Normal Level" as the case may be. The overflow level shall be kept at least 20 cm or 10% of vessel height above the "Level High /Normal Level" for all the tank except for the DM tanks for which a minimum height of 300 mm shall be provided over the "High Level". Further, a minimum 100 mm free board shall be provided above the top of overflow level to the top of tank.
- v. 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 torospherical type.

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- vi. 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 atleast 6 mm thickness.
- vii. All pressure vessels shall be fabricated from carbon steel plates to SA-515 / 516 Gr. 70 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.
- viii. Vessel internals shall meet the following requirements:
 - 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 Hastelloy-B.
 - Under drains: Same as above 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 porous septanurese screen, fully supported by subway grid or equal).
 - All internal fasteners shall be of SS-316 and heavy duty locknuts shall be used throughout.
- ix. 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 shall be of rubber lined steel construction and 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.
- x. Carbon Trap (for ACF): Outlet of each Activated Carbon filler on Carbon trap (media trap) shall be provided by bidder as per manufacturer standard.

F. ADDITIONAL REQUIREMENT

- 1) Operating platforms, permanent ladders (not rugs), supports and other structural works for each vessels, tanks, valves etc. 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) Painting requirement as indicated in Section- II are bare minimum. 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.
- 5) Start-up and commissioning spares as required.
- 6) Mandatory spares as indicated in Annexure – V.
- 7) Wherever pipe racks are not available, pipes shall run on pedestals or below ground. All auxiliary structure & fixing items such as U clamps, nuts, bolts, channels, insert plates etc. required to lay the

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pipes on pedestals shall be in bidder's scope of work. Coating, wrapping and protection required for buried pipes shall also be in bidder's scope of work.

- 8) For calculating the required pump head for pump selection, at least 10% margin shall be taken over the pipe friction losses and static head shall be calculated from the minimum water level of the tank/ sump/ reservoir from which the pumps draw water. However, the static head to be consider shall be 15 meters (minimum).
- 9) All the first fill and one Year's topping requirements of consumable such as reagent (as required for all analysers etc.), greases, oil, lubricants, servo fluids/control fluids, gases and etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be in the scope of the bidder. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.
- 10) The Condensate Polisher Service vessels, blowers etc. will be located indoor near corresponding units. Regeneration system equipment shall be kept under shed and one-meter height parapet wall shall be provided around this shed. Effluent re-circulation/disposal pumps, Bulk chemical storage tanks, unloading transfer pumps and DM water storage tanks for regeneration system etc. shall be kept in open area.
- 11) MCC shall be located in CPU regeneration area.
- 12) Space available for CPU service Vessels area & CPU Regeneration area (Vide ref. Dwg. No. PE-DG-475-100-M003 & General Layout Plan Dwg. No. 9915-370-301-PVC-B-034) are attached in this specification. Bidder to accommodate their equipment within the space provided. Further the location of other facilities has also been indicated in Dwg. No. 9915-370-301-PVC-B-034 attached in this specification. The location of DM waste water pit shall be in CPU regeneration area.
- 13) Any statutory requirement / clearance required for the packages from government / local body shall be in bidder's scope.
- 14) 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.
- 15) 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.
- 16) KKS numbering as per BHEL/ Customer requirement shall be provided by the Bidder during detailed engineering stage without any commercial/ delivery implication to BHEL.
- 17) 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.
- 18) 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.
- 19) 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

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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”.

- 20) All the equipment, piping etc. shall be assembled on two (2) structural steel skids one (1) for acid and one (1) 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. Each equipment skid shall be provided with suitable lifting lugs, eye bolts etc. to facilitate erection and maintenance.
- 21) Wherever any design standard mentioned in this specification, bidder to consider latest standard for designing of all the items.
- 22) 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 minimised by the use of pipe headers wherever possible. Alkali solution preparation, alkali dosing and acid dosing system are a recommended listing of the main equipment skids to be furnished under this package. The bidder may also supply and install this equipment independently instead of assembling the skids.
- 23) Chain Pulley block/ Electric Hoist shall be in bidder's scope in line with selection criteria mentioned in section IIA.

8.0 CONTROL & OPERATION

8.1 General

- 8.1.1 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 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.
- 8.1.2 It shall be possible to operate 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.
- 8.1.3 '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.
- 8.1.4 '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.
- 8.1.5 On control system failure, it shall be possible to operate the valves by means of manual operator of solenoid valves too.
- 8.1.6 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.
- 8.1.7 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.
- 8.1.8 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 setting from inside the panel.
- 8.1.9 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/control panel.

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- 8.1.10 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.
- 8.1.11 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.
- 8.1.12 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.
- 8.1.13 Wherever standby equipments are provided, it shall be possible to select each of the drive on 'standby' duty.
- 8.1.14 The detailed logic for the sequence and for each of the drive shall be subject to the BHEL/Customer's approval.
- 8.1.15 Start, progress and stop of each of the sequence shall be annunciated.
- 8.1.16 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.
- 8.1.17 Details of control system specification and configuration details shall be as elaborated in the relevant C&I section II of the technical specification

8.2 Control & Operation of the Condensate Polishing Unit

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

- (1) Standby (Applicable for where spare service vessel (s) are provided)
- (2) Service
- (3) Isolation from service.
- (4) Exhausted Resin Transfer from CPU vessel to Regeneration plant.
- (5) Regenerated Resin Transfer from Regeneration plant to CPU vessel
- (6) Rinse mode.

Each mode or operation is described as below:

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

Service mode:

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- (1) Service flow rate for each polishing vessel shall be monitored. 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) High differential pressure across the influent and effluent headers will cause an 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) 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 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 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) The differential pressure (DP) across the inlet and outlet headers of CPU services vessels shall be measured and the bypass control valve will also modulate as per the DP. The bypass system shall also be actuated upon high condensate temperature.

Isolation from Service:

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

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) The transfer of resin from the service vessel shall include operations such as isolation of the service vessel, hydraulic transfer of the resin to the external regeneration system (resin separation vessel) and the complete drain down of the service vessel.
- (3) The sequence of "Resin Transfer" operation shall be initiated from the Control system in panel of CPP and shall be controlled in the regeneration Panel.
- (4) The completion of the operation shall be exhibited in the panel.

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 vessel of Condensate Polishing plant.
- (2) This shall be initiated by the operator from the control panel of condensate polishing plant of the

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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 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.

Rinse 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 mode shall be a manually initiated full automatic sequence. This sequence shall include the rinse down step using condensate at a suitable 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) Cation conductivity values shall be monitored and interlocked to prevent advancing of the automatic sequence until the rinse down is complete.
- (5) 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.

8.3 External Regeneration Control System

- 8.3.1 A manually initiated automatic sequence for physical cleaning and chemical regeneration of the resin shall be provided. Control for chemical dosing system and alkali preparation facility shall also be provided in it.
- 8.3.2 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.
- 8.3.3 The chemical regeneration is a many step sequence. This will include hydraulic reclassification of the resins and the transfer of the resins to the respective regeneration vessels. 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, 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.

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- 8.3.4 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.
- 8.3.5 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 Balance of 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.
- 8.3.6 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.
- 8.3.7 Demineralized water shall be used throughout the regeneration process for backwashing, diluting the regenerant, rinsing and resin transfer.
- 8.3.8 A conical bottom hopper having a water ejector will be used for resin make-up.
- 8.3.9 At any time only one of the sequence shall be in progress.
- 8.3.10 Interlocks**
- All interlocks for safe operation of the plant shall be provided. They shall specifically include the following as minimum requirement.
 - Service vessels can be back in service, only after they have been pressurized.
 - Service vessels can be taken up for resin transfer only after they have been completely isolated from the condensate system and depressurized.
 - Resin can be transferred to and from only one service vessel at a time.
 - Resin transfer between the service and the regeneration skids shall be permitted only when the receiving vessel is initially empty.
 - 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.
 - 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. 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.
 - 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.
 - 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.
 - Adequate diluent water flow shall be established before starting of the ejectors/ dosing pumps for acid and alkali.
 - The immersion heater in the hot water tank can be put on only when there is adequate water level in the tank.
 - CPU service vessel inlet & isolate valves will close automatically in the event of tripping of condensate extraction pump.

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9.0 SCOPE OF SUPPLY (ELECTRICAL)

Complete electrical as per specification / details indicated in Section IB & IIB.

10.0 SCOPE OF SUPPLY (C&I)

Complete C&I as per specification / details indicated in Section IC & IIC.

11.0 SCOPE OF SUPPLY (CIVIL)

Total Civil work is in BHEL Scope of work; however Civil Input drawing shall be provided by bidder.

12.0 SCOPE OF SERVICES

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

- (i) Unloading, Storage, handling and transportation at site.
- (ii) 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 MS 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 or AWWA C 203.
- (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) Erection and Commissioning of entire Condensate polishing plant.
- (v) Arrangement of all lubricants, instruments, reagents for carrying out trial run, commissioning and PG test.
- (vi) Monitoring gadgets, instruments and equipment's required for maintenance (till PG test & Plant Hand over).
- (vii) During FAT of DCS, bidder will depute his concerned representative for technical support as and when required by customer / BHEL.
- (viii) All personnel required during maintenance and PG test.
- (ix) Trial run for requisite period.
- (x) Performance testing.
- (xi) Painting of all equipment within scope of supply as per Surface preparation & painting specification.
- (xii) Bidder shall also provide one final coat additionally of same DFT as specified in tender specification at site after completion of erection of each equipment / item.
- (xiii) Preparation of civil assignment drawings i.e. pedestals details; insert plates / embedment's plates required for supporting pipes and equipment etc. and review of civil drawing prepared by BHEL based on civil assignment drawing of bidder. In case any modification is required in the civil work already done based on civil inputs given by vendor, rework shall be done at the cost and risk of the vendor.
- (xiv) Preparation & submission of all drawings & documents as per drawing/documents requirement & distribution schedule enclosed as Annexure-IV.

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- (xv) Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.
- (xvi) All other facilities/ services as described in section on site services in specification and related to Condensate polishing system scope of work.
- (xvii) Relevant requirements as per GTR, GCC, ECC & SCC.
- (xviii) AMC requirement for analyser instruments is in bidder's scope and shall be governed as per Section IC & IIC.
- (xix) Any other service required for making the installation complete in all respect within battery limits and for satisfactory erection & commissioning of the system as well as to meet any statutory requirement relevant to the package, unless specifically EXCLUDED from scope of services.

13.0 TERMINAL POINTS

13.1 CONDENSATE POLISHING PLANT - SERVICE VESSEL AREA

- (i) Service vessel inlet – (OD 355.6 X 9.27 mm thick, ASTM A-106 Gr-B) - Single piping connection at 5 meters from nearest Vessel of each TG Unit. Further piping is in bidder's scope.
- (ii) Service vessel outlet – (OD 355.6 X 9.27 mm thick, ASTM A-106 Gr-B) - Single piping connection at 5 meters from nearest Vessel of each TG Unit. Further piping is in bidder's scope.
- (iii) Rinse water outlet- Rinse water outlet piping (OD 168.3 x 7.11 mm, ASTM A-106 Gr-B) till condensate return tank for each unit is in the scope of bidder.
- (iv) 25 NB connection of Instrument air supply at 5 to 7 kg/cm² (g) – At 5 meter distance from service vessel area. Further piping is in bidder's scope.
- (v) 25 NB connection of Service air supply at 5 to 7 kg/cm² (g) – At 5 meter distance from service vessel area. Further piping is in bidder's scope (if required).
- (vi) Gland sealing water supply & analyser rack cooling water supply piping - Service water connection (50 NB) at 5 meter distance from service vessel area. Further piping is in bidder's scope.

13.2 EXTERNAL REGENERATION AREA

- (i) 25 NB Instrument air supply at 5 to 7 kg/cm² (g) – At 5 meter distance from the regeneration building at 0.5 meters above FGL at end closer to pie rack/ pedestal. Further piping is in bidder's scope.
- (ii) 25 NB Service air supply at 5 to 7 kg/cm² (g) - At 5 meter distance from the regeneration building at 0.5 meters above FGL at end closer to pie rack/ pedestal. Further piping is in bidder's scope (if required).
- (iii) Service water (50 NB) - At 30 meter distance from the regeneration building at 0.5 meters above FGL at end closer to pie rack/ pedestal. Further piping is in bidder's scope.
- (iv) Potable water (25 NB) - At 30 meter distance from the regeneration building at 0.5 meters above FGL at end closer to pie rack/ pedestal. Further piping is in bidder's scope.

14.0 EXCLUSIONS

- 14.1 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.

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- 14.2 Pipe Trestle from CPU Service Vessel area to Regeneration area, pipe trestle between service vessel area (pre-filter backwash waste water sump) up to terminal point, pipe trestle from CPU Regeneration area for Resin Transfer waste water sump up to terminal point, pipe trestle for N-Pit waste water sump up to terminal point are not in bidder's scope. 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, DM waste water piping, resin transfer piping, instrument air piping, service air piping, service water piping, potable water piping, pre-filter backwash waste transfer piping etc.) are in bidder's scope.
- 14.3 Instrument air & service air up to terminal points.
- 14.4 All chemicals except lubricants, reagents, monitoring gadgets required for pre- commissioning, commissioning, trial run and PG test.
- 14.5 Air conditioning, ventilation & firefighting facilities.
- 14.6 Other exclusions are mentioned in the electrical & C&I parts of this specification.
- 14.7 Service water & DM water up to terminal points.

15.0 QUALITY PLAN(QP) REQUIREMENTS

- 15.1 Minimum QP requirements are specified as ANNEXURE -I. However, any additional comments as given by BHEL/Customer shall be adhered by the bidder without any commercial & delivery implication to BHEL. 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. The cost of third party inspection for all components shall also be in bidder's scope.

16.0 SUB-VENDOR ITEMS

The sub vendor list (Annexure- II) enclosed is indicative only and is subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.

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.

- Documentation to show that the equipment /system has been supplied for a plant of similar or higher capacity.
- End user performance certificate that the equipment/system has been operating satisfactorily for minimum one year as on the scheduled date of bid opening.

Bidder to assess the capability of their proposed sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them.

For approval of Sub vendor list proposed by bidder, meetings shall be arranged by BHEL in Customer office for which bidder representative along with sub supplier as desired by BHEL/Customer will attend the meetings.

17.0 DESIGN/ CONSTRUCTION

In addition to the requirements of Section I & II the following shall also be complied under scope of this specification.

The P&I diagram is enclosed herein in this section for bidders 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.

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18.0 SPARES

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

18.1 MANDATORY SPARES

- 1) The list of mandatory spares considered essential by the BHEL & Customer is indicated in Annexure V. The bidder shall indicate the prices for each and every item (except for items not applicable to the bidder's design) in the 'Schedule of mandatory Spares' whether or not he considers it necessary for the BHEL & Customer to have such spares. If the bidder fails to comply with the above or fails to quote the price of any spare item, the cost of such spares shall be deemed to be included in the contract price. The bidder shall furnish the population per unit of each item. Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.
- 2) BHEL reserves the right to buy any or all the mandatory spares parts.
- 3) The prices of mandatory spares indicated by the Bidder in the price schedule shall be used for bid evaluation purposes.
- 4) 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.
- 5) Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.
- 6) 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/equipments.

18.2 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.

- 18.3 The Bidder shall indicate the service expectancy period for the spares parts (both mandatory and recommended) under normal operating conditions before replacement is necessary.
- 18.4 All spares supplied under this contract shall be strictly inter changeable with the parts for which they are intended for replacements. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site e.g. small items shall be packed in sealed transparent plastic with desecrator packs as necessary.
- 18.5 All the spares (both recommended and mandatory) shall be manufactured alongwith the main equipment components as a continuous operation as per same specification and quality plan.
- 18.6 The Bidder will provide cross-sectional drawings, catalogues, assembly drawings and other relevant documents so as to enable BHEL to identify and finalise order for recommended spares.
- 18.7 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.
- 18.8 All cases, containers or other packages are to be opened for such examination as may be considered

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necessary by BHEL / Customer.

- 18.9 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.
- 18.10 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.
- 18.11 In addition to the recommended spares listed by the Bidder, if the BHEL/Customer further identifies certain particular items of spares, the Bidder shall submit the prices and delivery quotation for such spares within 30 days of receipt of such request with a validity period of 6 months for consideration by the BHEL/Customer and placement of order for additional spares if the BHEL/Customer so desires.
- 18.12 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-Bidders. Further, in case of discontinuance of manufacture of any spares by the Bidder and/or his sub Bidders, Bidder will provide the BHEL/Customers, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by the BHEL/Customer for the purpose of manufacture/procurement of such items.
- 18.13 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.

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ANNEXURE-I

QAP FOR CONDENSATE POLISHING UNIT (CPU)

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Tests/Check Items / Components	Material Test	WPS/PQR/Welder Qualification	DPT/MP	Assembly Fit up	Dimension	RT	Hydraulic / Water Fill	Performance Test	Test as per relevant Std/ Appd.	Other Tests	Remarks
1. Horizontal Centrifugal Pumps				Y	Y			Y	Y		LEGENDS: Applicable tests are identified by 'Y'. Y ^a One per Heat/Heat Treatment batch./Lot Y ^b On machined surfaces only. Also 100% on Butt Welds & 10% on Fillet Welds. Y ^c UT shall be done for shafts with Dia 50 mm or above & Plates of Thickness 25 mm or above. Y ^d Dynamic Balancing per ISO: 1940, Grade 6.3 minimum shall be conducted for rotating assy. Y ¹ As per HIS, USA. Y ² Random 10% RT to be conducted on butt welds for Thk ≥10 mm. Y ³ Seat Leakage Test for actuator operated valves shall be done by operating the valve with job actuator. Y ⁴ Tests on Rubber Diaphragms shall be conducted per batch of Rubber mix for Tensile, Elongation, Hardness, Thickness, Bleed Resistance. In addition, Type Test for 50,000 cycles for each type of diaphragm shall also be conducted. Y ⁶ Blue Matching, Wear Travel for Gate Valves and reduced pressure test for check valves shall be conducted as per relevant standards.
1.1. Casing	Y ^a		Y ^b		Y		Y				
1.2. Impeller	Y ^a		Y ^b		Y					Y ^d	
1.3. Shaft	Y ^a		Y		Y					Y ^c	
2. Vertical Pumps				Y	Y			Y ¹	Y		
2.1. Casing	Y ^a		Y ^b		Y		Y				
2.2. Impeller	Y ^a		Y ^b		Y					Y ^d	
2.3. Shaft	Y ^a		Y		Y					Y ^c	
2.4. Fabricated Parts	Y ^a	Y	Y ^b		Y	Y ²	Y				
3. Dosing/ Metering Pumps	Y ^a						Y	Y ¹	Y		
4. Gate/ Globe/ Check Valves	Y ^a		Y ^b		Y		Y	Y	Y	Y ⁶	
5. Dual Plate Check Valves	Y ^a		Y ^b		Y		Y	Y	Y	Y ¹² / Y ⁶	
6 Diaphragm Valves	Y ^a				Y		Y ³		Y	Y ⁴	
6. Butterfly Valves (Low Pr.)				Y	Y		Y ³	Y	Y		
7.1Body (Cast)	Y ^a		Y ^b								
7.2Disc (Cast)	Y ^a		Y ^b								
7.3 Shaft	Y ^a		Y ^b							Y ^c	
8. Plug/ Ball Valves (Low Pr.)	Y ^a		Y ^b	Y	Y		Y	Y	Y		
9. Blowers/Compressors	Y ^a		Y ^b	Y	Y			Y	Y	Y ^{de}	

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Items / Components	Material Test	WPS/PQR/Weider Qualification	DPT/MPI	Assembly Fit up	Dimension	RT	Hydraulic / Water Fill	Performance Test	Test as per relevant Std/ Appd.	Data Sheets	Other Tests	Remarks
10. Atmospheric Storage Tanks/ Pressure Vessels	Y ^a		Y ^b	Y	Y	Y ^c	Y		Y ^d	Y ^e	Y ^f	
Tests/Check												
Items / Components												
11. Rubber lining	Y ^a				Y		Y		Y		Y ^d	Y ^f Heat Treatment of the Tank/Vessel shall be done per fabrication code requirement. Welded dished ends shall be stress relieved. Dished ends manufactured by cold working shall also be stress relieved as per the requirement of code.
12. Butterfly valves (HP)	Y ^a			Y	Y		Y	Y				Y ⁸ RT as per fabrication code requirements. However, dished ends welds, if manufactured by using welded plates shall be subjected to 100% RT.
13. Ball valves (HP)	Y ^a			Y	Y		Y	Y				Y ⁹ Rubber Lining Mix shall be subjected to Bleed Resistance Test on mould sample. Adhesion Test, Spark Test and Hardness Test for the Rubber lined jobs shall also be conducted
12. Resins / Activated Carbon Filter	Y ^a	Y	Y ^b	Y	Y				Y	Y ¹⁰		Y ¹⁰ Gear Boxes shall be checked for smooth No Load Operation at shop to verify noise and vibration levels. Gear Ratio and Kerosene Leak Test shall also be conducted.
13. Hoists & Cranes	Y ^a	Y	Y ^b	Y	Y	Y ^c		Y	Y			Y ¹¹ One Fan of each type & size shall be routine performance tested as per corresponding code for air flow, static pressure, total pressure, speed, efficiency, power consumption, noise & temperature rise. Also all Fans shall be subjected to run test of 4 hours during which noise, vibration, temperature rise and current drawn shall be measured.
14. Agitators / Flash Mixer/ Flocculator	Y ^a	Y	Y ^b	Y	Y			Y		Y ¹⁰		Y ¹² Dry cycle test on valve spring for 1, 00,000 cycles shall be carried out as type test, if not carried out earlier, for the similar MOC, size and type of spring.
15. Pipes (Fabricated)	Y ^a	Y	Y	Y	Y	Y	Y		Y	Y ^{dc}		
16. Ventilation/Exhaust Fan	Y ^a		Y ^b	Y	Y			Y ¹¹	Y			
17. Wrapping and Coating Material	Y ^a								Y			

After erection the complete piping system along with valves & fittings shall be hydraulically tested at 1.5 times design pressure or 2 times working pressure whichever is higher.

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

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ANNEXURE - I

QAP FOR LOW PRESSURE PIPING (LP PIPING)

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	Tests/Check Items / Components											REMARKS
		Material Test	DPT/MPI / RT	Ultrasonic Test	WPS/ WQS/PQR	Hydraulic / Water Fill Test	Pneumatic Test	Assembly Fit up	Dimensions	Functional/operational Test	Other Tests	
1	Pipes & Pipe Fittings	Y ^a	Y ^b			Y ¹			Y			Y
2	Diaphragm Valves	Y ^a				Y ⁵			Y		Y ^a	
3A	Cast Butterfly Valves (Low Pressure)					Y		Y	Y	Y	Y ¹	
	Body	Y ^a	Y ⁶									
	Disc	Y ^a	Y ⁶									
	Shaft	Y ^a	Y	Y ^c								
3B	Fabricated Butterfly Valves	REFER NOTE 14										
4	Gate/ Globe/Swing Check / Ball Valves	Y ^a	Y ⁶	Y ^c		Y ⁵	Y	Y	Y	Y	Y ⁶	
5	Dual Plate Check Valves	Y ^a	Y ⁶	Y ^c		Y	Y	Y	Y	Y	Y ⁴	
6	Rolled & Welded Pipes and Mitre Bends	Y ^a	Y ³		Y	Y ³			Y		Y ³ S15	Y
7	Coating & Wrapping of Pipes	Y ²									Y ²	
8	Tanks & Vessels	Y ^a	Y ⁶		Y	Y			Y		Y ¹⁸	
9	Strainers	Y ^a	Y ⁶		Y [#]	Y					Y ¹¹	#For Fabricated Strainer
10	Rubber Expansion Joints	Y ^a				Y ¹²		Y	Y		Y ¹³	
11	Internal Lining of Pipes	Y ^a							Y		Y ⁹	
12	Site Welding		Y ¹⁰		Y	Y						

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b	On machined surfaces only for castings and on butt welds.
c	For shaft/spindles > or = 50 mm
1	100% Hydraulic test shall be carried out. 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/ IS-10221/IS 15337 as applicable.
3	Followings are the testing requirements for fabrication of pipes at site
	TESTS QUANTUM OF CHECKS
	WPS, PQR, Welder Qualification Test 100%
	DPT on root run 100% for pipes up to 1200 mm diameter
	DPT after back gauging 100% for pipes above 1200 mm diameter
	RT / UT by TIME OF FLIGHT 5% (100% of T Joints)
	DEFRACTION (TOFD) Technique
	DPT on finished butt weld joints 10%
	Hydraulic Test 100%, 1.5 times the design pressure or 2 times the working-pressure whichever is higher.
4	Dry Cycle Test on Dual Plate Check valve spring for one lakh Cycles shall be carried out as a type test. If Dry Cycle test carried out earlier for same material & diameter, Test report shall be reviewed.
5	Seat Leakage Test for Actuator Operated Valves, shall be done with by closing the valves with actuator.
6	Tests on rubber parts shall be conducted per batch of rubber mix for tensile, Elongation, hardness, adhesion, spark test, bleed resistance test. In addition, type test for 50,000 cycles of each type of diaphragm shall also be conducted.
7	Hydraulic Test of Body, Seat and disc-strength shall be carried out in accordance with governing design standard in presence of owner's representatives. Actuator operated valves shall be checked for Seat Leakage by closing the valves with actuator. For Proof of Design Test refer respective chapters of engineering portion in the technical specification
8	Blue matching, wear travel for gates, valves, pneumatic seat leakage, and reduced pressure test for check valves shall be done as per relevant standard. Maximum allowable vacuum loss is 0.5 mm of Hg abs. for valves to be tested for vacuum operation for internal pressure 25 mm of Hg abs. for a period of 15 minutes. Fire safe test for ball valve shall be done wherever specified. In case of already carried out, the test report shall be submitted for review and acceptance by NTPC Engineering. Valves shall be offered for hydro test in unpainted condition.

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| 9 | Tensile, Elongation, Hardness, Specific Gravity, Lining Thickness, Humidity Check, Pipe temperature check, Adhesion Test and Holiday Detection Test etc as per applicable standard shall be done for all lining material and application. |
| 10 | 10% of welds (Root and finished welds) shall be subjected to DPT.(100% DPT for compressed air line and boiler & deaerator fill line.). |
| 11 | Pressure drop across the strainer for each type and size as a special test shall be carried out. In case of already carried out, the test report shall be submitted for review and acceptance by NTPC Engineering. |
| 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 | In addition of all tests as indicated for Cast Butter Fly valve being applicable for fabricated butterfly valves, following test shall be done for Fabricated Butter Fly Valve: <ul style="list-style-type: none"> a. UT as per ASTM A-435 on plate material for body and disc shall be carried out for plate thickness 25mm and above. b. 100% RT and DPT as per ASTM, Section-VIII, Division-I, on butt joints of body and disc. 10% DPT on other welds shall be done. c. Post weld heat treatment as per ASME, Section-VIII, Division-I on butt joints of body and disc. d. Welders and WPS shall be qualified as per ASME- section IX |
| 15 | Maximum number of segments in segmental flanges shall be four (04) only. All butt weld joints in the segmental flanges shall be examined by RT/UT.
Segmental flanges exceeding 37.5 mm thickness shall be stress-relieved as per norms of ASME Section VIII after welding |
| 16 | For pressure vessel welds RT shall be done as per design code requirements. |

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**TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT****2X660 MW KHURJA STPP**

BHEL DOCUMENTS NO.: PE-TS-475-155-A001

VOLUME IIB

SECTION – IA

REV. NO. 00

DATE:

QAP FOR POWER CYCLE PIPING IN CPU SERVICE VESSEL AREA

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TITLE:

TECHNICAL SPECIFICATION FOR
CONDENSATE POLISHING UNIT

2X660 MW KHURJA STPP

BHEL DOCUMENTS NO.: PE-TS-475-155-A001

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POWER CYCLE PIPING**1.00.00****H.P.PIPING FOR TURBINE GENERATOR & AUX.****1.01.00****Piping:**

- (a) All raw materials used shall have co-related mill test certificate meeting material specification.

All tests, as given in respective material code (other than supplementary requirements), shall be carried out as minimum. This includes the tests wherein it is specified in the ASTM code that "the test is to be carried out when specified by the purchaser" or any such indication, in the code

- (b) All pipe lengths under this package, including piping where alloy steel is used shall be subjected to 100 % ultrasonic examination as per material specification standard with acceptable notch depth of 5% of the selected wall thickness (1.5mm maximum) except for the following piping system:

DOWN STREAM OF AUX. PRDS (where carbon steel is used) and aux. steam piping system (station HDR, unit HDR, interconnection) where notch depth of 12.5% of the selected wall thickness (1.5mm maximum) will be adhered to.

- (c) The edge preparation for shop and site welds in stainless steel /alloy steel shall be subjected to a dye penetrate check.
- (d) Pipe bend shall be checked for ovality and thinning by ultrasonic or other acceptable methods on first off lot & on random samples for subsequent pieces for high pressure applications. Outer surface of bends shall be subjected to magnetic particle examination/LPI.
- (e) Non-destructive examination of welds shall be carried out after post weld heat treatment, if any.
- (f) All butt welds in alloy steel piping of P-91, X -20 , X-22 & material P-5B group & above shall be checked for RT/ UT & MPI after SR.
- (g) For welds in P91, X20 & X22 and material P5B group & above Materials requiring heat treatment, induction type of heating shall be deployed for post weld heat treatment, or heat treatment can be carried out in furnace.
- (h) Non-destructive examination of welds shall be carried out in accordance with the relevant design/manufacturing codes. However, as a minimum, the following requirements shall be met. Further statutory requirement, wherever applicable shall also be complied with.

- (1) Temperature > 400 Deg. C or pressure exceeding 71 bar.

- (i) 100% RT/UT on butt welds and full penetration branch welds.
- (ii) 100% MPE.

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1.02.00

- (2) Temperature > 175 Deg. C upto 400 Deg. C or pressure exceeding 17 bar and upto 71 bar.
- (i) 100% RT/UT on butt welds and full penetration branch welds for pipe dia. more than 100 NB.
- (ii) 10% RT/UT on butt welds and full penetration branch for pipe dia upto 100NB.
- (iii) 100% MPE.
- (3) For all other pipes not covered above, shall be subjected 100% MPE/ DPT in case of under ground pipes and 10% MPE/DPT in case of piping above the ground. Further, 10% of butt welds of underground piping shall be subjected to RT.
- (i) Wherever SR/PWHT is envisaged for alloy steel, above NDTs shall be after SR/PWHT.
- (j) Hardness survey of welds shall be carried out on alloy steel/stainless steel piping (100% Hardness survey of welds on P91, X20 & X22 & above material grade of P5B above piping) and 3% hardness survey on welds of other alloy steel).

Fittings :

- (a) Raw material of all forged/formed fitting shall be ultrasonically tested. All mother pipes used for fitting shall be ultrasonically tested or hydraulic tested. Forged fitting shall be ultrasonically tested and formed fittings shall be MPI tested.
- All tests, as given in respective material code (other than supplementary requirements), shall be carried out as minimum. This includes the tests wherein it is specified in the ASTM code that "the test is to be carried out when specified by the purchaser" or any such indication, in the code
- (b) Fittings shall be subjected to suitable NDT as per applicable standards. However following minimum. NDE requirement shall be applicable / met.
- (i) For fittings X20, P-91 and material group 5B & above
- 100% MPI &
 - 10% hardness check.
 - Also 100% UT/RT, for fittings of 200 NB & above
- (ii) 100% UT/RT for fittings of 200 NB & above for boiler feed discharge, recirculation and spray piping of boiler feed system.
- (iii) 100% UT/RT for fittings of all other piping of size OD 508 mm & above.

1.03.00

Hangers & Supports:

- (a) All raw materials used shall have co-related mill test certificate meeting mandatory checks of material specification.

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	(b) Completed springs shall be tested for Scragging Test & Load vs Deflection Test and for dia. > 25mm MPI shall be carried out. (c) Butt Welds shall be tested for UT and fillet welds shall be tested for MPI. (d) Turn buckle/ pipe clamps/ Hangers of thickness > 25mm shall be checked by MP/DPT on bent portion. (e) Assembled Hangers shall be checked for Variation in deflection and Travel vs Load test and shall meet the requirements of NTPC data sheet.
1.04.00	Thermal Insulation & Lagging, Cladding:
1.04.01	Light resin bound mineral wool: LRB mattresses of Rockwool / Glasswool confirming to IS-8183, tested as per relevant clauses of IS 3144 and shall meet the requirements of NTPC data sheet. Type tests except Thermal Conductivity shall be regularly carried out once in three months, Thermal Conductivity Type Test shall be carried out minimum once in twelve months by the manufacturer. Requirements of various components like Binding wires, Lacing wires, Wire mesh, etc. shall be as per NTPC approved data sheet / as given in respective Sub-Section of Technical Requirements of Power Cycle system.
1.04.02	Lagging & Cladding: Aluminium sheeting confirming to ASTM B-203-1080 temper H14 from reputed manufacturer meeting the requirements of NTPC data sheet.
1.05.00	Valves: (a) Pressure retaining parts of valves shall be subjected to (min.) NDT as per Table 1. (b) Hardened/stellitted valve disc and seat are to be subjected to LPI and hardness check. (c) Color matching of valve disc/plug and seat shall be carried out to ensure min. 80% contact and no through passage. (d) Hydraulic pressure test and seat leak test shall be carried out as per ANSI 18.34/ IBR. (e) Air seat leak test shall be carried out as per applicable Standards/Codes. (f) Functional testing shall be carried out on each valve to check the following as per the approved valve data sheet (1) Smooth operation (2) Valve travel, closing and opening time. (3) Current drawn by actuators.

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- (g) Springs for safety valves shall be tested with suitable NDT and for spring rate.
- (h) Safety and safety relief valves shall be tested for performance.
- (i) All forgings rounds above diameter 40 mm shall be ultrasonically tested.

TABLE-1

Valve size NB in mm	ANSI Class upto 300	ANSI Class above 300 upto 600	ANSI Class above 600 below 900	ANSI Class 900 & above & below 4500
Less than 50	Visual	Visual	Visual	MPI
50 & above but below 100	Visual	Visual	MPI	MPI & RT (on 10% of valves on 100% area)
100 & above but less than 300	Visual	MPI	MPI & RT (on 10% of valves on change of section & weld ends)	MPI & RT (on 100% area)
300 and above	MPI	MPI	MPI & RT (on change of sections & weld ends)	MPI, RT on 100% area)

NOTE: For body and bonnet forgings UT with MPI may be adopted in place of RT

For austenitic steel MPI may be replaced by LPI.

1.06.00

CHEMICAL DOSING SYSTEM (HP/LP/OXYGENATED)

- (a) Pumps of chemical dosing system shall be performance tested as per relevant international codes.
- (b) In case of diaphragm type of pumps, the life cycle test shall be done on pumps. If this test is already conducted for same model in earlier projects of NTPC, then TCs for same shall be reviewed.
- (c) Dosing skid shall be subjected to leakage test and functional test.
- (d) Oxygen cylinders shall be as per relevant standard meeting statutory requirements.

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1.07.00

MEATLLIC EXPANSION JOINT FOR PIPING (IF APPLICABLE)

- (a.) Hydraulic pressure test shall be carried out on each pipe and expansion bellow.
- (b.) Longitudinal butt weld on bellow shall be subjected to suitable NDT examination before forming, and after forming MPE / DP test shall be carried out.
- (c.) All welds shall be subjected to 100% magnetic particle/dye pentrant check and butt welds shall be subjected to 100% radiographic testing.
- (d.) All the bellows subjected to vacuum service shall be subjected to vacuum test.
- (e.) The bellows shall be subjected to movement test to establish suitability to perform satisfactorily in site conditions. During this test spring rate shall also be measured.
- (f.) Life cycle test, meridional yield rupture test and squirm test to be carried out on a prototype/expansion bellow as per Sec.D clause 3.2 of standards of Expansion joint Manufacturer Association (EJMA). In case these tests have already been accepted by NTPC on a prototype expansion bellow, as defined in Sec.D Clause 3.2 of Expansion Joints Manufacturers Association (EJMA) test reports may be furnished by manufacturer for consideration and approval of Employer.

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ANNEXURE-II

SUB-VENDOR LIST

NTPC			PROJECT: KHURJA 660 MW PACKAGE: TG CONTRACTOR: BHEL HARIDWAR CONTRACT NO.:			LIST OF ITEMS REQUIRING QUALITY PLAN AND SUBCONTRACTOR APPROVAL			REF NO.: 00 REV NO.: 00 Date: 27.04.19		
ITEM			QP Insp Cat.	NTPC QP No. QVM-Q-	Vendor/ Manufacturer Name	PLACE	SC A PP L ST	Remarks			
1.	STATOR FRAME FABRICATION		I	QVE-Q-	BHEL-HEEP	HARIDWAR	A				
2.	STATOR FRAME MACHINING		I	QVE-Q-	BHEL-HEEP	HARIDWAR	A				
3.	FLAT SPRINGS & SPRING BASKET (FABRICATION & MACHINING)		I	QVE-Q-	BHEL-HEEP	HARIDWAR	A	REFER NOTE-6			
4.	CORE BAR FOR STATOR		I	QVE-Q-	BHEL-HEEP	HARIDWAR	A				
5.	STATOR LAMINATION		II	QVE-Q-	CENTRAL STAMPING UNIT BHEL(BHEL-CSU)	HARIDWAR	A				
6.	RIPPLE SPRING		II	--	KREMPAL GMBH	GERMANY	A	NO SEPARATE QP			
7.	TENSION BOLT FOR STATOR CORE (INSULATED)		•		SIEMENS LIMITED	INDIA	DR				
8.	STATOR CORE ASSLY		II	QVE-Q-	BHEL-HEEP	HARIDWAR	A				
9.	SPRING & SPRING BASKET ASSEMBLY		I	QVE-Q-	BHEL-HEEP	HARIDWAR	A				
10.	BUS BAR CONNECTION TUBES		II	--	LUVATA PORI	FINLAND	A	NO SEPARATE QP			
			II	--	BUNT METAL	AUSTRIA	A	NO SEPARATE QP			
			II	--	KME GERMANY GMBH	GERMANY	A	NO SEPARATE QP			
			•		SIEMENS LIMITED	INDIA	DR				
			•		HAEGANG ALLOY CO. LTD.	KOREA	DR				
11	SOLID COPPER CONDUCTOR (FOR STATOR BAR)		I	QVE-Q-	PEARL INSULATIONS	BANGLORE	A				
			I	QVE-Q-	COSMOS CONDUCTORS PVT.LTD.	BANGLORE	A				
			I	QVE-Q-	KAPSI ELECTRICAL POWER PRODUCT	BANGLORE	A				

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			QVE-Q-				A	
			I	MAHENDRA INDUSTRIES	BANGLORE		A	
			*	COPRAL INSULATED CONDUCTORS	HOSUR		DR	
12	HOLLOW COPPER INSULATED CONDUCTOR (STATOR BAR)		I	MAHENDRA INDUSTRIES	BANGLORE		A	
			I	PEARL INSULATIONS	BANGLORE		A	
			II	VONROLL	SWITZERLAND		A	NO SEPARATE QP
13	OVER HANG SUPPORT RING		I	COSMOS CONDUCTORS	BANGLORE		A	
			II	ROECHLING ENGINEERING PLASTICS	GERMANY		A	NO SEPARATE QP
			II	POWER & COMPOSITE TECHNOLOGIES	USA		A	NO SEPARATE QP
			*	KOMPOZYTY SP.Z.O.O	POLAND		DR	
14	STATOR SLOT WEDGE (RAW MATERIAL)		*	NANTONG DAWNTINE ELECTRICAL	CHINA		DR	
			II	PERMALI WALLACE PRIVATE	BHOPAL		A	NO SEPARATE QP
			II	MICAPLY	BHOPAL		A	NO SEPARATE QP
			*	THE BOMBAY BURMAH TRADING	RUDRAPUR (UTTARAKHAND)		DR	
			*	LAMTUF PLASTICS LTD	HYDERABAD		DR	
15	WATER SUPPLY HOSE (INSULATED)		II	DR SCHNABEL GMBH & CU KG LIMBURG	GERMANY		A	NO SEPARATE QP
			II	CRANE RESISTOFLEX	USA		A	NO SEPARATE QP
			I	MIL INDUSTRIES LIMITED	CHENNAI		A	
			*	SGL CARBON INDIA PVT. LTD	PUNE		DR	
16	HEADER FOR STATOR (ASSEMBLY)		I	BHEL-HEEP	HARIDWAR		A	
17	ETS MATERIAL		II	THYSSEN KRUPP ELECTRICAL STEEL	NASIK		A	NO SEPARATE QP
			II	ARCELOR MITTAL INTERNATIONAL	LUXAMBOURG		A	NO SEPARATE QP

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		SUB SYSTEM: TG & AUX				A	NO SEPARATE QP
		II	THYSSENKRUPP MATERIAL TRADING GMBH	GERMANY		A	NO SEPARATE QP
18	BAFFLE RING & BAFFLE RING CARRIER MACHINING	*	VOESTALPINE STAHL GMBH	AUSTRIA		DR	
19	WATER BOX FOR STATOR BARS	I	BHEL-HEEP	HARIDWAR		A	
		I	MADRAS CUUPRUM	CHENNAI		A	
		II	ZOLLERN GMBH & CO	GERMANY		A	NO SEP QP
		*	SIEMENS LIMITED	INDIA		DR	
20	CORE PRESS RING & FINGERS	I	BHEL-HEEP	HARIDWAR		A	
21	STATOR WINDING BAR	I	BHEL-HEEP	HARIDWAR		A	
22	STATOR WINDING ASSEMBLY	I	BHEL-HEEP	HARIDWAR		A	
23	GENERATOR SHAFT FORGING	II	BUDERUS EDELSTAHL	GERMANY		A	NO SEPARATE QP
		II	THE JAPAN STEEL WORKS LTD.(JSW)	JAPAN		A	NO SEPARATE QP
		II	SAARSCHEMIEDE	GERMANY		A	NO SEPARATE QP
		II	JAPAN CASTING & FORGING(JCFC)	JAPAN		A	NO SEPARATE QP
		II	CHINA FIRST HEAVY INDUSTRIES	CHINA		A	NO SEPARATE QP
		*	CHINA NATIONAL ERZHONG GROUP	CHINA		DR	
		II	PJSC ENERGO MASHPETSTAL	UKRAINE		A	NO SEPARATE QP
		*	SHAANXI SENWELL	CHINA		DR	
		*	SHEFFIELD FORGEMASTERS	UK		DR	
		II	SDF Turnl	ITALY		A	NO SEPARATE QP
		II	SC DOOSAN IMGB SA	ROMANIA		A	NO SEPARATE QP
24	GENERATOR SHAFT MACHINING	QVE-Q	BHEL-HEEP	HARIDWAR		A	

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		SUB SYSTEM: TG & AUX						
25	CURRENT CARRYING BOLTS FOR ROTOR(M/C)	I	QVE-Q-	BHEL HECP	HARIDWAR	A		
26	ROTOR COIL FORMING	I	QVE-Q-	BHEL HECP	HARIDWAR	A		
27	ROTOR SLOT ANGLE	I	QVE-Q-	SAHNEY KIRKWOOD PVT. LTD.	NASIK	A		
		II	--	ABB SWITZERLAND LTD.	SWITZERLAND	A	NO SEPARATE QP	
		II	--	VON ROLL ISOLA	FRANCE	A	NO SEPARATE QP	
		*		POWER & COMPOSITE TECHNOLOGIES	USA	DR		
28	CENTERING RING MACHINING	I	QVE-Q-	BHEL-HECP	HARIDWAR	A		
29	FIELD LEAD CORE BAR	II	--	KME GERMANY GMBH	GERMANY	A	NO SEPARATE QP	
30	FIELD LEAD CORE BAR MACHINING	I	QVE-Q-	BHEL-HECP	HARIDWAR	A		
31	RETAINING RING MACHINING	I	QVE-Q-	BHEL-HECP	HARIDWAR	A		
32	RETAINING RING	II	--	SAARSCHMIEDE	GERMANY	A	NO SEPARATE QP	
		II	--	ENERGIETECHNIK	GERMANY	A	NO SEPARATE QP	
		II	--	THE JAPAN STEEL WORKS LTD.(JSW)	JAPAN	A	NO SEPARATE QP	
		II	--	DEYANG WANXIN	CHINA	A	NO SEPARATE QP	
		II	--	SIEMENS AG	GERMANY	A	NO SEPARATE QP	
33	FAN BLADE FOR COMPRESSOR M/C	I	QVE-Q-	BHEL-HECP	HARIDWAR	A	REFER NOTE-6	
34	FAN BLADE FOR COMPRESSOR (RAW MATERIAL) HW10786-X20Cr13			REFER ST LIST FOR SAME GRADE MATERIAL FOR BLADE BAR			NO SEPARATE QP	
35	ROTOR WINDING ASSLY.(GEN.)	I	QVE-Q-	BHEL HECP	HARIDWAR	A		
36	GENERATOR ROTOR -FINAL	I	QVE-Q-	BHEL-HECP	HARIDWAR	A		

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		SUB SYSTEM: TG & AUX					A	NO SEPARATE QP
37	BEARING SHELL FORGING(GENERATOR)	II	BHEL-CFFP	HARIDWAR			A	
		*	GOLDEN IRON AND STEEL WORKS	NEW DELHI			DR	
		*	ECHJAY INDUSTRIES PVT LTD	MUMBAI			DR	
		*	MACKEIL ISPAT AND FORGINGS LTD	KOLKATA			DR	
		*	STAR WIRE (INDIA) LTD.	BALLABGARH			DR	
		*	CHAUDHRY & SONS (FORGINGS) PVT	GHAZIABAD			DR	
		*	PAHLADRAI STEEL FORGING WORKS	KANPUR			DR	
		*	VIKRANT FORGE LIMITED	KOLKATA			DR	
		*	BAY-FORGE LIMITED	KANCHIPURAM			DR	
		*	SIEMENS LIMITED	INDIA			DR	
		II	QVE-Q- RENK AG	GERMANY			A	
		II	QVE-Q- ZOLLERN	BRAZIL			A	
		II	QVE-Q- EURO BEARINGS	ITALY			A	
39	END SHIELD FABRICATION & MACHINING	I	QVE-Q- BHEL-HEEP	HARIDWAR			A	
40	SHAFT SEAL ASSEMBLY	I	QVE-Q- BHEL-HEEP	HARIDWAR			A	
41	BEARING SHELL MACHINING(GENERATOR)	I	QVE-Q- BHEL-HEEP	HARIDWAR			A	
42	COMPRESSOR HUB M/C & ASSEMBLY	I	QVE-Q- BHEL-HEEP	HARIDWAR			A	
43	HYDROGEN COOLER	I	QVE-Q- BHEL	HARIDWAR			A	
		*	LORD VISHWAKARMA HEAT EXCHANGER	KANKHAL (HARIDWAR)			DR	

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			SUB SYSTEM: TG & AUX			
44	HIGH PRESSURE HOSE FOR BEARING PEDESTAL		*	LAXMI ENGINEERING INDUSTRIES	BHOPAL	DR
			*	FITWELL CORPORATION	BHOPAL	DR
			*	ORIENTAL ENGINEERING WORKS	YAMUNANAGAR	DR
			*	SMT EXPORT	HARIDWAR	DR
			*	PARKER HANNIFIN INDIA PVT.LTD	MUMBAI	DR
			II	PARKER HANNIFIN	GERMANY	A
			II	MULTIMETALS LTD.	KOTA	A
			II	METAL ALLOYS CORPORATION	JAMNAGAR	A
			*	MEHTA TUBES LTD.	VAPI	DR
			*	INDUSTRIAL TUBES MANUFACTURERS(ITM)	MUMBAI	DR
45	TUBES FOR COOLERS (BRASS / COPPER TUBES)		I	QVE-Q-	BHOPAL	A
			I	QVE-Q-	HARIDWAR	A
			I	QVE-Q-	BHOPAL	A
			I	QVE-Q-	HARIDWAR	A
46	FINNING OF COOLER TUBES		I	QVE-Q-	BHOPAL	A
			I	QVE-Q-	HARIDWAR	A
			I	QVE-Q-	BHOPAL	A
			I	QVE-Q-	HARIDWAR	A
47	TERMINAL BUSHING BOX FABRICATION AND MACHING		I	QVE-Q-	BHOPAL	A
			I	QVE-Q-	HARIDWAR	A
48	CONFORMABLE ROPE		II	BIW	GERMANY	A
			II	TEXPLAS	HARIDWAR	A
			II	SUMICA	HARIDWAR	A
49	PW FITER, FINE FILTER, OIL FILTER		I	HYDAC (INDIA) PVT. LTD.	INDIA	DR

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		SUB SYSTEM: TG & AUX					REV NO. : 00	Date: 27.04.19
		II	--		BOLL & KIRCH FILTERBAU GMBH	GERMANY	A	NO SEPARATE QP
		II	--		L&Z VERFAHRENSTECHNIK GMBH	GERMANY	A	NO SEPARATE QP
		*			GRAND PRIX ENGINEERING PVT LTD	FARIDABAD	DR	
50	P W TANK INCLUDING PIPING	I	QVE-Q-		BHEL-HEEP	HARIDWAR	A	
51	VAPOUR EXHAUSTER	II	QVE-Q-		CB DOCTOR	AHMEDABAD	A	
		II	QVE-Q-		S.K SYSTEM	DELHI	A	
		II	QVE-Q-		AIR LINK	MATHURA	A	
		II	QVE-Q-		DUSTECH	FARIDABAD	A	
52	ION EXCHANGER	I	QVE-Q-		THERMAX LTD.	PUNE	A	
		*			SIEMENS LIMITED	INDIA	DR	
		*			CHEM PROCESS	AHMEDABAD	DR	
		*			H K ENTERPRISES	AHMEDABAD	DR	
53	PW COOLER & FILTER UNIT	I	QVE-Q-		BHEL-HEEP	HARIDWAR	A	
54	PW COOLER FOR STATOR	I	QVE-Q-		BHEL-HEEP	HARIDWAR	A	
		I	QVE-Q-		ALFA LAVAL (INDIA) LIMITED	PUNE	A	
		*			I.D.M.C. LTD	GUJRAT	DR	
		I	QVE-Q-		TRANSTER INDIA PVT. LIMITED	PUNE	A	
		I	QVE-Q-		KELVION INDIA (GEA)	PUNE	A	
		*			HRS PROCESS SYSTEMS LIMITED	PUNE	DR	



Signature

NTPC	PROJECT: KHURJA 660 MW PACKAGE: TG CONTRACTOR: BHEL HARIDWAR CONTRACT NO.:	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUBCONTRACTOR APPROVAL SUB SYSTEM: TG & AUX	REF NO.: 00 REV NO.: 00 Date: 27.04.19	
			DR	
55	TERMINAL BUSHING	SIEMENS LIMITED	INDIA	
		TRENCH FRANCE SAS	FRANCE	NO SEPARATE QP
		HSP HOCHSPANNUNGSGERAETE	GERMANY	NO SEPARATE QP
		SUZHOU JIU & ZHENG ELECTRIC CO	CHINA	NO SEPARATE QP
56	HYDROGEN DRIER (REFRIGERANT TYPE)	JINDAL ELECTRONICS	ROORKEE	
		MELCON ENGS PVT	NEW DELHI	
		SPAN MANUFACTURING	ROORKEE	
57	SEAL OIL COOLER	BHEL-HEEP	HARIDWAR	
		ALFA LAVAL (INDIA) LIMITED	PUNE	
		TRANSTER INDIA PVT. LIMITED	PUNE	
		KELVION INDIA (GEA)	PUNE	
		I.D.M.C. LTD	GUJRAT	
		HRS PROCESS SYSTEMS LIMITED	PUNE	
58	ALKALYSER UNIT	BHEL-HEEP	HARIDWAR	
59	SEAL OIL PUMP	ALLWEILER INDIA PRIVATE	DAMAN	
		UT PUMPS	FARIDABAD	
		ALEKTON	CHENNAI	
		HUANGSHAN	CHINA	
		DELTA PD PUMPS PVT. LTD.	MUMBAI	
60	PRIMARY WATER PUMP	KSB INDIA	PUNE	

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NTPC	PROJECT: KHURJA 660 MW PACKAGE: TG CONTRACTOR: BHEL HARIDWAR CONTRACT NO.:	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUBCONTRACTOR APPROVAL				REF NO. : 00 REV NO.: 00 Date: 27.04.19	
		QVE-Q-	SULZER INDIA	NAVI MUMBAI	A	SUB SYSTEM: TG & AUX	
61	H2/CO2/N2/ CYLINDER	•	WPIL LTD.	GHAZIABAD	DR		
62	SEAL OIL UNIT & PIPING	III	BHEL APPROVED SOURCES		A	COMPLIANCE TO STATUTORY REQUIREMENT	
63	SEAL OIL STORAGE TANK	I	BHEL-HEEP	HARIDWAR	A		
64	GAS UNIT & PIPING	I	BHEL-HEEP	HARIDWAR	A	REFER NOTE-6	
65	CO2 VAPOURISER	I	BHEL-HEEP	HARIDWAR	A		
66	GENERATOR ASSEMBLY AT WORKS INCLUDING TERMINAL BUSHING	I	BHEL-HEEP	HARIDWAR	A	REFER NOTE-6	
67	SILVER BEARING COPPER HOLLOW STRIPS (ROTOR COIL)	II	BUNT METAL	AUSTRIA	A	NO SEPARATE QP	
68	MULTI CONTACT BAND	II	BOASHIDA SWISS METAL	SWITZERLAND	A	NO SEPARATE QP	
69	WEDGES FOR ROTOR (DAMPER+SLOT)	III	STAUBLI TEC SYSTEMS	MUMBAI	A	Make-STAUBLI SWITZERLAND	
		II	KME	GERMANY	A	NO SEPARATE QP	
		II	BOASHIDA SWISS METAL	SWITZERLAND	A	NO SEPARATE QP	
		•	ORIENTAL COPPER	THAILAND	DR		
		II	BUNT METAL	AUSTRIA	A	NO SEPARATE QP NEW NAME- WIELAND AUSTRIA GMBH	
		II	LUVATA (OUTO KUMPU PORI)	FINLAND	A	NO SEPARATE QP	
70	LT MOTORS		REFER TO BHEL PEM LIST FOR THIS ITEM			A	



Signature

NTPC	PROJECT: KHURJA 660 MW PACKAGE: TG CONTRACTOR: BHEL HARIDWAR CONTRACT NO.:	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUBCONTRACTOR APPROVAL					REF NO.: 00 REV NO.: 00 Date: 27.04.19	
		SUB SYSTEM: TG & AUX						
71	GENERATOR WORKS RUN TEST	I	QVE-Q-	BHEL HECP	HARIDWAR	A		
72	EXCITER SHAFT MACHINING	I	QVE-Q-	BHEL-HEEP	HARIDWAR	A		
73	EXCITER STATOR MAIN	I	QVE-Q-	BHEL-HEEP	HARIDWAR	A		
74	EXCITER STATOR PILOT	I	QVE-Q-	BHEL-HEEP	HARIDWAR	A		
75	EXCITER ROTOR BALANCING	I	QVE-Q-	BHEL-HEEP	HARIDWAR	A		
76	RECTIFIER WHEEL MACHING & ASSLY	I	QVE-Q-	BHEL-HEEP	HARIDWAR	A		
77	DC LEAD ASSLY FOR EXCITER	I	QVE-Q-	BHEL-HEEP	HARIDWAR	A		
78	EXCITER ASSLY (MAIN & PILOT)	I	QVE-Q-	BHEL-HEEP	HARIDWAR	A		
79	EXCITER AIR COOLER	II		BHEL	HARIDWAR	A		
		*		LORD VISHWAKARMA HEAT EXCHANGER	KANKHAL (HARIDWAR)	DR		
		*		LAXMI ENGINEERING INDUSTRIES	BHOPAL	DR		
		*		FITWELL CORPORATION	BHOPAL	DR		
80	EXCITER TEST RUN	I	QVE-Q-	BHEL-HEEP	HARIDWAR	A		
81	FORGING FOR MAGNETIC HUB, CENTERING RING, INTERMEDIATE RING, CARRIER HUB/DIODE WHEEL, COMPRESSOR HUB	II	--	BHEL-CFFP	HARIDWAR	A	NO SEPARATE QP	
		*		BAY-FORGE LIMITED	KANCHIPURAM	DR		
		*		KISAAN STEEL (PVT.) LTD	GHAZIABAD	DR		
		*		MACKEL ISPAT AND FORGINGS LTD	KOLKATA	DR		
		*		STAR WIRE (INDIA) LTD.	BALLABGARH	DR		



NTPC	PROJECT: KHURJA 660 MW PACKAGE: TG CONTRACTOR: BHEL HARIDWAR CONTRACT NO.:	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUBCONTRACTOR APPROVAL SUB SYSTEM: TG & AUX	REF NO. : 00 REV NO. : 00 Date: 27.04.19	
			DR	
82	MAGNETIC HUB, CENTERING RING, INTERMEDIATE RING, CARRIER HUB/DIODE WHEEL MACHINING	VIKRANT FORGE LIMITED	KOLKATA	DR
83	MAGNET (MATERIAL ONLY)	BHEL-HEEP	HARIDWAR	A
		THYSEEN KRUPP MAGNETTECHNIC	GERMANY	A
		HANGZHOU PERMANENT MAGNET	CHINA	A
		SIEMENS LIMITED	INDIA	DR
84	PERMANENT MAGNET & SHOE ASSLY FOR EXCITER	BHEL-HEEP	HARIDWAR	A
85	MAIN EXCITER ARMATURE WINDING	BHEL-HEEP	HARIDWAR	A
86	BALANCING RING	SCHMOLZ+BICKENBECH	GERMANY	A
		RV ENGG	BALLABHGARH	A
		BSL CASTING PVT. LTD	FARIDABAD	DR
87	EXCITER CORE PRESS RING	RATAN ENGINEERING	NEW DELHI	A
		SCHMOLZ+ BICKENBECH	GERMANY	A
		RV ENGG	BALLABHGARH	A
		SOUTHERN ALLOY FOUNDRIES P LTD	CHENNAI	DR
88	EXCITER FRAME (MAIN & PILOT)	BHEL-HEEP	HARIDWAR	A
89	RC BLOCK	ZENTRONICS SYSTEMS	HYDERABAD	A
		SIEMENS LIMITED	INDIA	DR
90	EXCITER SHAFT FORGING	ALL SUPPLIERS OF GENERATOR SHAFT FORGING		A
		CFFP	HARIDWAR	A

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NTPC	PROJECT: KHURJA 660 MW PACKAGE: TG CONTRACTOR: BHEL HARIDWAR CONTRACT NO.:	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUBCONTRACTOR APPROVAL				REF NO.: 00
		SUB SYSTEM: TG & AUX				REV NO.: 00
						Date: 27.04.19
		I	QVE-Q	BHARAT FORGE	PUNE	A
		II		BUDEUS EDELSTAH L	GERMANY	A
		*		MACKEIL ISPAT AND FORGINGS	KOLKATA	DR
		*		OFAR S.P.A	ITALY	DR

LEGENDS: A- APPROVED, DR- DETAILED REQUIRED, N-NOTED

NOTE 1: IN ADDITION TO ABOVE SOURCES BHEL MAY PROCURE ITEMS FROM SIEMENS, SIEMENS APPROVED SOURCES BHEL TO SUBMIT DOCUMENTS IN SUPPORT OF SIEMENS APPROVED SOURCE.

NOTE 2: LT MOTORS UP TO 50 KW SHALL BE ACCEPTED BASED ON COC OF MANUFACTURER TC AND CONTRACTOR CONFIRMING AS FOLLOWS: IT IS HEREBY CONFIRMED THAT ABOVE MENTIONED MOTOR/MOTORS WAS/WERE MANUFACTURED TAKING CARE OF NTPC SPECIFIC REQUIREMENTS REGARDING AMBIENT TEMP, VOLTAGE FREQUENCY VARIATION, HOT STARTS, PULL OUT TORQUES, STARTING KVA/ KW, TEMP RISE, DISTANCE BETWEEN CENTRE OF STUD GLAND PLATE, SPACE HEATER AND TESTED IN ACCORDANCE WITH APPROVED DRAWING/DATA SHEETS AND LT MOTORS ABOVE 50 KW ACCEPTANCE SHALL BE BASED ON NTPC REVIEW OF ROUTINE TEST INSPECTION REPORT AS PER IS 325 BY MAIN MOTOR/MOTORS WAS/WERE MANUFACTURED TAKING CARE OF NTPC SPECIFIC REQUIREMENTS REGARDING AMBIENT TEMP, VOLTAGE FREQUENCY AND TESTED IN ACCORDANCE WITH APPROVED DRAWINGS/DATA SHEETS AND LT MOTORS, FOR > 75 KW, SEPARATE QP TO BE SUBMITTED

NOTE 3: QP/ INSPECTION CAT-I QP APPROVAL AND PHYSICAL INSPECTION BY NTPC: QP/ INSPECTION CAT-II QP APPROVAL BY NTPC, NO PHYSICAL INSPECTION BY NTPC. ACCEPTANCE BASED ON REVIEW OF CONTRACTOR INSPECTION REPORT/ TC : QP/INSPECTION CAT-III NO QP APPROVAL AND INSPECTION BY NTPC, ACCEPTANCE BASED ON REVIEW OF COC BY BHEL.

NOTE 4: A* -MEANS SUPPLY EXPERIENCE OF COMPARABLE UNIT TO BE FURNISHED TO NTPC

NOTE 5: * - INSPECTION CATEGORY WILL BE DECIDED DURING VENDOR EVALUATION.

NOTE 6: MQP APPROVED FOR BHEL HARDWAR SHALL BE USED ON SUB VENDOR'S WORKS FOR FABRICATION AND MACHINING OF COMPONENTS.

(Signature)
29.04.19
(SP Singh)

PEM (QAX)
BHEL Haridwar.

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NTPC		PROJECT : Khurja STPP PACKAGE : TURBINE GENERATOR AND ASSOCIATED PACKAGES CONTRACTOR : BHEL CONTRACT NO : THDC/RKSHCC-9915-371						LIST OF C&I ITEMS REQUIRING QP APPROVAL & SUB SUPPLIER APPROVAL FOR SUB OR ITEMS				REVISION NO : 00 DATE : 26.06.2019
REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submissi on SCH	QP approva l SCH	Proposed Sub Supplier	Country	SS Approval tatus	SS Detail Sub-SCH	SS Approval SCH	Remark	
1	DDCMIS	I	SQP			SIEMENS AG	Germany	Note-I			EDN	
		I				Emerson Process Management Asia Pacific Pvt Ltd	Singapore	Note-I				
		I				Honeywell Automation India Ltd	Pune	Note-I				
		I				BHEL (MAX DNA)	Bengaluru	Note-I				
		I				Astom India Ltd	Noida	Note-I				
		I				GE (ALSTOM)	France	Note-I				
		I				Toshiba	Japan	Note-I				
		*				BHEL Valmet DNA	Bengaluru	Note-I				
2	Intelligent Battery charger 24V DC / DCDH/RHMS	II				Charbo Electricals	Jalgaon	Note-I			EDN	
		II				Elech	Gurgaon	Note-I			Rectifier module Controller module and Battery Health monitoring system shall be of M's VERTIV make	
		II				MasTech	Jalgaon	Note-I			Unit-II for assembly and function testing only	
		II				VERTIV ENERGY PVT LTD	Mumbai	Note-I			Rectifier module Controller module and Battery Health monitoring system shall be of M's VERTIV China	
3	SWAS (Sampling Handling System and Dry Panel)	I				Emerson Process Management Ltd	Navi Mumbai	Note-I			EDN	
		I				Forbes Marshall	Pune	Note-I			Procured from USA assembly & testing in pawane	
		*				SEPL	Pune	Note-I				
		*				ABB	Bengaluru	Note-I				
		*				CHEMIN CONTROLS AND INSTRUMENTATION	PONDICHERRY	Note-I				
		*				ENDRESS + HAUSER INDIA PVT LTD	MUMBAI	Note-I				
		*				STEAM EQUIPMENTS PVT LTD	KONDIWA BUDURK, PUNE	Note-I				
		*				FLOW LINE INSTRUMENTATION PVT. LTD.	India	Note-I				
		*				Yokagawa	Bangalore	Note-I				
4	SWAS Analyser (Chloride)	III				Thermo FISHER Scientific Orion	USA	Note-I			EDN	
		III				ABB	UK	Note-I				

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REF_NO	Major_Equipment	Qp Inspection Category	Qp No	Qp submission on SCH	Qp approval on SCH	Proposed Sub-Supplier	Country	SS Approval status	SS Detail Sub-SCH	SS Approval SCH	Remark
		•				ENDRESS + HAUSER INDIA PVT. LTD.	MUMBAI	Note-1			
		•				HAUTLANGE S.A.R.L. CH-1222	VESENZ	Note-1			
		•				SWAN Analytische Instrumente AG,	CH-8340 Hinwil, Switzerland	Note-1			
		•				METTLER-TOLEDO INDIA PVT. LTD.,	MUMBAI	Note-1			
5	SWAS Analyser (Conductivity)	•				DKK Tea	Japan	Note-1			EDN
		III				Emerson Process Management Ltd	Pawane	Note-1			procured from USA, assembly & testing in pawane
		III				Hach	USA	Note-1			
		III				ABB	USA	Note-1			2-WIRE HART COMPATIBLE MAKE ABB UK
		•				ROSEMOUNT ANALYTICAL INC IRVINE (Emerson)	Irvine	Note-1			
		•				ENDRESS + HAUSER INDIA PVT. LTD.	MUMBAI	Note-1			
		•				SWAN Analytische Instrumente AG,	CH-8340 Hinwil, Switzerland	Note-1			
		•				METTLER-TOLEDO INDIA PVT. LTD.,	MUMBAI	Note-1			
6	SWAS Analyser (Dissolved Oxygen)	•				THERMO ORION INC 6199	BEVERLY MA 01915- Japan	Note-1			
		•				DKK Tea	Japan	Note-1			
		III				Yokogawa	Japan	Note-1			
		III				Thermo fisher Scientific ABB	USA	Note-1			EDN
		III				Emerson Process Management	UK	Note-1			MODEL 1816
		III				Hach	USA	Note-1			
		•				ENDRESS + HAUSER INDIA PVT. LTD.	Switzerland	Note-1			
		•				SWAN Analytische Instrumente AG	Mumbai	Note-1			
		•				METTLER-TOLEDO INDIA PVT. LTD.	Switzerland	Note-1			
7	SWAS Analyser (Hydrazine)	•				DKK Tea	Mumbai	Note-1			
		•				Hach	Japan	Note-1			EDN
		III				ABB	Switzerland	Note-1			
		III				Thermo fisher Scientific	UK	Note-1			
		III					USA	Note-1			Orion Brand model no 2118XP

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REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submission on SCH	QP approval T SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub SCH	SS Approval SCH	Remark
		.				ROSEMOUNT ANALYTICAL INC IRVINE (Emerson)	Irvine	Note-1			
		.				ENDRESS + HAUSER INDIA PVT LTD	MUMBAI	Note-1			
		.				SWAN Analytische Instrumente AG	Switzerland	Note-1			
		.				METTLER-TOLEDO INDIA PVT LTD	MUMBAI	Note-1			
8	SWAS Analyser (PH)	.				DKK Toa	Japan	Note-1			EDN
		III				Emerson Process Management Ltd	Pawane	Note-1			procured from USA, assembly & testing in Pawane
		III				ABB	USA	Note-1			2-WIRE HART COMPATIBLE
		III				Hach	USA	Note-1			
		III				Yokogawa	Japan	Note-1			
		.				ENDRESS + HAUSER INDIA PVT LTD	MUMBAI	Note-1			EXACT 430 AND EXA 202 SERIES
		.				SWAN Analytische Instrumente AG	Switzerland	Note-1			
		.				METTLER-TOLEDO INDIA PVT LTD	MUMBAI	Note-1			
		.				DKK Toa	Japan	Note-1			
9	SWAS Analyser (Phosphate)	.				THERMO ORION INC BEVERLY MA 01915-0199	Beverly	Note-1			
		III				Hach	USA	Note-1			EDN
		III				ABB	UK	Note-1			SERIES 5000, MODEL 6000/100
		.				ROSEMOUNT ANALYTICAL INC IRVINE (Emerson)	Irvine	Note-1			
		.				ENDRESS + HAUSER INDIA PVT LTD	MUMBAI	Note-1			
		.				SWAN Analytische Instrumente AG	Switzerland	Note-1			
		.				METTLER-TOLEDO INDIA PVT LTD	MUMBAI	Note-1			
		.				DKK Toa	Japan	Note-1			
10	SWAS Analyser (Silica)	.				THERMO ORION INC BEVERLY MA 01915-0199	Beverly	Note-1			
		III				Hach	USA	Note-1			EDN
		III				ABB	UK	Note-1			
		III				Hach	Switzerland	Note-1			
		III				Eutech Instrument PTE Ltd (part of ThermoFisher Scientific Inc)	Singapore	Note-1			BRAND-ORION

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REF NO	Major Equipment	QP Inspection Category	QP No	QP submission on SCH	QP approval / SCH	Proposed Sub Supplier	Country	SS Approval status	SS Detail Sub SCH	SS Approval SCH	Remark
		*				ROSEMOUNT ANALYTICAL INC IRVINE (Emerson)	Irvine	Note-1			
		*				ENDRESS + HAUSER INDIA PVT LTD	MUMBAI	Note-1			
		*				SWAN Analytische Instrumente AG	Switzerland	Note-1			
		*				METTLER-TOLEDO INDIA PVT LTD	MUMBAI	Note-1			
		*				DKK Toa	Japan	Note-1			
		*				THERMO ORION INC BEVERLY MA 01915-6199	Beverly	Note-1			
11	SWAS Analyser (Sodium)										EDN
		III				Hiach	Switzerland	Note-1			POLYMER TRON BRAND
		III				ABB	UK	Note-1			
		III				Orion	USA	Note-1			
		*				ROSEMOUNT ANALYTICAL INC IRVINE (Emerson)	Irvine	Note-1			
		*				ENDRESS + HAUSER INDIA PVT LTD	MUMBAI	Note-1			
		*				SWAN Analytische Instrumente AG	Switzerland	Note-1			
		*				METTLER-TOLEDO INDIA PVT LTD	MUMBAI	Note-1			
		*				DKK Toa	Japan	Note-1			
12	SWAS Analyser (Turbidity)										EDN
		III				Hiach	USA	Note-1			
		III				ABB	UK	Note-1			
		*				ROSEMOUNT ANALYTICAL INC IRVINE (Emerson)	Irvine	Note-1			
		*				ENDRESS + HAUSER INDIA PVT LTD	MUMBAI	Note-1			
		*				SWAN Analytische Instrumente AG	Switzerland	Note-1			
		*				METTLER-TOLEDO INDIA PVT LTD	MUMBAI	Note-1			
		*				DKK Toa	Japan	Note-1			
		*				THERMO ORION INC BEVERLY MA 01915-6199	Beverly	Note-1			
13	Vibration Monitoring System	Note-7									EDN

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REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submission SCH	QP approval SCH	Proposed Sub Supplier	Country	SS Approval status	SS Detail Sub SCH	SS Approval SCH	Remark
		II				BHEL (Valmet DNA based)	Bengaluru	Note-1			1 Imported items like Vibration Monitors, Cross Connection Cables, Buffered Output Modules, and Piezoelectric Vibration Sensors. Eddy Current type Proximity Probe, Extension Cable and Signal Conditioner will be procured from Valmet Automation Finland 2 Indigenous items like Communication cables, networking components, blank panels TB, OWS will be procured from owner approved sources
		II				Rockwell Automation	Shillabad	Note-1			FOR ROCKWELL USA MAKE SYSTEM
		II				SKF	Pune	Note-1			FOR SKF USA MAKE SYSTEM
		II				Imageneous Engineering Pvt Ltd	Vadodara	Note-1			For MEGGITT SWITZERLAND MAKE VIBRATION SYSTEM
		II				Shinkawa	Japan	Note-1			
		II				GE (Bentley Nevada)	USA	Note-1			
		II				GE	Pune	Note-1			FOR GE BENTLEY USA MAKE SYSTEM
		II				MEGITT (Vibrometer)	Switzerland	Note-1			
		II				SENSONICS LIMITED	UK	Note-1			
		II				Sensomics Technology India	Kundli	Note-1			For Sensomics UK system
		II				IRD Mechanalysis Ltd	Thane	Note-1			Vibration sensors will be sourced from M/s Hanford UK, however brand name of IRD and its logo is acceptable with suitable traceability of M/S Hanford UK
		II				M/S Scherck Rotec India Ltd	Noida	Note-1			Loop powered sensor with indicator. Main sensor LPS-420 procured from M/S Hanford sensor UK
		II				Forbes Marshall Pvt Limited	Pune	Note-1			VMS hardware and sensors with integral cable shall be shinkawa Japan make. 2. All other BOM shall be from I/OA agreed sources

LEGENDS:

1.0 SYSTEM SUPPLIER / SUB SUPPLIER APPROVAL STATUS CATEGORY

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

DR - For those items "Detailed Required" for Customer review. To be identified with letter "DR" in the list. For these items, vendor shall be proposed for owner acceptance with-in the agreed contract schedule of the package

SQP-Standard Quality Plan

RQP-Reference Quality Plan

2.0 QP INSPECTION CATEGORY :

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

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



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REF_NO	Major Equipment	QP Inspection Category	QP No	QP No submitted on SCH	QP approval on SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub SCH	SS Approval SCH	Remark
CAT - III : For these items Quality control to be exercised as per Main contractor Quality Assurance System. The final acceptance by NTPC shall be on the basis of Certificate of Conformance (COC) by Main Contractor.											
UNIT WORKS : Place of manufacturing, Place of main supplier of multi units/works.											
* Inspection category will be decided during vendor evaluation.											
NOTE - 1 : Manufacturer/Sub vendor shall be considered for acceptance subject to Sub-QR/provenness approval from NTPC Engineering & Owner											
NOTE - 2 : For Instrument cable <= 1 KM inspection category CAT - III, For > 1 KM to <= 10 KM inspection category CAT - II COC & FOR > 10 KM inspection category CAT-I											
NOTE - 3 : For Filter Optic cable <= 10KM inspection category CAT - III & for > 10KM inspection category CAT-II											
NOTE-4: Batteries for UPS <= 10 KVA and batteries for intelligent battery charger 24 V DC <= 40 Amp inspection category CAT-III & for Batteries for UPS > 10KVA and batteries for intelligent battery charger 24 V DC > 40 Amp rating inspection category CAT-I											
NOTE-5 UPS <= 10 KVA rating inspection category CAT-III & for > 10KVA rating inspection category CAT-I											
NOTE - 6 : For the items not appearing in the preaward list and falls in the scope of supply of the bidder, bidder and Customer will mutually discussed in future.											
NOTE - 7 - EMPTY CABINETS, COMPUTERS, SIGNAL ISOLATOR/MULTIPLIER and TB SHALL ALSO BE ACCEPTABLE FROM OWNER ACCEPTED IN QP, IF THE TOTAL INTEGRATED PANEL AND TUBES CONDUCTED INDIVIDUALLY											
NOTE-8 : For the C & I Instruments mounted on the skid of the main item or supplied as a integral part of the main item, instrument to be supplied as per proven practice of the manufacturer meeting the Customer technical specification requirement.											
NOTE-9: This item is a bought out component of main equipments like DDCMS, PLC, I/O, CCTV, PA system etc											
NOTE-10: For these controlled items, Vendor shall be proposed for owner acceptance with-in the agreed contract schedule of the package											

Handwritten signature: *W. Nagawad*
 (Ch. A. V. Patil)
 GHCL

Handwritten signature: *W. Nagawad*
 NTPC



NTPC		PROJECT : Khurja STPP PACKAGE : TURBINE GENERATOR AND ASSOCIATED PACKAGES CONTRACTOR : BHEL CONTRACT NO : THDC/RKSHCC-9915371						LIST OF C&I ITEMS REQUIRING QP APPROVAL & ACCEPTABLE VENDOR AS APPROVED BY					REVISION NO : 00 DATE : 24-06-2019 26.06.2019	
REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submission on SCH	QP approval on SCH	Proposed Sub Supplier	Country	SS Approval status	SS Detail Sub SCH	SS Approval SCH	SS	Remark		
1	ADDRESSABLE DETECTORS (MULTI SENSOR, PHOTO & HEAT DETECTORS TYPE), INTERFACE UNITS & MANUAL CALL POINTS	II				Schrack	Austria	A				PUSD Hyd		
		II				Autronica	Norway	A						
		II				Edwards	USA	A						
		II				Notifier	USA	A						
2	Battery (Lead Acid - Plants)	II				SHIELD FIRE SAFETY	UK	A						
		Note-4				HOPPECKE BATTERIEN GMBH & CO KG	Germany	A				FDN		
		Note-4				EXIDE	Kolkata	A						
3	Battery (Ni-Cd)	*				Amara Raja	Chittoor	DR						
						HBL Nife	Hydrabad	DR						
		Note-4				AMCO SAFT INDIA LIMITED	Bengaluru	A				FDN		
		Note-4				HBL POWER	Hydrabad	A						
		Note-4				SAFT	France Sweden	A				Up to 60AH/H type		
		Note-4				HOPPECKE BATTERIEN GMBH & CO KG	Germany	A						
4	Blank Panels / Cabinets	III				Rittal	Bengaluru					FDN		
		III				Hoffman	Bengaluru	A						
		III				Pyrotech	Udaipur	A						
		III				BHEL	Bengaluru	A						
5	Concentration Analyser	*				Schneider	Bangalore	DR						
6	Control Desk	III				HAACH	USA	A				FDN		
		I				PYROTECH WORKSPACE SOLUTIONS PVT LTD	UDAIPUR	A				Bot shall be as per LOA approved sources		

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REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submission on SCH	QP approval /SCH	Proposed Sub Supplier	Country	SS Approval status	SS Detail Sub SCH	SS Approval SCH	Remark
		I				COSMOS MEDIA PRODUCTS PVT LTD	GREATER NOIDA	A			1 If block should be from Knurr Germany 2 Complete integrated mosaic grid should be procured from owner approved sources like Pro Plan Subless 3 solid acrylic surface should be procured from Du Pont owner approved sources 4 Extruded Al profile structure should be procured from Hindalco (With Knurr design)
		I				ADARSHA CONTROL SYSTEM PVT LTD	Bengaluru	A			1 Mosaic items should be from owner approved sources 2 Acrylic solid surface (ASS) should be procured from Du Pont owner approved sources 3 wood works are to be done by M S C K Furn Bengaluru
		.				HARMONY SYSTEMS	NEWDELHI	DR			
		.				CHEMIN CONTROLS AND INSTRUMENTATION	PONDICHERRY	DR			
7	Control Valve for BPP Recirculation.	I				Control Component India PVT Ltd	Sriely	A			1 The critical components of control valve i.e. Disk Stack (Drag technology) shall be sourced from CCI USA CCI KOREA The positioner from Owner approved sources & pneumatic actuators are sourced from CCI Korea 2 Control valve to be manufactured as per CCI USA design & drawing
		I				KOSO India Pvt Ltd	Nasik	A			
		I				KSB MIL CONTROLS LTD	Thiruvir (KERALA)	A			UP TO 10 INCHES & 3400 C.I ASS
		II				DRESSER PRODUCTS INDUSTRIES S.A.S	France	A			
		II				NIHON KOSO CO LTD	Japan	A			
		II				CCI	USA	A			CONDITIONAL
		II				Emerson (Fisher)	USA France Japan	A			
		.				HOLTER		A			
		.				REGELARMATUREN GMBH & CO KG	Germany	DR			
		.				Emerson Process Management	Chennai	DR			
8	Control valve for feedwater flow Control	I				KOSO India Pvt Ltd	Nasik	A			PEM

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REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submissi on SCH	QP approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub-SCH	SS Approval SCH	Remark
		I				Emerson Process Management Ltd	Chennai	A			1 The control valve body assembly will be manufactured and sourced from Nippon Fisher Japan with IIR form III C certificates 2 CV testing will be carried out at FCI Palakkad
		I				KSB Mill	Thrissur	A			1 Provision of straight type of brackets for linkage mechanism 2 Factory fitted strainer diffuser type seat ring 3 AFR with T connector for pneumatic connection to volume booster
		.				Bonafat Special Valve	Ahmedabad	DR			
		.				M's GE Oil & Gas India Pvt Ltd (Earlier known as Dresser India)	Coimbatore	DR			
		.				Forbes Marshall Area Pvt Ltd	Pune	DR			
		.				Instrument Limited	Palakkad	DR			
		.				Mascoot Valve	Ahmedabad	DR			
		.				R K Control Inst	Thane	DR			
		.				Severn Glocon India Pvt Ltd	Chennai	DR			
		.				Suzhou Delan Energy Sone	China	DR			
		.				Samson Control Pvt Ltd	Pune	DR			
		.				Valvitalia S P A	Italy	DR			
		.				Waldemar Pruss	Germany	DR			
9	Control valve (Other than BFP RC, FW flow Control)										PEM
		I				KOSO India Pvt Ltd	Nasik	A			
		I				KSB Mill	Thrissur	A			
		I				Emerson Process Management Ltd	Chennai	A			
		I				Forbes Marshall Area Pvt Ltd	Pune	A			up to 16" and 900 Class
		I				M's GE Oil & Gas India Pvt Ltd (Earlier known as Dresser India)	Coimbatore	A			Conditional as per approval letter C.W.EN-9061-JI-43-20 DATED 25/04/2013
		I				Instrumentation Limited	Palakkad	A			up to 2500 class
		.				Bonafat Special Valve	Ahmedabad	DR			
		.				Mascoot Valve	Ahmedabad	DR			
		.				R K Control Inst	Thane	DR			
		.				Severn Glocon India Pvt Ltd	Chennai	DR			
		.				Suzhou Delan Energy Sone	China	DR			
		.				Samson Control Pvt Ltd	Pune	DR			
		.				Valvitalia S P A	Italy	DR			
		.				Waldemar Pruss	Germany	DR			

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REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submission on SCH	QP approval on SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub SCH	SS Approval SCH	Remark
10	Electrical Actuator (With gear box if applicable)										EDN
		II				Antrieb Technik Pvt Ltd	Chennai	A			For low torque app like SH EH vent circulation & Feed WAF isolation
		II				Auma	Bengaluru	A			
		II				Limitorque	Faridabad	A			Model no L120 SMRT V series Gear Box T HBC Series
		II				Rotork	Bengaluru	A			For low torque app (Up to 1600 Newton meter)
		II				Rotork Controls (India) Private Ltd	Chennai	A			For low torque app (Up to 1600 Newton meter) & High torque 4000 to 7000 NM With integral starter for non critical applications
		III				Auma	Germany	A			
		III				Limitorque	USA	A			
		III				Rotork	UK	A			
		III				Nippon gear	Japan	A			
		III				Drehmo GmbH	Germany	A			C-MATIC SERIES (DMC/DMCR)
11	Electrical Actuator (With gear box if applicable) (Field bus based)	Note-10									
12	Electrical Indicating Instruments (Mosate Compatible)										EDN
		III				Siemens	Germany	A			
		III				Ganz	Germany	A			
		III				Gossen / Metrowair / Camille Bauer	Germany	A			
		III				Weigell Messgeräte	Germany	A			
13	Electromagnetic Flow Meter										PEM
		I				Electronet Equipment Pvt Ltd	Pune	A			Calibration upto 500 NB Inhouse, upto 110 NB by third party NABL accredited Lab
		*				Adapt Fluidics Pvt Ltd	Pune	DR			
		*				Scientific Device	Mumbai	DR			
		*				V/A Valves	Jalandhar	DR			
14	Fiber optic cable	SOP									EDN
		Note-3				KLC International Ltd	Mysore	A			
		Note-3				Apar Industries Limited	Valsad	A			
		Note-3				HFCT	Goa	A			
		Note-3				Aksh Fibre	Bhiwadi	A			
		Note-3				Finolex	Pune Goa	A			
		Note-3				M/S Birla Cable Limited	Rewa	A			
		Note-3				Jiansu Tongguang	China	A			

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REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submission on SCH	QP approval on SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub SCH	SS Approval SCH	Remark
		Note-3				R&M	Switzerland	A			
		Note-3				Molex	UK	A			
		Note-3				Corning	USA	A			
		*				SCHEIDER ELECTRIC	Bengaluru	DR			
		*				NETSOFT TECHNOLOGIES	India	DR			
		*				BINARY SYSTEMS PVT LTD	India	DR			
		*				TEXONIC	Bengaluru	DR			
		*				MICRO SOLUTION	Bengaluru	DR			
		*				WEBCOM	Bengaluru	DR			
		*				MICRONOVA IMPEX	Bengaluru	DR			
		*				PRISHA NETWORK	Bengaluru	DR			
		*				AKASH SOLAR	Bengaluru	DR			
		*				FIBERTEK	Bengaluru	DR			
		*				INTERFACE CONNECTRONICS		DR			
		*				TYCO/AMP		DR			
		*				SCHEIDER-DIGILINK		DR			
		*				D-LINK		DR			
15	FIRE ALARM PANEL - MICROPROCESSOR BASED										PESD HYD
		II				Notifier	USA				
		II				Autronica	Norway	A			
		II				Schrack	Austria	A			
		II				Edwards	USA	A			
		II				Toshniwal Industrial Pvt Ltd	AMER	A			FAPMSD MCP/NOTIFIER ISOLATOR & CONTROL MODULE SHALL BE FROM M/S NOTIFIER. 2 OTHER BCS SHALL BE AS PER LQA APPROVED SOURCES. 3 M/S HONEYWELL SECURITY SHALL ACTIVELY SUPPORT M/S TOSNIWAL DURING ENGG INSTALLATION & COMM OF FIRE ALARM SYSTEM.
		II				M/S SHIELD FIRE SAFETY AND SECURITY LTD	UK	A			
16	Flow nozzle assembly		SQP								PEM
		I				Microprecision Product Pvt Ltd	Palwal	A			Flow nozzle assembly. Allow steel material grade P-92 & other conditions as per approval letter.

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REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submissi on SCH	QP approval I SCH	Proposed Sub-Supplier	Country	SS Approval Status	SS Detail Sub-SCH	SS Approval SCH	Remark
		I				Minco India Flow Elements Pvt Ltd	Goa	A			1- up to 26 inches for Alloy steel/ Stainless steel pipe SA335 P-11, P-22 and SA 335 P-91 2- Branch pipe will be issued as free issue item from main supplier to manufacturer or procure from Customer approved sources by manufacturer from vendor identified in the contract 3- Carrying out wet calibration of flow nozzle per their standards regular suppliers 4- Carrying out wet calibration of flow nozzle assembly at FCRI or owner agreed third party laboratory 5- Approved up to alloy steel grade P-92 subject to qualified WPS & other conditions as per approval letter 6- Approved up to alloy steel grade P-92 subject to qualified WPS & other conditions as per approval letter
		I				Instrumentation Limited	Pattadak	A			
		I				Siamesh controls (India) Pvt Ltd	Pune	A			
		*				Dyna Fluid Valves & Flow Control	Belgaum	DR			
		*				Hydropneumatics Pvt Ltd	Bicholim	DR			
		*				Minco India Pvt Ltd	Goa	DR			
17	H2 Gas Analyser	I				M's Adage Automation Pvt Ltd	GOA	A			HWR 1 Hydrogen gas analyser (Calomat 6) will be imported from M's Siemens, Germany Analysers Will be imported from YFC Japan Microprocessor based working on gas density principle)
		I				YOKOGAWA INDIA LTD	Bengaluru	A			H2 GAS ANALYSER (CALOMAT 6) WILL BE IMPORTED FROM M'S SIEMENS GERMANY (KARL SRIJHE WORKS)
		I				SIEMENS	GURGAON	A			Approved for Thermal Conductivity based
		III				GF Sensing EMFA	IRELAND	A			
		III				ABB	UK	A			
		III				Emerson (Rosemount)	USA	A			
		III				SIEMENS	Germany	A			
		III				Environment One Corporation	USA	A			
		*				ABB Limited	Bangalore	A			
18	High Temp. cable (PTFE/FEP)	II				Thermocables	Hyderabad	DR			EDN
		II				Tempers	Udupur	A			
		II				Haba cables	China	A			Type-CI KX-wire, 2mm & 4 pair
		II				Haba cables	Sweden	A			
		II				Thermo Electrica BV	Netherland	A			

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REF. NO	Major Equipment	QP Inspection Category	QP No	QP submission on SCH	QP approval on SCH	Proposed Sub Supplier	Country	SS Approval status	SS Detail Sub SCH	SS Approval SCH	Remark
19	Impulse Pipes/Tubes	II				Japp cables	Germany	A			
		II				Kerpen cables	Germany	A			
		II				TEW & C	USA	A			
		*				ADVANCE CABLES TECHNOLOGIES	BANGALORE	DR			
		*				DILTON CABLES	NEW DELHI	DR			
		*				FLUTE INDUSTRIES	AHMEDABAD	DR			
		*				RELIANCE INDUSTRIES	BANGALORE	DR			
		*				RJ INDUSTRIAL CORPORATION	ROORKEE	DR			
		*				TOSHNIWAL CABLES PRIVATE LIMITED	JAIPUR	DR			
		*				UNIVERSAL CABLES LIMITED	SATNA	DR			
				SQP							
		II				Maharashtra Seamless	Raigarh	A			EDN
		II				Ratanam Metals and Tubes	Gandhinagar	A			FOR CS pipes ONLY
		II				Heavy metals and Tubes	Gandhinagar	A			For SS only
		II				ISMT	Gandhinagar	A			For SS & CS only
		II				Sumitomo Kawasaki Nippon	Japan	A			FOR CS AS upto Gr 22 pipes ONLY
		II				IPS TECHNITUBE	Germany	A			
		II				Vellure & manessman	Germany	A			
		II				Trouvay and Carvin	France	A			
		II				Sandvik	SWEDEN	A			For SS only Approved for SS duplex seamless Pipe upto 200NB by Mech
		*				BIHARAT HEAVY ELECTRICALS LTD	TIRUCHIRAPALLI	DR			
		*				INDIAN SEAMLESS METAL TUBES LTD	PUNE	DR			
		*				JINDAL SAW LTD	CHENNAI	DR			
		*				MAXIM TUBES COMPANY PVT LTD	AHMEDABAD	DR			
		*				SURAJ STAINLESS LIMITED	AHMEDABAD	DR			
		*				MBM TUBES PVT LTD	CHATTARAJ GUJARAT	DR			
		*				TUBACEX PRAKASH INDIA PVT LTD	UMBERGAON GUJARAT	DR			
		*				SHUBILAXMI METALS AND TUBES PVT LTD	MUMBAI	DR			
20	Instrument Cables (F.G & T/C Cables)			SQP							
		Note-2				PARAMOUNT COMMUNICATION LTD	Khushkhera	A			EDN/ PEM
		Note-2				Polycab	Daman & Diu	A			PVC FRIS type
		Note-2				Dellon	Faridabad	A			PVC FRIS type
		Note-2				KEI	Bhivadi	A			PVC FRIS type
		Note-2				Elkey Telclinks	Faridabad	A			PVC FRIS type
		Note-2				CORDS	Kaharwan	A			PVC FRIS type

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REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submission on SCH	QP approval on SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub SCH	SS Approval SCH	Remark
		Note-2				CORDS	Bhivadi	A			PVC FRLS type.
		Note-2				Nitco	Kolkata	A			PVC FRLS type.
		Note-2				Universal Cable	Satna	A			File for 132KV XLPE cable
		Note-2				Thermocables	Hydrabad / Mahabubnagar	A			A. B. F&G
		Note-2				Gupta Power Infrastructure Ltd	Khardia	A			PVC FRLS Shielded Multi Pair Twisted Type A,B,F&G
		Note-2				CMI	Fardabad	A			PVC FRLS type 0.5 SQMM F&G TYPE CABLES
		Note-2				Advance Cables Pvt Ltd	Bengaluru	A			0.5 SQMM F&G TYPE CABLES
		Note-2				Gemsab Industries Ltd	Bhivadi	A			0.5 SQMM F&G TYPE CABLES
		Note-2				Apar Industries Limited	Valsad	A			0.5 SQMM F&G TYPE CABLES
		Note-2				SUYOG ELECTRICALS LTD	HALOL (GUJRAT)	A			0.5 SQMM F&G TYPE CABLES
		Note-2				SPECIAL CABLES PVT LTD	RUDRAPUR	A			0.5 SQMM F&G TYPE CABLES
		Note-2				T C COMMUNICATION	GHAZIABAD	A			PVC FRLS type
		Note-2				TEW & C	USA	A			
		Note-2				Habia cables	Sweden	A			
		Note-2				Kerpen cables	Germany	A			
		Note-2				Lapp cables	Germany	A			
		Note-2				Thermo electra Bv	Netherlands	A			
		*				Goyolene fiber pvt ltd	India	DR			
		*				Polyscab	Habul	DR			
		*				Temposens Instruments Pvt Ltd	Udaipur	DR			
		*				Mansfield company ltd	India	DR			
		*				Gupta power infrastructure ltd	India	DR			
		*				RJ industrial corporation	India	DR			
		*				Apar industries	India	DR			
		*				Govind cable industries	India	DR			
		*				Torrent Cables	India	DR			
		*				Ravin cables	India	DR			
		*				SPM power & telecom pvt ltd	India	DR			
		*				Ultracab	India	DR			
		*				Suracables	India	DR			
		*				SPECIAL CABLES PVT LTD	New Delhi	DR			
		*				Servel Cables	Necmrana	DR			
		*				Thermo Cables Ltd	JADCHERLA	DR			
21	Instrument Valve		SOP								EDN
		II				RIHIL	Trehw	A			
		II				Instrumentation Limited	Palakkad	A			
		II				Fixed Hydro	Mumbai	A			upto 6000 lbs

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REF_NO	Major_Equipment	QP_Inspection Category	QP No	QP submission on SCH	QP approval I SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub SCH	SS Approval SCH	Remark
		II				HP Valves and fittings	CHENNAI	A			FORGED TYPE GLOBE VALVE 1.2" UPTO CLASS 4500 & 1" UPTO CLASS 2500 (BR/NBR)
		II				Baldota	Mumbai	A			
		II				Metpass Engineering works	Kolkata	A			Approved for 1/2" instrument valves (Globe Valve)
		III				Swagelok	USA	A			
		III				Parker	USA	A			
		III				HY Lok Corporation	Korea	A			
		III				DK TECH Corporation	Korea	A			
		III				Humlet	Israel	A			
22	Large Video Screen (LED Based)										
		I				Pyrotech Electronics Pvt Ltd	Udipur	A			FDN
		I				DELTA	GURGAON	A			
		I				BARCO	Noida	A			
		I				PLANAR	USA	A			
		*				Mitsubishi	Japan	DR			
		*				CHRISTIE-USA	USA	DR			
23	Level switch- cond type										
		III				EMERSON (Solatron mobrey) HYDRATEP	UK				FDN
		III				Yarway	USA	A			
		III				LEVEL STATE	UK	A			
		II				Raman Instruments	Della	A			FOR EMERSON (MOBNEY) UK SYSTEM
		II				Hi Tech	Kolkata	A			FOR LEVEL STATE UK SYSTEM VESSEL FROM III TECH QP VETTING FROM I/FV-STATE
		II				BHEL	Trichy	A			
		*				SOLARTRON TRANSDUCER	UK	*			
		*				PUNE TECHTROL PVT LTD, PUNE SYSTEM INTEGRATOR OF FOSSIL POWER SYSTEM)	Pune	*			
		*				IGEMA GMBH, MUNSTER	GERMANY	*			
24	Local Instrument Enclosure/Rack										
		I				Pyrotech	Udipur	A			FDN
		I				Instrumentation Limited	Kota	A			BOI from LOA approved sources
		I				Saras electrical	Trichurapalli	A			BOI from LOA approved sources
		I				Prammen	Pudlakottai	A			BOI from LOA approved sources

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REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submiss on SCH	QP approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub SCH	SS Approval SCH	Remark
		I				Chetan	Pondicherry	A			1- Fabrication at M's LUF Tech India 2- Painting at M's Supream Cooler & Fabricator 3 BOI from LOA approved sources
25	Mosaic tiles /Console items					PROCON INSTRUMENTATION (P) LTD	CHENNAI	DR			
		III				PRO PLAN EARLIER BOYKO STREY	Germany	A			FDN
26	PIL ANALYSER	III				TEW EARLIER SUBKLEW	Germany	A			
		III				Emerson Process Management Ltd	Pawane	A			LDN
		III				HACHI	Switzerland / USA	A			Make Emerson USA
		III				YOKOGAWA	Bengaluru / Japan	A			
27	PLC System	III				ABB	UK / USA	A			Make Yokogawa Japan
		I				M/S BEIJING K&U ELECTRICAL	BEIJING	A			ISG PLSDHYD,PEM 1 PLC modules from SIEMENS 2 BOI FROM owner LOA AGREED SOURCES
		I				GIE Intelligent platforms Pvt Ltd	Bengaluru	A			
		I				ABB	Bengaluru	A			
		I				Schneider	Nasik	A			
		I				Rockwell	Sahibabad	A			
		I				Siemens	Nasik	A			
		I				HONEYWELL	PUNE	A			1-PLC modules should be procured from M's Honeywell Co Ltd Korea 2-Make of Panel (Blank Enclosure), Terminal block, Network, components & interposing relay should be from owner approved source
		I				M/S VIRTUAL AUTOMATION	RANGAREDDY	A			PLC FORM M/S SCHNEIDER MAKE & OTHER BOI SHALL BE AS PER I/O AGREED SOURCES OTHER BOI FROM owner APPROVED MAKES
		I				M's Cormae Electronics Pvt Ltd	Pune	A			FOR SIEMENS MAKE PLC BOI FROM owner APPROVED SOURCES QP VETTED BY OEM PROJECT SPECIFIC AUTHORIZATION LETTER
		I				M/S Tech-Masters	Hyderabad	A			FOR GEIP MAKE PLC OTHER BOI FROM owner APPROVED SOURCES ENGG DOCUMENT VETTED BY OEM

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REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submission on SCH	QP approval T SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub SCH	SS Approval SCH	Remark
		I				M/S Powertech Switchgear (P) Pvt Ltd	Singapat	A			FOR SCHNEIDER MAKE PLC OTHER BOI FROM OWNER APPROVED SOURCES ENGG DOCUMENT VETTED BY OEM
		I				M/S Unity Industrial Automation Pvt Ltd	Delhi	A			1. System integrator for Rockwell make PLC 2. BOI shall be as per LOA agreed sources ENGG DOC VETTED BY OEM
		I				EMCONS	Ranchi	A			FOR ROCKWELL MAKE PLC SYSTEM OTHER BOI FROM OWNER APPROVED MAKES ENGG DOC VETTED BY OEM
		I				Schneider	Bengaluru	A			MODULES FROM SCHNEIDER, FRANCE AND ALL MAJOR BOI FROM OWNER APPROVED MAKE
		I				M/D Industries	Vadodra	A			System integrator for Gil make PLC
		I				Vedax automation	Surat	A			System integrator for SIEMENS make PLC & other BOI as per LOA. Enng document like QP shall be vetted by SIEMENS
28	Radar type level transmitter	I				Wuhan Guide	Chennai	A			System integrator for Siemens Make EDN HW
		III				Emerson Process Management Ltd	Pawane	A			01 CQA EMERSON DTD 24.01.2011 Basic Instrument Transmitter & Probe to be procured from Emerson Singapore, only integration & configuration at pawane works
		III				Endress & Hauser	Aurangabad	A			Transmitter procured from Siemens Canada with Co-related TC
		III				Supreme Technology	Thane	A			Valid Authorization from M/s Siemens
		III				B M Technology	Italy	A			
		III				Magnatrol	Belgium	A			
		III				ABB-TECH	USA	A			
		III				Endress & Hauser	Germany	A			Liquid like Oil & Water
		III				Saab Rosemount	Sweden	A			
						Emerson Process Management	Singapore	A			ROSEMOUNT 3300 GUIDED WAVE RADAR 5400 AND 5600 NON CONTACTING RADAR
		III				Endress & Hauser	Germany	A			
		III				Vega Grieshaber KG	Germany	A			
		III				Lumaco	Russia	A			
		*				Honeywell India Pvt Ltd	PUNE	DR			
		*				V AUTOMAT & INSTRUMENTS P LTD	New Delhi	DR			
		*				Vega India -level & Pressure Measurement	Pune	DR			
		*				Honeywell India Pvt Ltd	Gurgaon	DR			

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REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submission on SCH	QP approval on SCH	Proposed Sub Supplier	Country	SS Approval status	SS Detail Sub SCH	SS Approval SCH	Remark
29	SHORT TERM FIRE PROOF CABLES, MICC CABLES	III				Pentair	UK	A			PEM, PLESD HYD
		III				Wrexham Mineral	UK	A			2CX1.5 SQ MM AND 2CX2.5 SQ MM
		III				KMP	Italy	A			2.3.4 & 7 CORE CABLE
		III				TYCO	UK / China	A			2CX1.5 SQ MM AND 2CX2.5 SQ MM
30	Temp Transmitter	III				ENDRESS & HOUSER	Aurangabad	A			2CX1.5 SQ MM AND 2CX2.5 SQ MM
		III				Emerson Process Management Ltd	Pawane	A			EDN
		III				ABB	Bengaluru	A			Dual input & multioutput imported from Singapore but tagged & configured at Pawane works
		III				Wika Instruments India Pvt Ltd	Pune	A			DIN RAIL, DUAL IP FIELD MOUNTED TYPE (MAKE IN S. ABB GERMANY)
		III				Yokogawa	Japan	A			Model no 1-32 sourced from Wika Germany & calibration at Wika Pune is acceptable
		III				Moore	USA	A			CALIBRATION AT YOKOGAWA BANGLORE IS ALSO ACCEPTABLE
		III				M System co Ltd	JAPAN	A			MAAT APPROVAL DTD 10/04/2009 CARD 3067
		III				Emerson	U.S.A Singapore Germany	A			Model No-BNHL-0
		III				ABB	Germany	A			ASSEMBLED TT PROCURED FROM ABB GERMANY TESTING, CALIBRATION, CONFIG AND SUPPLY FROM FARIDABAD-MODEL TH 102
		III				Emerson	U.S.A Singapore Pawane	A			Dual Input and Multi Input imported from Singapore but tagged and configured at Pawane
		III				Yokogawa	Bengaluru				Make Yokogawa Japan and calibration at Yokogawa Bangalore
31	Terminal Block (Cage and Clamp type)	III				Elmax	Vadodara				EDN
		III				Phoenix	Germany / India	A			Model should have CE Marking
		III				Weidmuller	Germany	A			
		III				Wago	Germany / India	A			
		III				Connectwell	Dombivli-Mumbai	A			
32	Transmitter (Electronic) (Pressure, DP, Flow, Level application)	III				ABB Ltd	Bengaluru	A			EDN HWR
		III				Emerson Process Management Ltd	Pawane	A			2600T & critical item from ABB Italy SIND ALL OTHER COMPONENTS LIKE HOUSING AND FLANGES FROM ABB approved source

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REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submiss on SCH	QP approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub SCH	SS Approval SCH	Remark
		III				Siemens Ltd	Thane	A			Model - SITRANS P
		III				Honeywell Automation India Ltd	Pune	A			
		III				Baldor Control and Equipment Pvt Ltd	Navi Mumbai	A			PT & DPT of ID 301 Series (SMAR)
		III				Yokogawa India Limited	Bengaluru	A			EJA-E 110.430.530 SERIES & all raw material and BOI under locked down condition + sensor assembly as a single unit shall be sourced from M/S Yokogawa Japan
		III				M/s Endress - Hauser India Automation Instrument Pvt Ltd	Aurangabad	A			
		III				Emerson (Rosemount)	USA	A			
		III				YOKOGAWA	JAPAN	A			
		III				ABB	Germany - Italy	A			200T & critical item from ABB Italy. Their approved source
		III				Siemens	France	A			Sitans P-DSH Series
		III				Fuji Electric	France	A			FCX-AIII SERIES
		III				Fuji Elec co Ltd	China	A			FCX-III MICROPROCESSOR BASED CARD NO 3573
		III				FUJI	JAPAN	A			RESERVATION NOT NO ADDRESS IS MENTIONED
		*				Chino Corporation	Ghaziabad	DR			
		*				SMAR EQUIPAMENTOS INDUSTRIAIS	BRAZIL	DR			
33	Transmitter (Electronic) (Pressure, DP, Flow, Level application) (Field bus base)	I				ABB India Ltd	Bengaluru	A			EDN One no of TI will be available at DCS supplier for function testing of field bus communication with DCS during FAT
34	Turbine supervisory Instruments along with vibration analysis system	Note-7									EDN
		II				MEGGITT (VIBROMETER)	Switzerland				
		I				GE	Pune	A			For GE Bentley USA make system
		I				MEGGITT (VIBROMETER)	Bengaluru	A			For Meggitt (Vibrometer) Switzerland make system
		I				Forbes Marshall	Pune	A			For Shinkawa Japan make system
		II				GE BENTLY	USA	A			
		II				SIEMENS INDUSTRY AUTOMATION	Germany	A			* Sensors should be of Meggitt (Vibrometer - Switzerland) make
		II				SHINKAWA	JAPAN	A			
		*				ROCKWELL AUTOMATION	USA - INDIA	DR			
		*				SKF	USA - INDIA	DR			

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REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submission on SCH	QP approval on SCH	Proposed Sub-Supplier	Country	SS Approval Status	SS Detail Sub-SCH	SS Approval SCH	Remark
35	Ultrasonic type level Transmitter	.				BRUEL & KJAER VIBRO	GMBH SHERMAN, NEWDELHI	DR			FDN
		II				EEP ENVIRO	Noida	A			Ultrasonic level Tx shall be BM TECHNOLOGY ITALY MAKE REQUIRED MOUNTING ARRANGEMENT TESTING CALIBRATION SHALL BE CARRIED OUT AT M/S EIP WORKS AUTHORIZATION LETTER ALONG WITH VALIDITY DATE ALONG WITH QP
		III				E & H	Aurangabad	A			Complete Infrant Transmitter & Probe to be procured from Motrey UK, only integration & configuration at Pawane works
		III				Emerson Process Management Ltd	Pawane				
		III				BM Technology	Italy	A			
		III				SIEMENS MILTRONICS	Canada	A			
		III				Nivelco Process Control	Hungary	A			Manufactured assembled CALIBRATED AND TESTED in hungary Flange EXTERNAL CAGES MOUNTING BRACKETS PANELS ETC configured AND SUPPLIED BY NIVELCO PUNE
		III				E & H	Germany	A			
		III				HAWK Measurement PTY Ltd	Australia	A			
		.				M's FORBES MARSHALL PVT LTD	PUNE	DR			
		.				M's ABB INDIA LIMITED	INDIA	DR			
36	UPS WITH ACDB	Note-5				VERTIV ENERGY PVT LTD	Pune	A			FDN
		Note-5				VERTIV ENERGY PVT LTD	Mumbai	A			UP TO 125 KVA FOR 1 PHASE & 300 KVA FOR 3 PHASE
		Note-5				Hitachi Harel Power Electronics Pvt Ltd	Gandhinagar	A			UP TO 160 KVA INTELLIGENT BATTERY CHARGER 24VDC
		Note-5				M/S Consul Noowatt	Pune	A			Upto 120KVA Single phase IGBT
		Note-5				KELTRON	TRIVENDRUM	A			Up to 100 KVA single phase
		Note-5				Mofin & Gerni	France	A			REFER APPROVAL LETTER
		Note-5				Gutur	Switzerland	A			
		Note-5				AIG (Safe)	Germany	A			
		Note-5				Fun Electric	Japan	A			

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C/S



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REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submissi on SCH	QP approval I SCH	Proposed Sub Supplier	Country	SS Approval status	SS Detail Sub SCH	SS Approval SCH	Remark
37	Valve manifolds	III				Baldota VALVES AND FITTINGS	Mumbai	A			FDN
		III				Meipress	KOLKATA	A			2 3 5 way, 4500 class
		III				Excel hydro	Mumbai	A			upto 1 2" 5 way
		III				Astech	Mumbai	A			UP TO 6000 lbs
		III				HP Valves and fittings	CHENNAI	A			UPTO 5 WAYS UPTO 2000 PSI
		III				HYD AIR	LONAVALA	A			FOR INSTRUMENT VALVES
		III				Microprecision	Faridabad	A			
		III				Parker	USA	A			
		III				Hamlet	Israel	A			
		III				SCHNEIDER	Germany	A			
		III				HYLOK	Korea	A			
		III				DK TECH	Korea	A			
		III				Anderson Greenwood	USA	A			
		III				Swagelok	USA	A			1 2" AND 3/4" UPTO 3000 SPL CLASS
38	Wireless Solution (Microwave Tower Communication)										
		I				Lotus wireless technologies					FDN
		III				India Pvt Ltd	Visakhapatnam	A			
						Sheel	Pune	A			
39	Profibus cable PA & DP Type					AMG SYSTEMS LTD	UK	DR			
40	Field bus components	Note-10									FDN
											FDN
		III				Phoenix Contact Inc	USA	A			Material will be allowed to dispatch from the vendor works as CA I-III item however all material except SS junction box will be available at DC'S supplier works for functional testing
41	Pump transmitter Single & Dual Input (Field bus)										FDN
		I				ABB India Ltd	Bengaluru	A			One no of TI will be available at DC'S supplier for function testing of field bus communication with DC'S during FAT

Main Contractor approved sources

MC-1	AIR FILTER REGULATOR	III				Main contractor approved					All Packages
MC-2	Annunciator	III				Main contractor approved					All Packages
MC-3	Battery Health Monitoring System	III				Main contractor approved					All Packages
MC-4	Coupling Interposing relays / Isolator	III				Main contractor approved					All Packages
MC-5	Compression Fitting (SS) / Socket weld fitting	III				Main contractor approved					All Packages
MC-6	Condensing Pans	III				Main contractor approved					All Packages
MC-7	Conduits / Pipe (GI) / Conduits Lead (Conduit if feasible)	III				Main contractor approved					All Packages

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REF. NO	Major Equipment	QP Inspection Category	QP No	QP submissi on SCH	QP approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub SCH	SS Approval SCH	Remark
MC-8	Conductivity Analyser/ Total/ Specific/ Stator Water	III				Main contractor approved					All Packages
MC-9	Instrument tube fittings (air) / Copper tubing Brass connectors	III				Main contractor approved					All Packages
MC-10	Dev point sensor meter (H2 & Air)	III				Main contractor approved					All Packages
MC-11	Desk for GWS FWS Printer/ Server	III				Main contractor approved					All Packages
MC-12	Digital Indicators	III				Main contractor approved					All Packages
MC-13	Flow sensor assembly	III				Main contractor approved					All Packages
MC-14	Flow Nozzle for performance calibration	III				Main contractor approved					All Packages
MC-15	Electrical Control Panel	III				Main contractor approved					All Packages
MC-16	Flow Gauge	III				Main contractor approved					All Packages
MC-17	FLOW INDICATOR CUM TOTALISER	III				Main contractor approved					All Packages
MC-18	FLOW SWITCH	III				Main contractor approved					All Packages
MC-19	FRP Junction Box /UPS power distribution board	III				Main contractor approved					All Packages
MC-20	Furniture for control Room/ Chair, Almira, Lock)	III				Main contractor approved					All Packages
MC-21	Generator End Winding Vibration Monitoring System	III				Main contractor approved					All Packages
MC-22	Graphic Interface Unit	III				Main contractor approved					All Packages
MC-23	H2 Gas Leak detector	III				Main contractor approved					All Packages
MC-24	Hart Management System/ Hand Held Calibrator	III				Main contractor approved					All Packages
MC-25	Humidistat / Thermostat / Glycerstat / Airstat	III				Main contractor approved					All Packages
MC-26	KVM SWITCH/MATRIX KVM SWITCH	III				Main contractor approved					All Packages
MC-27	Level Switch (RF Type)	III				Main contractor approved					All Packages
MC-28	Level gauge (Transparent & Reflex Tubular type) and level Indicator (Float & Board type)	III				Main contractor approved					All Packages
MC-29	Level switch - Float Displacer Type Capacitance	III				Main contractor approved					All Packages
MC-30	LIMIT SWITCH	III				Main contractor approved					All Packages
MC-31	Lub Oil Control Valve- Self Regulating	III				Main contractor approved					All Packages
MC-32	Mini UPS up to 3.5 KVA	III				Main contractor approved					All Packages
MC-33	Network Components	III				Main contractor approved					All Packages
MC-34	Operator work stations Server/Laptop/Monitor	III				Main contractor approved					All Packages
MC-35	Office plate assembly	III				Main contractor approved					All Packages
MC-36	Pressure / Vacuum / DP Gauges	III				Main contractor approved					All Packages
MC-37	Press. DP. Vacuum Switch	III				Main contractor approved					All Packages

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REF_NO	Major_Equipment	QP Inspection Category	QP No	QP submiss on SCH	QP approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub SCH	SS Approval SCH	Remark
MC-38	PRESSURE TRANSMITTER (PRESSURE, DP FLOW, LEVEL APPLICATION)	III				Main contractor approved					All Packages
MC-39	Printer (Dot Matrix Inkjet Laser)	III				Main contractor approved					All Packages
MC-40	Rotameter & Sight flow indicator	III				Main contractor approved					All Packages
MC-41	Reverse Rotation Indicator (RRI)	III				Main contractor approved					All Packages
MC-42	Smart Positioner / EP Converter	III				Main contractor approved					All Packages
MC-43	SOLENOID VALVE	III				Main contractor approved					All Packages
MC-44	Temperature cum Humidity Indicator	III				Main contractor approved					All Packages
MC-45	TEMPERATURE ELEMENT (THERMOCOUPLE, RTD & THERMOWELL)	III				Main contractor approved					All Packages
MC-46	TEMPERATURE GAUGE (WITH THERMOWELL)	III				Main contractor approved					All Packages
MC-47	TEMPERATURE SWITCH	III				Main contractor approved					All Packages
MC-48	Temp Transmitter Multi Input (Field bus)	III				Main contractor approved					All Packages
MC-49	Transducer	III				Main contractor approved					All Packages
MC-50	Instrument Cables (F, G & T/C Cables)	III				Main contractor approved					All Packages
MC-51	Control Valves	III				Main contractor approved					CPU / AC
MC-52	Valve manifolds	III				Main contractor approved					CPU
MC-53	Beam detector	III				Main contractor approved					CPU/AC/FDPS
MC-54	LIIS Cable	III				Main contractor approved					FDPS
MC-55	Probe type Heat detector	III				Main contractor approved					FDPS
MC-56	Siren	III				Main contractor approved					FDPS
MC-57	SMF Lead Acid Battery for Microprocessor based fire alarm panel	III				Main contractor approved					FDPS

SYSTEM SUPPLIER / SUB SUPPLIER APPROVAL STATUS CATEGORY

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

DR - For those items "Detailed Required" for Customer review. To be identified with letter "DR" in the list. For these items, vendor shall be proposed for owner acceptance with-in the agreed contract schedule of the package

SQP-Standard Quality Plan RQP-Reference Quality Plan

2.0 QP INSPECTION CATEGORY :

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

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

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

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REF. NO	Major Equipment	QP Inspection Category	QP No	QP submit on SCH	QP approval on SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub SCH	SS Approval SCH	Remark
UNITS/WORKS : Place of manufacturing, Place of main supplier of multi units/works.											
* - Inspection category will be decided during vendor evaluation.											
NOTE -1 : Manufacturer/Sub vendor shall be considered for acceptance subject to Sub-QR/provenness approval from NTPC Engineering & Owner											
NOTE -2 : For Instrument cable <= 1 KM inspection category CAT - III, For > 1 KM to <= 10 KM inspection category CAT - II COC & FOR > 10 KM inspection category CAT-I											
NOTE -3 : For Fiber Optic cable <= 10KM inspection category CAT - III & for > 10KM inspection category CAT-II											
NOTE-4 : Batteries for UPS <= 10 KVA and batteries for intelligent battery charger 24 V DC <= 40 Amp inspection category CAT-III & for Batteries for UPS > 10KVA and batteries for intelligent battery charger 24 V DC > 40 Amp rating inspection category CAT-I											
NOTE-5 UPS <= 10 KVA rating inspection category CAT-III & for > 10KVA rating inspection category CAT-I											
NOTE -6 : For the items not appearing in the preaward list and falls in the scope of supply of the bidder, bidder and Customer will mutually discussed in future.											
NOTE -7 - EMPTY CABINETS, COMPUTERS, SIGNAL ISOLATOR/MULTIPLIER and TB SHALL ALSO BE ACCEPTABLE FROM OWNER ACCEPTED IN OP. IF THE TOTAL INTEGRATED PANEL AND EXIST CONDUCTED INDEGENOUSLY											
NOTE-8 : For the C & I instruments mounted on the skid of the main item or supplied as a integral part of the main item, instrument to be supplied as per proven practice of the manufacturer meeting the Customer technical specification requirement.											
NOTE-9- This item is a bought out component of main equipments like DDCMS, PLC, ISELCCTV, PA system etc											
NOTE-10- For these controlled items, vendor shall be proposed for owner acceptance with-in the agreed contract schedule of the package											


 N. Agarwal
 NTPC


 N. Agarwal
 NTPC



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PROJECT : 2X660MW KHURJA PACKAGE : Turbine Generator and Associated Packages Sub-package-III & LT Switchgear, HT & LT busducts, lighting, cabling, earthing, DG Set, Solar				SUB-VENDOR LIST FOR ITEM REQUIRING SUB-VENDOR/ QUALITY PLAN APPROVAL			DOC NO. : THDC/RKSH/CC-9915-371 REVISION NO. 00 DATE : PAGE : 1 OF 11	
Sl. No.	ITEM	QP / INS CAT.	QP No.	Subvendor proposed by M/s BHEL	PLACE	SCAPPL STATUS	Remarks	
	Alternator	1	1	M/s Kirloskar Electric	Bangalore	A	415 V alternators	
				M/s Cummins Generator Technology (Stamford)	U.K	A	415 V & 11 KV alternators	
				M/s Leroy Somer	France	A	Up to 11kV alternator 3500 kW	
				M/s Nidec	Bangalore	DR		
				M/s Marathan	USA	A	Alternators for up to 415 V, 1500 KVA DG SET	
				M/s Cummins Generator Technology (Stamford)	Ahmednagar	A	415 V Alternators up to 1600 KVA	
	Diesel engine	1	2	M/s Cummins	Pune	A		
				M/s Cater Pillar	USA	A		
				M/s Mitsubishi	Japan	A	Diesel engine for up to 2000 KVA DG SET	
				M/s MTU	Germany	A	Diesel engine for up to 1500 KVA DG SET	
				M/s Perkins	UK	A	Diesel engine for up to 2000 KVA DG SET	
				M/s Perkins	Aurangabad	A	Conditions apply	
				M/s Cater Pillar	Hosur	DR		
	D G set (assembly & testing) (item covered under proveness, sub-section A- I, Chapter-VI of tech spec)	1	3	M/s Sterling Generators Pvt Ltd	Silvasa	A@	For up to 415 V 1500 KVA, @- subject to sub-QR clearance from Owner	
				M/s Powerica	Silvasa	A@	Up to 2000 KVA, 415 V & 1500 KVA, 11 KV, @- subject to sub-QR clearance from Owner	
				M/s Jakson	Kathua	A@	Up to 415 V, 2000 KVA, @- subject to sub-QR clearance from Owner	
				M/s Caterpillar	Hosur	DR@	@- subject to sub-QR clearance from Owner	
				M/s Kohler	Singapore	A@	Up to 2000 kVA, 11kV, @- subject to sub-QR clearance from Owner	
				M/s CLLS	Singapore	A@	Up to 1250 kVA, 415 V, @- subject to sub-QR clearance from Owner	

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BHEL



For (BHEL) (M/s BHEL)
(M/s BHEL)

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PROJECT : 2X600MW KIHURJA PACKAGE : Turbine Generator and Associated Packages Sub-package-HT & LT Switchgear, HT & LT busducts, lighting, cabling, earthing, DG Set, Solar				SUB- VENDOR LIST FOR ITEMS REQUIRING SUB-VENDOR / QUALITY PLAN APPROVAL				DOC NO. : THDC/RKSH/CC-9915-371 REVISION NO. 00 DATE : PAGE : 2 OF 11	
Sl. No.	ITEM	QP / INS CAT.	QP No.	Subvendor proposed by M/s BHEL.	PLACE	SCAPPL STATUS	Remarks		
				M/s Supremova	Rajpur	A@	@- subject to sub-QR clearance from Owner		
				Absotherm	Mumbai	DR@	@- subject to sub-QR clearance from Owner		
				Apollo	Bangalore	DR@	@- subject to sub-QR clearance from Owner		
				JG Ankesaria	Ratlam	DR@	@- subject to sub-QR clearance from Owner		
				Kirloskar	Bangalore	DR@	@- subject to sub-QR clearance from Owner		
				Trans Generators	Bangalore	DR@	@- subject to sub-QR clearance from Owner		
				Universal Generators	Bangalore	DR@	@- subject to sub-QR clearance from Owner		
				Wartsila NSD	Bangalore	DR@	@- subject to sub-QR clearance from Owner		
				Vijay Power	Bangalore	DR@	@- subject to sub-QR clearance from Owner		
				BHEL	Bhopal	A@	@- subject to sub-QR clearance from Owner		
	11KV/6.6KV/ 3.3KV Switchgear (item covered under proveness, sub-section A- I, Chapter-VI of tech spec)	I	4						
	Fast Bus Transfer Panel	I		Aartech ABB	Parwanoo Vadodara	A A	FBT device Model- BTS-2000 from Cooper Power, USA FBT Device Model- SUE-3000 from ABB, Finland		
				SEL	Delhi	A	FBT device Model- SEL-451 from SEL, USA		
	LT Switchgear (item covered under proveness, sub-section A- I, Chapter-VI of tech spec)	I	5	L&T	Coimbatore	A@	@- subject to sub-QR clearance from Owner		
				C&S Electric	Noida/Haridwar	A@	@- subject to sub-QR clearance from Owner		
				Siemens	Mumbai	A@	@- subject to sub-QR clearance from Owner		
				Schneider	Nashik	A@	@- subject to sub-QR clearance from Owner		
				ABB	Bangalore	DR@	@- subject to sub-QR clearance from Owner		
				Pyrotech	Udaipur	A@	@- subject to sub-QR clearance from Owner		
				Tricolite	Manesar/Sahiba bad	A@	@- subject to sub-QR clearance from Owner		
				Nitya Electrocontrols	Noida	A@	@- subject to sub-QR clearance from Owner		



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PROJECT : 2X660MW KHURJA PACKAGE : Turbine Generator and Associated Packages Sub-package-HIT & LT Switchgear, HIT & LT busducts, lighting, cabling, earthing, DG Set, Solar				SUB- VENDOR LIST FOR ITEMS REQUIRING SUB-VENDOR/ QUALITY PLAN APPROVAL				DOC NO. : THDC/RKSH/CC-9915-371 REVISION NO. 00 DATE : PAGE : 3 OF 11	
Sl. No.	ITEM	QP / INS CAT.	QP No.	Subvendor proposed by M/s BHEL	PLACE	SC APPL STATUS	Remarks		
				CONTROL & SCHEMATICS	Hyderabad	DR@	@- subject to sub-QR clearance from Owner		
				GE Energy Services	Bangalore	DR@	@- subject to sub-QR clearance from Owner		
				BHEL-EPD	Bangalore	DR@	@- subject to sub-QR clearance from Owner		
	Battery charger (item covered under proveness, sub-section A- I, Chapter-VI of tech spec)	I	6	M/s Amara Raja	Tirupati	A@	@- subject to sub-QR clearance from NTPC Engg		
				M/s HBL- Power System	Hyderabad	A@	@- subject to sub-QR clearance from Owner		
				M/s Chhabhi electrical	Jalgaon	A@	@- subject to sub-QR clearance from Owner		
				M/s. Chloride Power	Kolkata	A@	@- subject to sub-QR clearance from Owner		
				M/s Vertiv Energy	Maharashtra	DR@	@- subject to sub-QR clearance from Owner		
				M/s Mass Tech Controls	Jalgaon	A@	@- subject to sub-QR clearance from Owner		
				M/s Statcon	Hapur	A@	Up to 220 V, 850 A, @- subject to sub-QR clearance from Owner		
				M/s Dubas	Bangalore	A@	Up to 220 V, 800 A, @- subject to sub-QR clearance from Owner		
				M/s Saft Nife Power Systems	Singapore	A@	@- subject to sub-QR clearance from Owner		
				M/s Emerson	Ambernath	DR@	@- subject to sub-QR clearance from Owner		
	Battery (Ni-Cd) (item covered under proveness, sub-section A-1, Chapter- VI of tech spec)	I	7	M/S HBL-Power System	Hyderabad	A@	Up to 990 Ah with conditions @- subject to sub-QR clearance from Owner		
				M/S Amcosoft	Bangalore	A@	8Ah to 990Ah- KPH type 10Ah to 1365 Ah- KPM type 11Ah to 1550Ah – KPL type @- subject to sub-QR clearance from Owner		
				M/s Hoppecke	Brilon, Germany	DR@	@- subject to sub-QR clearance from Owner		
	Battery Lead Acid Plante (item covered under proveness, sub-section A- I)	I	8	M/s Exide	Kolkata	A@	@- subject to sub-QR clearance from Owner		



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PROJECT : 2X660MW KHURJA PACKAGE : Turbine Generator and Associated Packages Sub-package-HT & LT Switchgear, HT & LT busducts, lighting, cabling, earthing, DG Set, Solar				SUB-VENDOR LIST FOR ITEMS REQUIRING SUB-VENDOR / QUALITY PLAN APPROVAL			DOC NO. : THDC/RKSH/CC-9915-371 REVISION NO. 00 DATE : PAGE : 4 OF 11	
Sl. No.	ITEM	QP / INS CAT.	QP No.	Subvendor proposed by M/s BHEL	PLACE	SC APPL STATUS	Remarks	
	1, Chapter-IV of tech spec)			M/s Hoppecke	Brilon, Germany	A@	@- subject to sub-QR clearance from Owner	
	IEC 61850 compliant Numerical Protection Relays (item covered under proveness, sub- section A-1, Chapter-IV of tech spec)	1	9	SEL	Pullman, USA	A@	@- subject to sub-QR clearance from Owner	
				T&D	Stafford, UK	A@	P14X, P34X, P44X, P64X, P74X models only., @- subject to sub-QR clearance from Owner	
				ALSTOM T&D	Chennai	A@	P14X, P24X, P34X, P44X, P64X, P74X models only., @- subject to sub-QR clearance from Owner	
				ABB	Finland	A@	@- subject to sub-QR clearance from Owner	
				ABB	Baroda	A@	For 6XX Series, @- subject to sub-QR clearance from Owner	
				GE Multilin	Zamudio, Vizcaya, Spain/ Markham, Ontario, Canada	A@	F-650 only, @- subject to sub-QR clearance from Owner	
				Schneider	Stone, UK	A@	PX30, PX40, VAMP 5X and VAMP 2XX models only., @- subject to sub-QR clearance from Owner	
				Siemens	Germany	A@	7SX Series only	
				Siemens	Goa	A@	@- subject to sub-QR clearance from Owner	
							7SR2X, 7SJ66X series only	
							@- subject to sub-QR clearance from Owner	
	Numerical Relay Network Integration(item covered under proveness, sub-section A-	1	10	Main contractor approved sources		DR@	@- subject to sub-QR clearance from Owner	



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PROJECT : 2X660MW KHURJA				SUB- VENDOR LIST FOR ITEMS		DOC NO. : THDC/RKSH/CC-9915-371	
PACKAGE : Turbine Generator and Associated Packages				REQUIRING SUB-VENDOR / QUALITY		REVISION NO. 00	
Sub-package-HT & LT Switchgear, HT & LT busducts, lighting, cabling, earthing, DG				PLAN APPROVAL		DATE :	
Set, Solar						PAGE : 5 OF 11	
CONT. NO. : THDC/RKSH/CC-9915-371							
Sl. No.	ITEM	QP / INS CAT.	QP No.	Subvendor proposed by M/s BHEL	PLACE	SCAPL STATUS	Remarks

I, Chapter-IV of tech spec)				Inar Profiles Ltd	Enkapalli (Vishakhapatna m)	A	
GI cable trays, fitting & accessories including bends	1	11		Vatco	Mumbai	A	Galvanization at Sigma Mumbai
				Indiana cable trays	Mumbai	A	Galvanization at Karamtara galvanizer- Mumbai
				Industrial Perforation	Kolkata	A	Galvanized and offered for inspection at M/s Industrial Perforation Pvt Ltd, Ganganagar, Kolkata, WB
				Ratan Projects	Howrah	A	Galvanization at DMP Projects- Howrah
				India Electric Syndicate	Kolkata	A	Galvanization at BMW Industries/B.P Projects- Howrah
				Steelite engg.	Mumbai	A	
				Premier Power Products	Howrah	A	Galvanising at Neha Galvaniser- Howrah
				Indiana Gratings	Pune	A	
				M.J. Engineering	Okhla/ Bhiwadi	A	
				T.R.G	Chennai	A	Galvanization at TM Radhakrishna Chetty & Co-Chennai
				Amtech	Pune	A	Galvanization at B.G. Shirke - Pune
				Kannade Anand Udyog	Mumbai	A	Fabrication at their units; Plot No. 42, Morivali, MIDC, District Thane & Plot No.: D-35 Anand Nagar MIDC, Addl. Ambarnath, Dist. Thane
				Rukmani	Raipur	A	Ladder type cable trays only
				Passive Infra	Hasangarh (Rohtak)	A	
				Unitech Fabricators & Engineers	Howrah/ Hoogly	A	
				Patny System	Hyderabad	A	
				Rabi Engg	Kolkata	A	Galvanizing from OWNER approved sources
				Indmark Formtech Pvt. Ltd.	Pune	DR	
				Vinfab	Thane	DR	



