

PATRATU VIDYUT UTPADAN NIGAM LIMITED

(A SUBSIDIARY OF NTPC LTD IN JOINT VENTURE WITH JHARKHAND BIJLI VITRAN NIGAM LTD.)

PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE- I (3X800 MW)

TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM

SPECIFICATION NO.: PE-TS-434-154-A101



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



TITLE: PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE- I (3 X 800 MW) TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM	SPECIFICATION NO.: PE-TS-434-154-A101	
	SUB-SECTION:	
	REV. NO.: 00	DATE: 12.04.2019

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SUB-SECTION-I-B

PROJECT INFORMATION

**EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION
EXPANSION PHASE-1 (3x800 MW)**

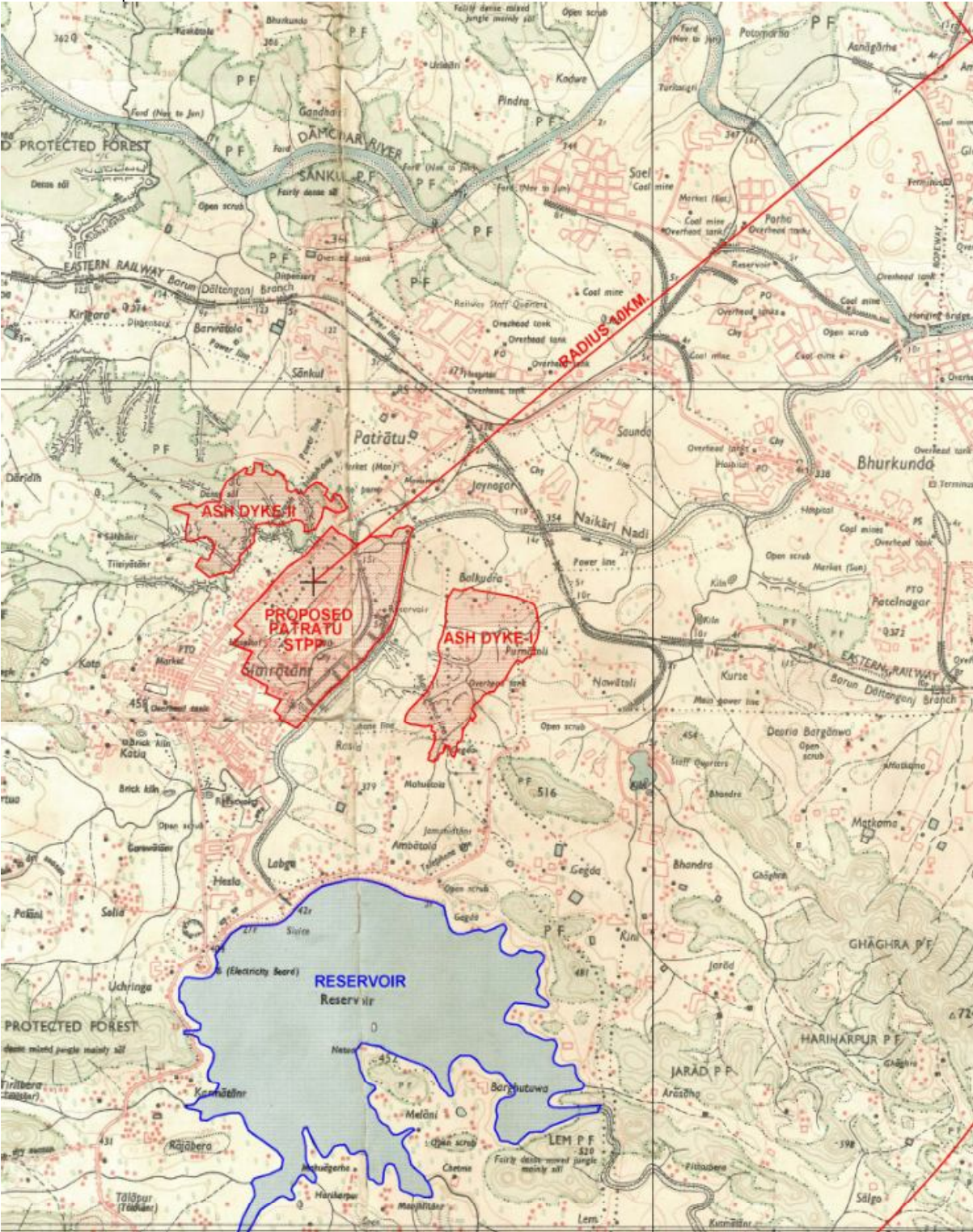
**TECHNICAL SPECIFICATION
SECTION-VI, PART-A
BID DOC NO: CS-9585-001-2**

CLAUSE NO.	PROJECT INFORMATION			
5.00.00	A copy of Vicinity plan of the project site is placed at Annexure - I .			
	LAND	The total land to be transferred to JV Company is 1859 acres. Out of 1859 acre, about 1234 acres of land has been envisaged for Plant, Ash pond and Land on railway track of the for Phase-I (3x800 MW). The balance 625 acre of land shall be transferred during commencement of Phase-II (2x800 MW).		
6.00.00	WATER	The make-up water for PSTPS is to be met from Patratu Dam on Nalkari River (capacity 99 MCM i.e. 110 Cusecs). About 52.34 Cusecs of water will be available at 90% dependable monsoon flow after considering evaporation loss.		
		GoJ/JUVNL owns and controls water of Patratu Dam. GoJ/JUUNL supplies water to PTPS and to the other entities in the vicinity from this water reservoir. JUVNL had entered into agreements with these other entities for supply of water from water reservoir. JUVNL shall revisit these agreements to meet the requirement of water for expansion projects, if required.		
		Make up water requirement of PSTPS, Phase-I (3x800 MW) would be about 27 Cusecs with “Air Cooled Condenser” based power plant. GoJ shall provide the required water from the existing reservoir to the JV Company.		
		The JVC shall be responsible for the water supply arrangement starting at the downstream of intake chamber from where water supply commences for the Station. Ownership of the entire water supply system and related plant and equipment, including the water treatment plant, shall be that of the JVC and after the asset transfer, the JVC shall maintain, take care and use the same. The additional facility including addition of plant, equipment etc. for enhanced requirement (if any) and drawl of water shall be the responsibility of JVC and to be arranged by the JVC at their own cost.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02	SUB-SECTION-IB PROJECT INFORMATION	PAGE 2 OF 15

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7.00.00	COAL			
7.01.00	Coal Requirement, Availability and Linkage About 12 MTPA of coal will be required to meet coal requirement of the Phase-I (3x800 MW) of the project. The Banhardih captive coal block at a distance of about 155 km from plant is allocated to JUVNL for end use of Patratu expansion. The coal from Banhardih captive coal block shall be transferred to the JVC for the usage of PSTPS with the approval of Ministry of Coal, GOI. MOC (11.09.15) has accorded in-principle approval of the Central Govt. to assign Banhardih Coal Block allocated to JUVNL to the JV Company.			
7.02.00	Coal Transportation The envisaged mode of coal transportation from the coal mines to the power plant is by Indian Railways through BOBR / BOX- N wagons.			
7.03.00	Coal Quality The primary fuel for the main steam generator shall be coal. The domestic coal quality parameters are indicated in Annexure-IV-2 and imported coal parameters are indicated in Annexure-IV-4 are to be considered for steam generator design.			
7.04.00	Fuel Oil The fuel oils to be used for start-up, coal flame stabilization and low load operation of the steam generator shall be Heavy Fuel Oils having the characteristics given at Annexure-IV-3 and Light Diesel Oil having the characteristics given at Annexure-IV-1 .			
8.00.00	NOT USED			
9.00.00	STEAM GENERATOR TECHNOLOGY The steam generators shall be super critical once through type, water tube, direct pulverized coal fired, top supported, balanced draft furnace, single reheat, radiant, dry bottom type, suitable for outdoor installation. The gas path arrangement shall be single pass (Tower type) or two pass type.			
10.00.00	FLUE GAS DESULPHURIZATION SYSTEM (FGD) &SCR: The project is envisaged with Flue Gas Desulfurization (FGD) system and SCR meeting Ministry of Environment, Forest & Climate Change notification dated 07.12.2015. Limestone to be used for design of FGD system shall be as per the characteristic given at Annexure-IV-5.			
11.00.00	POWER EVACUATION SYSTEM 85% of power from the project is envisaged to be allocated to Jharkhand State subject to approval of Ministry of Power, while balance 15% would be as unallocated portion and Project is envisaged as regional project. Since major power (85%) is proposed to be absorbed by Jharkhand, the issue of Associated Transmission			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02		SUB-SECTION-IB PROJECT INFORMATION
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	System for the project would be taken up with them for planning and execution of transmission system modalities as Inter-State System or ISTS System. Considering overall capacity of the project as 4000 MW, 765 kV step-up system has been envisaged. Two D/C 765 KV line, one each to New Ranchi (Bero) and Gaya has been envisaged. This would also form part of 765 kV transmission corridor connecting Ranchi to Gaya. These lines can be used to evacuate power to the Eastern Region ISTS as well as to Jharkhand State. In view of above, provision of four nos. of 765 kV outgoing Line bays has been kept in the new 765 kV generation switchyard. The issue of power evacuation of the proposed project shall be taken up with appropriate Transmission Utility (STU or CTU) as per regulatory provision, based on allocation of power.			
12.00.00	METEOROLOGICAL DATA The meteorological data from nearest observatory is placed at Annexure-II.			
13.00.00	PLANT WATER SCHEME The Plant water scheme is described below.			
13.01.00	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 ACW system in a secondary circuit. The station auxiliaries such as Air compressors, Compressors of ash handling plant, compressor of mill reject 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.			
13.02.00	Not used			
13.03.00	Other Miscellaneous Water Systems (a) The drinking water requirement of the plant shall be provided from water treatment plant. (b) Steam Cycle make-up water, makeup to the primary circuit of ECW (unit auxiliaries) system, boiler fill water shall be provided from demineralizing plant. (c) The quality of Raw Water & DM Water is enclosed with this sub-section as Annexure-III. (d) Effluent from various areas in TG & SG system shall be collected in respective pits in their areas and pumped to a common terminal point as shown in plant water scheme.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02	SUB-SECTION-IB PROJECT INFORMATION	PAGE 4 OF 15

CLAUSE NO.	PROJECT INFORMATION 			
14.00.00	CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in Part-B of this section.			
15.00.00	CRITERIA FOR WIND RESISTANT DESIGN OF STRUCTURES AND EQUIPMENT All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given as given in Part-B of this section.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02	SUB-SECTION-IB PROJECT INFORMATION	PAGE 5 OF 15

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	ANNEXURE-I			
				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02	SUB-SECTION-IB PROJECT INFORMATION	PAGE 6 OF 15	

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PROJECT INFORMATION

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NTPC

ANNEXURE-II

C

स्टेशन : रामगढ़ STATION : Ramgarh		अक्षांश LAT 23°38' N		देशांतर LONG 85°30' E		समुद्री सतह से ऊँचाई HEIGHT ABOVE M.S.L. 335 METRES		मंदर 335 METRES		1953 से 1980 तक के अवर्षा पर अवर्षा BASED ON OBSERVATIONS FROM 1953 TO 1980											
जलवायवी सारणी CLIMATOLOGICAL TABLE																					
वायु तापमान																					
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CLAUSE NO.	PROJECT INFORMATION			
	ANNEXURE-III			
	RAW WATER ANALYSIS			
	S.No	Constituent	As	mg/l
	1	Calcium	CaCO ₃	105
	2	Magnesium	CaCO ₃	81
	3	Sodium	CaCO ₃	70
	4	Potassium	CaCO ₃	7
		Total cations	CaCO ₃	263
	5	HCO ₃	CaCO ₃	180
	6	P- Alkalinity	CaCO ₃	0
	7	Chloride	CaCO ₃	60
	8	Sulphate	CaCO ₃	23
		Total Anions	CaCO ₃	263
	9	Silica, Reactive	Si	3
	10	Iron (Total)	Fe	0.6
	11	pH	-	7.0-7.8
	12	Turbidity	NTU	100
	13	Total dissolved solids		230-300
	14	Temperature	Deg C	20-35
	15.	Organics (KMnO ₄)		2
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02	SUB-SECTION-IB PROJECT INFORMATION	PAGE 9 OF 15

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	ANNEXURE-III			
	THE MINIMUM QUALITY OF DM WATER TO BE CONSIDERED FOR MAKE-UP WATER			
	Sl.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	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02		SUB-SECTION-IB PROJECT INFORMATION
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CLAUSE NO.	PROJECT INFORMATION		
	ANNEXURE-IV-1		
	<u>LIGHT DIESEL OIL CHARACTERISTICS</u>		
	AS PER IS 15770-2008		
	Characteristics	LDO	
	1. Pour Point (max)	21 °C & 12°C for Summer and Winter respectively	
	2. Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.0	
	3. Sediment percent by mass (max)	0.10	
	4. Total sulphur percent by mass (max)	1.5	
	5. Ash percentage by mass (max)	0.02	
	6. Carbon residue (Rams bottom) percent by pass (max.)	1.50	
	7. Acidity inorganic	Nil	
	8. Flash point (Min.) - Pensky Martens	66 deg.C	
	9. Copper strip corrosion for 3 hours at 100°C	Not worse than No. 2	
	10. Water content, % by volume (max)	0.25	
	11. GCV(kcal/kg)	10,000	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02	SUB-SECTION-IB PROJECT INFORMATION
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CLAUSE NO.	PROJECT INFORMATION					
	ANNEXURE-IV-2 DOMESTIC COAL CHARACTERISTICS					
S No.	Characteristics (As received basis)	Range of 95% coal supplies			Range of 5% coal supplies	
1.0	PROXIMATE ANALYSIS	Column-1	Column-2	Column-3	Range of Adequacy coal	
		Design	Worst	Best	Worst	Best
1.1	Total Moisture (%)	14	17	11	18	10
1.2	Ash (%)	36	42	34	44	30
1.3	Volatile matter (%)	23	19	24	19	28
1.4	Fixed carbon (%)	27	22	31	19	32
2.0	ULTIMATE ANALYSIS					
2.1	Carbon (%)	33.31	27.23	39.07	25.72	44.43
2.2	Hydrogen (%)	3.49	3.05	3.53	2.93	3.72
2.3	Sulphur (%)	0.6	0.9	0.5	0.95	0.35
2.4	Nitrogen (%)	0.9	1.3	0.8	1.4	0.6
2.5	Oxygen (%) (By difference)	11.7	8.52	11.1	7	10.9
2.6	Total Moisture (%)	14	17	11	18	10
2.7	Ash (%)	36	42	34	44	30
2.8	GCV (kcal/kg)	3400	2900	3900	2800	4400
2.9	Hard Grove index	55	50	60	45	65
2.10	YGP Index (mg/kg)	75	80	70	85	65
2.11	Carbonates	0.3	0.38	0.27	0.2	0.43
2.12	Phosphorous	0.05	0.04	0.06	0.03	0.07
2.13	Chloride	0.08	0.15	0.05	0.18	0.04
2.14	Trace Elements (ppm)					
2.14.1	Arsenic	1	1.5	0.5	2.5	0.4
2.14.2	Lead	35	75	25	150	10
2.14.3	Mercury	0.1	0.5	0.08	0.6	0.06
2.14.4	Selenium	0.8	1	0.6	1.5	0.5
3.0	ASH ANALYSIS					
3.1	Silica (%)	59.25	63.4	56.92	63.56	54.2
3.2	Alumina (%)	27.62	27.29	28.47	27.2	29.89
3.3	Iron Oxide (%)	6.75	5.48	7	5.46	7.5
3.4	Titania (%)	1.95	0.88	2.5	0.98	2.82
3.5	P ₂ O ₅ (%)	0.24	0.3	0.11	0.35	0.1
3.6	Lime (%)	0.9	0.7	1.5	0.6	1.6
3.7	Magnesia (%)	0.2	0.3	0.15	0.35	0.1
3.8	Sulphuric Anhydride (%)	1.2	0.5	1.4	0.4	1.7
3.9	Sodium Oxide (%)	0.17	0.25	0.15	0.3	0.15
3.10	Balance Alkalies (By Difference) (%)	1.72	0.9	1.8	0.8	1.94
4.0	ASH FUSION RANGE (Under reducing atmosphere)					
4.1	Initial Deformation Temperature (°C)	1100	1100	1100	1100	1100
4.2	Hemispherical temperature (°C)	1300	1250	1350	1250	1350
4.3	Flow temperature (°C)	1400	1400	1400	1400	1400
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02		SUB-SECTION-IB PROJECT INFORMATION		PAGE 12 OF 15

CLAUSE NO.	PROJECT INFORMATION				एनटीपीसी NTPC
	ANNEXURE-IV-3				
	FUEL OIL CHARACTERISTICS				
	Sl. No.	Characteristics	Heavy Furnace Oil grade HV (HFO) IS-1593-1982	Low Sulphur Heavy Stock (LSHS) IS-11489-1985	Heavy Petroleum stock (HPS) IS-11489-1985
	1.	Total sulphur content	4.5% Max.	1.0% Max.	4.5% Max.
	2.	Gross calorific value (KCal/kg)	of the order of 10,000	of the order of 10,000	of the order of 10,000
	3.	Flash Point (Min)	66 deg C	76 deg C	66 deg C
	4.	Water content by volume (Max)	1.0%	1.0%	1.0%
	5.	Sediment by weight (Max)		0.25%	0.25% 0.25%
	6.	Asphaltene content by weight (Max.)	2.5%	2.5%	2.5%
	7.	Kinematic viscosity in Centistokes	370 at 50deg C	100 at 100deg C	100 at 100deg C
	8.	Ash Content by weight (Max.)	0.1%	0.1%	0.1%
	9.	Acidity (inorganic)	Nil	Nil	Nil
	10.	Pour Point (Max.)	57 deg C	66 deg C	72 deg C
	11.	Sodium content	—	—	100 ppm
	12.	Vanadium content	25 ppm	25ppm	25 ppm
13.	Specific heat below pour point (KCal/Kg °C)		0.65		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02		SUB-SECTION-IB PROJECT INFORMATION	PAGE 13 OF 15

CLAUSE NO.	PROJECT INFORMATION																																																																																																																																																										
	ANNEXURE-IV-4 TYPICAL IMPORTED COAL AND ASH CHARACTERISTICS <table> <tr> <th data-bbox="459 363 537 390">Sl.No.</th><th data-bbox="565 363 812 432">Characteristics (as received basis)</th><th colspan="2" data-bbox="998 363 1187 390">Imported Coal</th></tr> <tr> <th></th><th></th><th data-bbox="1052 432 1133 459">Worst</th><th data-bbox="1222 432 1284 459">Best</th></tr> <tr> <td>1.0</td><td>Proximate Analysis</td><td></td><td></td></tr> <tr> <td>1.1</td><td>Total Moisture (%)</td><td>20</td><td>16</td></tr> <tr> <td>1.2</td><td>Ash (%)</td><td>10</td><td>10</td></tr> <tr> <td>1.3</td><td>Volatile Matter (%)</td><td>30</td><td>45</td></tr> <tr> <td>1.4</td><td>Fixed Carbon (%)</td><td>40</td><td>29</td></tr> <tr> <td>1.5</td><td>Total (%)</td><td>100</td><td>100</td></tr> <tr> <td>2.0</td><td>Ultimate Analysis</td><td></td><td></td></tr> <tr> <td>2.1</td><td>Carbon (%)</td><td>56.4</td><td>62.4</td></tr> <tr> <td>2.2</td><td>Hydrogen (%)</td><td>4.5</td><td>4.9</td></tr> <tr> <td>2.3</td><td>Sulphur (%)</td><td>0.9</td><td>0.8</td></tr> <tr> <td>2.4</td><td>Nitrogen (%)</td><td>0.9</td><td>0.5</td></tr> <tr> <td>2.5</td><td>Oxygen (%) (By difference)</td><td>7.3</td><td>5.4</td></tr> <tr> <td>2.6</td><td>Carbonates (%)</td><td>0</td><td>0</td></tr> <tr> <td>2.7</td><td>Phosphorous (%)</td><td>0</td><td>0</td></tr> <tr> <td>2.8</td><td>Total Moisture (%)</td><td>20</td><td>16</td></tr> <tr> <td>2.9</td><td>Ash (%)</td><td>10</td><td>10</td></tr> <tr> <td></td><td>Total</td><td>100</td><td>100</td></tr> <tr> <td>2.10</td><td>GCV (Kcal/Kg)</td><td>5800</td><td>6500</td></tr> <tr> <td>2.11</td><td>Hard Grove Index</td><td>45</td><td>60</td></tr> <tr> <td>2.12</td><td>YGP (mg/kg)</td><td>100</td><td>70</td></tr> <tr> <td>3.0</td><td>Ash Analysis</td><td></td><td></td></tr> <tr> <td>3.1</td><td>Silica (SiO₂) (%)</td><td>32.74</td><td>34.94</td></tr> <tr> <td>3.2</td><td>Alumina(Al₂O₃) (%)</td><td>30.5</td><td>28.43</td></tr> <tr> <td>3.3</td><td>Iron Oxides(Fe₂O₃) (%)</td><td>18.2</td><td>15.2</td></tr> <tr> <td>3.4</td><td>Titania (TiO₂)</td><td>1.56</td><td>1.76</td></tr> <tr> <td>3.5</td><td>Phosphoric Anhydride(P₂O₅) (%)</td><td>0.44</td><td>0.54</td></tr> <tr> <td>3.6</td><td>Lime (CaO) (%)</td><td>6.12</td><td>7.62</td></tr> <tr> <td>3.7</td><td>Magnesia (MgO) (%)</td><td>1.83</td><td>1.93</td></tr> <tr> <td>3.8</td><td>Sulphuric Anhydride (%)</td><td>6.95</td><td>7.65</td></tr> <tr> <td>3.9</td><td>Sodium Oxide (Na₂O) (%)</td><td>0.3</td><td>0.4</td></tr> <tr> <td>3.10</td><td>Balance alkalies (by difference)</td><td>1.36</td><td>1.56</td></tr> <tr> <td></td><td>Total</td><td>100</td><td>100</td></tr> <tr> <td>4.0</td><td>Ash Fusion Temperature reducing temperature</td><td></td><td></td></tr> <tr> <td>4.1</td><td>Initial deformation Temp (°C)</td><td>1100</td><td>1250</td></tr> <tr> <td>4.2</td><td>Hemispherical Temp. (°C)</td><td>1300</td><td>1350</td></tr> <tr> <td>4.3</td><td>Flow Temp. (°C)</td><td>1400</td><td>1400</td></tr> </table>	Sl.No.	Characteristics (as received basis)	Imported Coal				Worst	Best	1.0	Proximate Analysis			1.1	Total Moisture (%)	20	16	1.2	Ash (%)	10	10	1.3	Volatile Matter (%)	30	45	1.4	Fixed Carbon (%)	40	29	1.5	Total (%)	100	100	2.0	Ultimate Analysis			2.1	Carbon (%)	56.4	62.4	2.2	Hydrogen (%)	4.5	4.9	2.3	Sulphur (%)	0.9	0.8	2.4	Nitrogen (%)	0.9	0.5	2.5	Oxygen (%) (By difference)	7.3	5.4	2.6	Carbonates (%)	0	0	2.7	Phosphorous (%)	0	0	2.8	Total Moisture (%)	20	16	2.9	Ash (%)	10	10		Total	100	100	2.10	GCV (Kcal/Kg)	5800	6500	2.11	Hard Grove Index	45	60	2.12	YGP (mg/kg)	100	70	3.0	Ash Analysis			3.1	Silica (SiO ₂) (%)	32.74	34.94	3.2	Alumina(Al ₂ O ₃) (%)	30.5	28.43	3.3	Iron Oxides(Fe ₂ O ₃) (%)	18.2	15.2	3.4	Titania (TiO ₂)	1.56	1.76	3.5	Phosphoric Anhydride(P ₂ O ₅) (%)	0.44	0.54	3.6	Lime (CaO) (%)	6.12	7.62	3.7	Magnesia (MgO) (%)	1.83	1.93	3.8	Sulphuric Anhydride (%)	6.95	7.65	3.9	Sodium Oxide (Na ₂ O) (%)	0.3	0.4	3.10	Balance alkalies (by difference)	1.36	1.56		Total	100	100	4.0	Ash Fusion Temperature reducing temperature			4.1	Initial deformation Temp (°C)	1100	1250	4.2	Hemispherical Temp. (°C)	1300	1350	4.3	Flow Temp. (°C)	1400	1400		
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EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02	SUB-SECTION-IB PROJECT INFORMATION	PAGE 14 OF 15																																																																																																																																																								

CLAUSE NO.	PROJECT INFORMATION 			
	ANNEXURE-IV-5 LIMESTONE CHARACTERISTICS The details of Limestone data shall be furnished later.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X800 MW)		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO CS-9585-001-02	SUB-SECTION-IB PROJECT INFORMATION	PAGE 15 OF 15



TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO.: PE-TS-434-154-A101

SUB-SECTION: I

REV. NO.: 00

DATE: 12.04.2019

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



TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO.: PE-TS-434-154-A101

SUB-SECTION: IA

REV. NO.: 00

DATE: 12.04.2019

SECTION – IA

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)



TITLE: PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE- I (3 X 800 MW)	SPECIFICATION NO.: PE-TS-434-154-A101	
	SUB-SECTION: IA	
	REV. NO.: 00	DATE: 12.04.2019

1.0 SCOPE

This specification is intended to cover design, engineering, manufacturing, fabrication, assembly, supply, inspection/ testing at vendor's & sub-vendor's works, painting, mandatory spares, special tools and tackles (as applicable), forwarding, proper packing, shipment and delivery at site, preparation and submission of drawing/ documents & equipment/ system guarantee etc. as specified hereinafter for PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE- I (3 x 800 MW) OXYGEN DOSING SYSTEM.

Broad scope of work of this package includes all equipment and accessories. Please also refer C&I section for C&I scope.

The Oxygen dosing system as specified in Technical Specification shall consist of the followings:

- Entire Oxygen dosing system mounted on skid as per P&IDs and Data Sheet-A.
- Instrumentation (minimum) as per the enclosed P&ID.
- Mandatory spares as specified.
- Storage racks (3 Nos.) each to hold 32 cylinders, cylinders (96 Nos.), injector assemblies (12 nos.), tees (30 nos.), elbows (30 nos.), loose tubing (600 meter), compression fittings (105 nos.) for loose tubing.
- Foundation nuts & bolts to fix each skid on the floor, as required.

1.1 SCOPE OF SERVICES

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

- ✓ Design and engineering.
- ✓ Fabrication of the skid mounted oxygen dosing system.
- ✓ Painting as per the enclosed painting schedule. However, any variation in the painting schedule as finally approved by customer shall be taken care by the bidder without any commercial and delivery implication. Color-coding scheme shall be intimated to vendor during detailed engineering.
- ✓ Inspection and testing of the skid as per the approved quality assurance plan.
- ✓ Supply of the skid mounted oxygen dosing system up to the power plant site along with all accessories as defined in the technical specification.

1.2 CIVIL SCOPE

Nil.

2.0 OXYGEN DOSING SYSTEM: (2 SKIDS PER UNIT; TOTAL= 4 SKIDS)

(Refer Drawing. No. PE-DG-434-154-A101)

One skid of Oxygen Dosing System consists of the following:-

- ✓ One number of bank of two oxygen cylinders, dosing at downstream of Deaerator/ CPU outlet.
- ✓ Two number of Pressure Regulator as per Section D1 and Data Sheet – A.
- ✓ Associated Piping, valves, fitting as indicated in the P&ID of oxygen dosing system and Data Sheet-A enclosed and as required to make the system complete.
- ✓ Control & instrumentation as per P&ID of Oxygen Dosing System, Data sheet-A, Section IB, and IIB.

3.0 TERMINAL POINTS

- i. All field instruments (pressure and flow transmitters), solenoid valves and MFCs shall be terminated at JB by the oxygen dosing vendor for further connection to DCS by BHEL/ Customer.
- ii. All vent connections shall be connected via vent header and terminated at one point of the skid for further connection to atmosphere, if required, by BHEL.
- iii. Dosing termination point shall be after MFCs and terminated at one point by the oxygen dosing



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- supplier for further interconnection till dosing locations by BHEL/ Customer.
- iv. 24 V-DC connection to SV-3, SV-4 and SV-5 shall be directly connected by BHEL/ Customer.

4.0 QP AND SUB VENDOR APPROVAL

- 4.1 The quality assurance plan is enclosed elsewhere in technical specification. However requirement of detailed QP, inspection checklist, certificate of conformance etc. for each equipment and sub-vendor shall be finalized during detailed engineering stage; decision of BHEL/ customer shall be binding on vendor in this regard. Any changes/ additional tests insisted upon by Owner during approval of QAP's shall be accepted by bidder without any commercial and delivery implication to BHEL/ Customer. Bidder shall submit the quality plans in BHEL format during detailed engineering stage. Bidder to note further that during detailed engineering all the QAP's/ check lists etc. shall be submitted to Customer/ BHEL for approval. All inspection & testing etc. shall be carried out accordingly.
- 4.2 The sub vendor list (Annexure- II) enclosed is indicative only and is subject to approval/ acceptance by customer. Bidder to propose his sub vendor list with back up documents (experience list, end user performance certificate as applicable) etc. The same shall subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL/ Customer.

5.0 DOCUMENTS TO BE SUBMITTED BY BIDDER ALONG WITH THE BID

BIDDER SHOULD SUBMIT THE SIGNED AND STAMPED COPY OF THE FOLLOWING DOCUMENTS:

- Deviation, if any in the enclosed Schedule of deviation with cost of withdrawal only with mention of specification clause for which deviation is being asked. (Stamped & Signed).
- Compliance certificate (stamped & signed).
- Price Schedule duly filled in (stamped & signed).
- List of Recommended spares, if any (stamped & signed).

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

6.0 DRAWING/ DOCUMENTS REQUIREMENT

For the drawings/ documents submission schedule, please refer ANNEXURE-III.

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

7.0 SPARES

- 7.1 All the spares for the equipment under the contract provided by the vendor will strictly conform to the specifications and documents and will be identical to the corresponding main equipment/ components supplied under the contract.
- 7.2 The quality plan and the inspection requirement finalized for the main equipment will also be applicable to the corresponding spares.

8.0 MANDATORY SPARES

- 8.1 The list of mandatory spares considered essential by the BHEL & Customer is indicated in Annexure- V.
- 8.2 All mandatory spares shall be delivered at site at least two months before scheduled date of



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initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipments.

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

8.4 The Bidder shall note that if there is any change/ variation in equipment/ system during detail engineering which causes any change/ variation in the essential spares quantity, the same shall be supplied without any commercial implications. The price indicated for the mandatory spares shall be considered for the purpose of evaluation.

9.0 — START-UP AND COMMISSIONING SPARES

~~Start up and Commissioning spares are those which would be required during plant or equipment testing, start up and commissioning. All spares used until the plant is finally handed over by the Contractor to the Owner come under this category. Commissioning spares if deemed necessary by the bidder for commissioning of oxygen dosing skids shall be supplied by the bidder as a part of base offer. List of commissioning spares quoted for and individual price break up of the same shall be submitted separately.~~

10.0 RECOMMENDED SPARES

10.1 Bidders shall furnish a recommended spare parts schedule which the Bidder considers necessary and which has not been specified in the list of mandatory spares for the normal and trouble free plant operation for 3 years operation along with their offer for all equipment under the scope. The list of spares shall include such spares which are to be stored to achieve the plant availability level indicated by the bidder. The unit price of each recommended spares shall be indicated separately and shall not be quoted along with the lumpsum price. The price indicated for the recommended spares shall not be considered for the purpose of evaluation.

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

11.0 MAINTENANCE TOOLS AND TACKLES

- One set of all special tools shall be furnished and shipped with each piece of equipment for dismantling, maintenance, adjustment, and calibration of the equipment. The tools shall be shipped in separate heavily constructed wooden boxes provided with hinged covers and padlock hasps.
- The Contractor shall supply under this contract all maintenance tools for each piece of equipment/ system and it shall be boxed separately and the boxes shall be appropriately marked for shipment and identification of contents.
- A weather-proof itemized list of the contents shall also be attached to the outside of each container.
- The maintenance tools shall include all special handling rigs, bars, slings, cable and all specialized equipment for control system maintenance such as extender boards, scopes, and all software and hardware. Further, Bidder shall also include a full set of regular maintenance tools and tackles required. Bidder shall also include all maintenance tools and tackles in their scope. Total price of all the maintenance tools and tackles shall be included in the quoted lump sum price.

12.0 PACKING

To prevent damage to any equipment/ item of the skid during transit, wooden/ angle iron/ steel frame supports to be provided wherever required. Special attention shall be provided while packing and loading for overhead equipment.

Bidder shall submit the packing details during detailed engineering for approval. Any changes required in packing details shall be complied by the bidder without any price and delivery implication.



TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO.: PE-TS-434-154-A101

SUB-SECTION: IA

REV. NO.: 00

DATE: 12.04.2019

13.0 PAINTING

Bidder to note that painting shall be as per approved painting schedule to be finalized during detailed engineering. However the same shall be prepared in line with the schedule enclosed in Section IA/ Annexure-IV.

14.0 OTHER DESIGN REQUIREMENTS

Bidder to note that other design requirement of the Oxygen dosing skids shall be as below: -

- All the terminal points shall be easily accessible and towards one side of skid.
- All valves shall be easily accessible for the operator.
- All equipment shall have SS name plate clearly indicating the equipment name.
- Tube fittings of the system shall be done using elbows and tees. Tube bending is not acceptable.
- All JB's shall be mounted in their respective dosing skids only.
- MFCs shall also be mounted in an enclosure. DOP of enclosure shall be IP-65 minimum. Other technical requirements of this enclosure shall be in line with JB details indicated elsewhere in the specification.
- All cylinders supplied should conform to "Gas Cylinder Rules, 2004" and CCE license for the same shall be arranged by the bidder.
- All items supplied for the oxygen dosing systems shall be suitable for oxygen service. Bidder shall provide the certificates indicating items are oxygen cleaned or suitable for oxygen service.

15.0 MISCELLANEOUS REQUIREMENTS

- Finish paints for touch-up painting of equipment after erection at site in sealed container.
- Document approval by Customer/ BHEL under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval.
- Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to Customer and BHEL for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
- In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion. However, in case changes are necessitated due to any constraints at Customer/BHEL end, delay in review/ approval of drawing beyond one month will be to Customer/BHEL account.
- Relevant requirements as per GTR, GCC, ECC & SCC. Any statutory requirement / clearance required for the packages from government / local body shall be in bidder's scope.
- In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- Vendor to attend regular engineering meeting with BHEL and Customer fortnightly in BHEL or Customer office as decided during detail engineering. Vendor will depute his entire concerned Engineering representatives along with the project manager for discussion and approval. Meeting can be held at site also.
- Latest version of all codes and standards to be followed.
- For detailed dispatch instructions, Bidder to refer special condition of contract (SCC) of the project.



TITLE: PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE- I (3 X 800 MW) TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM	SPECIFICATION NO.: PE-TS-434-154-A101	
	SUB-SECTION: IA	
	REV. NO.: 00	DATE: 12.04.2019

ANNEXURE - I

QUALITY PLAN FOR OXYGEN DOSING SYSTEM

		MANUFACTURER'S NAME & ADDRESS :		MANUFACTURING QUALITY PLAN				PROJECT PACKAGE		: OXYGEN DOSING SYSTEM			
				ITEM: OXYGEN DOSING SYSTEM SUB - SYSTEM : DEAERATOR & CEP DISCHARGE DOSING		QP. NO : REV. : DATE : PAGE :				CONTRACT NO. MAIN SUPPLIER BHEL QP. NO CUS QP. NO		: BHEL/PEM/NOIDA	
S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	D*	AGENCY**			REMARKS
1	2	3	4	5	6	7	8	9		M	C	N	11
1.0	<u>WELDER'S QUALIFICATION</u>												
1.1	WELDING PROCEDURE SPECIFICATION (WPS)	CORRECTNESS	MA	SCRUTINY	100%	ASME IX	ASME IX	QW 482		P	V	V	
1.2	WELDER PERFORMANCE & PROCEDURE QUALIFICATION RECORD	WELD SOUNDNESS & WELDING PERFORMANCE	MA	PHYSICAL TEST	100%	ASME IX	ASME IX	QW 483 & QW 484		P	V	V	
2	EMPTY OXYGEN CYLINDER	MTC, HYDRO TEST & RELEVANT TESTS AS PER IS 7285	MA	IS 7285	100%	APPROVED DATASHEET	AS PER APPROVED DATASHEET	MFRS CERTIFICATE		P	V	V	
3	VALVES (BODY & BONNET)	MATERIAL	MA	--	100%	APPROVED DATASHEET	AS PER MODEL DECODIFICATION MENTIONED IN MFRS CATALOGUE	MANUFACTURERS COC		P	V	V	
4	INSTRUMENTS												
4.A	PRESSURE GAUGE	MOC FOR WETTED PARTS, CALIBRATION & BOURDON OVER PRESSURE PROTECTION & TYPE CALIBRATION, OVER LOAD PROTECTION & TYPE TEST CERTIFICATE	MA	MEASUREMENT	1/TYPE	APPROVED DATASHEET	AS PER APPROVED DATASHEET	MFRS CERTIFICATE		P	V	V	
4.B	PRESSURE TRANSMITTER		MA	MEASUREMENT	100%	APPROVED DATASHEET	AS PER APPROVED DATASHEET	MANUFACTURERS COC		P	V	V	
5	SOLENOID VALVES	MATERIAL	MA	VISUAL	100%	APPROVED DATASHEET	AS PER MODEL DECODIFICATION MENTIONED IN MFRS CATALOGUE	MANUFACTURERS COC		P	V	V	
6	CYLINDER PRESSURE REGULATOR	MATERIAL	MA	VISUAL	100%	APPROVED DATASHEET	AS PER MANUFACTURERS CATALOGUE	MANUFACTURERS COC		P	V	V	
7	TERMINATION BOX	COUNTUNITY,IR-HV-IR & DEGREE OF PROTECTION	MA	ELECTRICAL	100%	APPROVED DATASHEET	AS PER APPROVED DATASHEET	MFRS COC & INSPECTION REPORT		P	V	V	
8	TUBING	CHEMICAL & PHYSICAL	MA	CHEMICAL & PHYSICAL TEST	100%	APPROVED DRAWING DATASHEET	APPROVED DRAWING DATASHEET	LAB REPORT		P	V	V	
9	MASS FLOW CONTROLLER	CALIBRATION REPORT	MA	ELECTRICAL	100%	APPROVED DRAWING & DATASHEET	APPROVED DRAWING & DATASHEET	CALIBRATION REPORT		P	V	V	
10	FITTING	MATERIAL	MA	VISUAL	100%	APPROVED DRAWING	AS PER MODEL DECODIFICATION MENTIONED IN MFRS CATALOGUE	MANUFACTURERS COC		P	V	V	
11	FINAL ASSAMBLY	DIMENSION, ORIENTATION & COMPLETENESS.	MA	MEASUREMENT	100%	APPROVED DRAWING	APPROVED DRAWING	INSPECTION		P	W	W	
	FAT	LEAKAGE		N2 FILL FOR 2HR	100%	APPROVED DRAWING / FACTORY ACCEPTANCE TEST	NO LEAKAGE	INSPECTION REPORT		P	W	W	
12	POWDER COATING STAMPING	DFT MEASUREMENT	MI	VISUAL	100%	NTPC APPROVED PAINTING SCHEME				P	W	V	
13	PMI Test for SS	GRADE CONFIRMATION	MA	CHEM.TEST	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/ DWG	INSPECTION REPORT		P	W	W	

NOTES: ALL INSTRUMENTS SHALL BE OXYGEN CLEANED AND SUITABLE FOR OXYGEN SERVICE. MANUFACTURERS COC CERTIFYING THE SAME REGARDING OXYGEN CLEANED SHALL BE SUBMITTED FOR REVIEW DURING FINAL INSPECTION.

		LEGEND :				DOC NO.		REV :		CAT :	
		* RECORDS IDENTIFIED WITH "TICKS" SHALL BE ESSENTIALLY INCLUDED BY CONTACTION IN QA DOCUMENTATION.									
MANUFACTURER/ SUB SUPPLIER		MAIN SUPPLIER		** M : MANUFACTURER/SUB-CONTRACTOR C : BHEL, N:NTPC		FOR CUSTOMER USE					
SIGNATURE		INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION AS APPROPRIATE, "CHP" SHALL BE IDENTIFIED IN COLUMN "N".						REVIEWED BY		APPROVED BY	
										APPROVAL SEAL	



TITLE:
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TEST PROCEDURE FOR OXYGEN DOSING SYSTEM

- A Factory Acceptance Testing will be conducted at vendor's Factory. This will be for verification of the functional performance of critical equipment/instruments and hardware design when run at design pressure, temperature and flow.
- FAT will be carried out using **only the inert gas** such as **Nitrogen**. Following will be the FAT protocol.
- Checking the completeness of the system. This will include visual inspection of equipment and instruments as per the P & ID s & GA along with skid after assembling on skid.
- Soap joint leak test of tubing/fittings/valves using nitrogen at 1.25 times of maximum operating pressure.
- **(ANSI B31.8)**, for 2 hours. The allowable pressure drop would be up to 0.5 bar over 2 hours.
- Functional testing of calibrated components (equipment/ instruments) using nitrogen. The test controller will be connected to Mass flow controller. The set point will be given from test controller & this will be monitored.
- Testing of Assembly of skid, instruments, termination box will be done by BHEL as per approved Quality Assurance Plan.
- Inert test run using nitrogen to demonstrate flow.
- Final Assembly & Factory Acceptance Test will be witnessed by BHEL & CUSTOMER.



TITLE:
**PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)**
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DOSING SYSTEM**

SPECIFICATION NO.: PE-TS-434-154-A101

SUB-SECTION: IA

REV. NO.: 00

DATE: 12.04.2019

ANNEXURE – II
SUB VENDOR LIST (INDICATIVE)



TITLE :
TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW) SG PACKAGE
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO. PE-TS-424-154-
A002

SECTION: IA

REV. NO. 00

DATE : 18/01/17

SUB VENDOR LIST - MECHANICAL



TITLE :
TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW) SG PACKAGE
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO. PE-TS-424-154-A002

SECTION: IA

REV. NO. 00

DATE : 18/01/17

SR. NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	FILLING OF OXYGEN CYLINDER	FILLING OF EMPTY CYLINDERS MAY BE DONE FROM ANY CCE LICENSED OXYGEN GAS FILLER	AS APPLICABLE	
2.	EMPTY OXYGEN CYLINDERS	BPCL	ALLAHABAD	
		EVEREST KANTO	BOMBAY	
		MARUTI KOATSU CYLINDER LTD	HALOL, GUJARAT	
3.	CHECK VALVE/BALL VALVE/	HAMLET	USA	
		SWAGELOK	USA	
		PARKER	USA	
4.	VALVE MANIFOLD	HAMLET	USA	
		EXCEL HYDRO	MUMBAI	
		SCHNEIDER	GERMANY	
		HY LOK	KOREA	
		DK TECH	KOREA	
		ANDERSON GREENWOOD	USA	
		ASLACH	MUMBAI	
		HP VALVE AND FITTING	CHENNAI	
		HYD AIR	LONAVLA	
		FLUID CONTROL	MUMBAI	
		MICRO PRECISION	FARIDABAD	
		PARKER	USA	
		SWAGELOK	USA	
		BALDOTA	MUMBAI	
5.	PRESSURE REDUCING VALVE	TESCOM	USA	
		SWAGELOK	USA	
6.	TUBING	SWAGELOK	USA	
		HAMLET	USA	
		PARKER	USA	
		SANDVIK	USA	
		VIKAS INDUSTRIAL PRODUCTS	NOIDA	
7.	NEEDLE VALVE & PRESSURE SAFETY VALVE	SWAGELOK	USA	
		HAMLET	USA	
		PARKER	USA	
8.	SOLENOID VALVE	ROTEX	BARODA	
		AVCON	MUMBAI	
		ASCO	CHENNAI	
		SMC	NOIDA	
		NUCON	HYDERABAD	
9.	3 WAY VALVE	HI TECH	AHMEDABAD	
		ADVANCE VALVES PVT.LTD	NOIDA	
		BDK	HUBLI	
		FOURESS ENGG.INDIA LTD.	MUMBAI	
		FLUIDLINEVALVES COMPANY PRIVATE LTD.,	MUMBAI	
		INSTRUMENTATION LTD.	PALAKAD	
		KIRLOSKAR BROTHERS LTD.	PUNE	
		VENUS PUMP & ENGG. WORKS	KOLKATA	
		SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY	CHENNAI	
		STAFFORD CONTROLS LIMITED	PUNE	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
10.	PAINT	ASIAN PAINTS (I) LTD.		



TITLE :
TELANGANA SUPER THERMAL POWER
PROJECT PHASE-I (2X800 MW) SG PACKAGE
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SPECIFICATION NO. PE-TS-424-154-A002

SECTION: IA

REV. NO. 00

DATE : 18/01/17

		BERGER PAINTS INDIA LTD		
		GOODLASS NEROLAC		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		SHALIMAR PAINTS LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		JOTUN PAINTS		
11.	STRUCTURE STEEL	SAIL		
		TISCO		
		JINDAL		
		BHUSWAL		
12	MASS FLOW CONTROLLER	BROOK'S (EMERSON)		

NOTE:

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

BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.

2. DEALERS ARE NOT ACCEPTABLE FOR ANY ITEM OF THE PACKAGE. BIDDER SHALL PROCURE ALL ITEMS INCLUDING PLATES, STRUCTURAL, FLANGES; COUNTER FLANGES ETC. FROM APPROVED SUB VENDOR ONLY.
3. THE INSPECTION CATEGORY WILL BE INTIMATED AFTER AWARD OF CONTRACT BY BHEL/CUSTOMER. HOWEVER THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/ CUSTOMER.



TITLE :
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A002

SECTION: IA

REV. NO. 00

DATE : 18/01/17

SUB VENDOR LIST C&I

BHEL-PEM SUB VENDOR LIST AS ON 4/5/2018			
Sl No	Package Name	Supplier Name	Supplier Communication Address
1	Cold Junction Compensation Box (CJCB)	CREATIVE INSTRUMENTS & CONTROLS	NO-17/1, 1ST FLOOR, 11TH CROSS 1ST K BLOCK, RAJAJINAGAR, BANGALORE-560010 Phone- Pincode : Email : crinstruments@gmail.com
2	CONTROL VALVE	FORBES MARSHALL ARCA PVT.LTD.	A-34/35, MIDC ESTATE, H-BLOCK, PIMPRI, PUNE, Phone- 020-27442020, Pincode : 411018 Email : mnadgaundi@forbesmarshall.com
		INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpgt.com
		Koso India Private Limited,	H 33 & 34, MIDC, Ambad, Nashik, Phone- 09650233433 Pincode : 422010, Email : jetmal.gour@koso.co.in
		BOMFA SPECIAL VALVE SOLUTIONS PVT LTD	Mr. K.M. Anklesaria/ R. M. Anklesaria Plot No: 285/2, Panchratna Estate, Near Ramol Bridge, Vatva Ahmedabad Phone- 079-40083825 Pincode : 382445 Email : info@bomafa-india.com
		KSB MIL CONTROLS LTD.	Mr.Jacob Cherian/Mr.Geo Jolly Meladoor, Annamanada P.O. MALA, Thrissur Phone- 0480-2695700 Pincode : 680741 Email : btiu.simon@ksb.com
		SUZHOU DELAN ENERGY SCIENCE & TECHNOLOGY CO., LTD.	No 566 Fangqiao Road Caohu Industrial Park, Xiangcheng Economic Development Zone, Suzhou Phone- 008618012776062 Pincode : 215143 Email : jeanielei@delan-valve.com
		Valvitalia S.P.A. ,	Mr. Salvatore Ruggeri Via Tortona 69, Rivanazzano (Pavia) Phone- +39-03839459875 Pincode : 27055 Email : dario.torluccio@valvitalia.com
		R.K.CONTROL INSTRUMENTS PVT. LTD.	PLOT NO.A-250, OPP.POLICE STATION, WAGLE INDUSTRIAL ESTATE, THANE Phone- 25820943/2331 Pincode : 400604 Email : rkcipl@vsnl.com ; rkcinpvt@bol.net.in
		Mascot Valves Pvt. Ltd.	166-167 GIDC Naroda Ahmedabad Phone- 0792282 1619 Pincode : 382330 Email : dom.sales@mascotvalves.com
		EMERSON PROCESS MANAGEMENT CHENNAI LIMITED	147, KARAPAKKAM VILLAGE, CHENNAI Phone- 23722184, 23716242 Pincode : 600096 Email : jatinder.singh@emerson.com
		DRESSER VALVE INDIA PVT. LTD	Mr. Raj Raman/Mr. Rajkumar Moria S.F. No: 608,Chettipalayam Road, Echanari Post, Coimbatore Phone- +91-98451 19085 Pincode : 641021 Email : Anoop.Ramachandran@qe.com
		WALDEMAR PRUSS ARMATURENFABRIK GMBH	Mr. Winfried Dremhel Schulenburgelandstrasse 261, Hannover Phone- +49-511279260 Pincode : 30419 Email : dremhel@pruss.de; vogel@pruss.de
3	ELECTROMAGNETIC FLOW METER	Adept Fluidyne Pvt. Ltd.	Vinayak Gadre Plot No 4,S.No.17/1-B Kothrud Industrial Estate Pune Phone- 020 25464551 Pincode : 411038 Email : info@adeptfluidyne.com
		Electronet Equipments Pvt Ltd.	Plot No. 84, 85 & 86, Tiny Industrial Estate Kondhwa Budruk, Pune Phone- 020-2026932039 Pincode : 411048 Email : ho@eeplindia.com
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
4	FLOW ELEMENT	MICRO PRECISION PRODUCTS PVT. LTD.	K.P. CHANDHOK/ATUL CHANDHOK 4, LINK ROAD, FARIDABAD Phone- 9810265688 Pincode : 121002 Email : pal@microa1.com
		STAR-MECH CONTROLS (I) PVT.LTD.	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net
		INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpgt.com
		TM TECNOMATIC SPA	MR. ANTONIO NOVIELLO/Mrs. Enrica Bazzocc VIA DELLE INDUSTRIE, 36 CREMONA Phone- 39037221574 Pincode : 26100 Email : info@tmtecnomatic.com
5	FLOW ELEMENT - NOZZLE	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.	Mr. Yogish M. Kulkarni Plot # 23, Udyambag, Belgaum Phone- 0831-4210386 Pincode : 590008 Email : yogish@dyna-fluid.com
		HYDROPNEUMATICS PVT. LTD.	Mr. DM Bichu G/B, Hill Crown Apts., College Road Mapusa Phone- 0832-2360364 Pincode : 403507 Email : ajayrc@hydropneumatics.co.in
		MINCO (INDIA) FLOW ELEMENTS PVT. LTD.	Mr. Raghavendra M. Kulkarni D2-49/50, Tivim Industrial Estate, Karaswada Mapusa Phone- 0832-2257059 Pincode : 403526 Email : qicflowelement@giconindia.com
		STAR-MECH CONTROLS (I) PVT.LTD.	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net
		INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpgt.com
		MINCO (INDIA) PRIVATE LIMITED	D/35,TIVIM INDUSTRIAL ESTATE, KARASWADA, MAPUSA, Goa, Phone- 9320197825, Pincode : 403526, Email : santoshkumar@general-gauges.com,
		MICRO PRECISION PRODUCTS PVT. LTD.	K.P. CHANDHOK/ATUL CHANDHOK 4, LINK ROAD, FARIDABAD Phone- 9810265688 Pincode : 121002 Email : pal@microa1.com
	FLOW ELEMENT - ORIFICE	MICRO PRECISION PRODUCTS PVT. LTD.	K.P. CHANDHOK/ATUL CHANDHOK 4, LINK ROAD, FARIDABAD Phone- 9810265688 Pincode : 121002 Email : pal@microa1.com
		TANSA EQUIPMENTS PVT. LTD.	Mr. Vardhan Tamhankar, Unit No35/36/41,Om Anand Industrial Est. Mohanjee Sundarjee Road,Raghunath Nagar, Thane Phone- 022-25832323 Pincode : 400604 Email : tansaindia@gmail.com

6		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
		MINCO (INDIA) PRIVATE LIMITED	D/35,TIVIM INDUSTRIAL ESTATE, KARASWADA, MAPUSA, Goa, Phone- 9320197825, Pincode : 403526, Email : santoshkumar@general-gauges.com,
		CHEMTROLS INDUSTRIES PVT. LTD.	Mr. K. NANDAKUMAR AMAR HILL, SAKI VIHAR ROAD, POWAI, MUMBAI Phone- 022-67151261 Pincode : 400072 Email : manikandan@chemtrols.com
		STAR-MECH CONTROLS (I) PVT.LTD.	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE Phone- 02026970450 Pincode : 411028 Email : marketing@starmech.net
		INSTRUMENTATION LTD.	KANJIKODE WEST, PALALKKAD, PALAKKAD Phone- 2566127-130,2567128 Pincode : 678623 Email : icvdlil@gmail.com;fa2@ilpgt.com
		HYDROPNEUMATICS PVT. LTD.	Mr. DM Bichu G/B, Hill Crown Apts., College Road Mapusa Phone- 0832-2360364 Pincode : 403507 Email : ajayrc@hydropneumatics.co.in
		Flow Star Engineering Pvt. Ltd.,	MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No-7 F/2, Northern India Industrial 20/3, Mathura Road FARIDABAD Phone- 9818176380 Pincode : 121005 Email : khalid@flowstar.co.in
		INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@ieflowmeters.com
		MINCO (INDIA) FLOW ELEMENTS PVT. LTD.	Mr. Raghavendra M. Kulkarni D2-49/50, Tivim Industrial Estate, Karaswada Mapusa Phone- 0832-2257059 Pincode : 403526 Email : qicflowelement@qiconindia.com
		DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.	Mr. Yogish M. Kulkarni Plot # 23, Udyambag, Belgaum Phone- 0831-4210386 Pincode : 590008 Email : yogish@dyna-fluid.com
7	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai Phone- 91-9324383121 Pincode : 400008 Email : shahanawaz.khan@perfectinstrumentation.com
		Comfit & Valve Pvt. Ltd.	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laxmipura, Nandasan Phone- 02764-267036/37 Pincode : 382705 Email : marketing@com-fit.com
		Arya Crafts & Engineering Pvt. Ltd.	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai Phone- +91-250-2392246 Pincode : 401210 Email : arya@aryaengg.com
		HP VALVES & FITTINGS INDIA PVT. LTD.	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com
		PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
		AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
		FLUIDFIT ENGINEERS PVT. LTD.	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com
		VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
		Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
		PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,
8	INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
		AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
		PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
		Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
		VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
		Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
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		AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com

9	JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com
		K.S.INSTRUMENTS PVT.LTD.	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net
		Shrenik & Company,	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com
		FLEXPRO ELECTRICALS PVT. LTD.	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari Phone- 02637-265140,265003 Pincode : 396424 Email : flexpro@flexproltd.com
		AJMERIA INDUSTRIAL & ENGINEERING WORKS	JIGNESH MAHENDRA AJMERIA DENA BANK BLDG.,SHREE NAGESH INDL. ESTATE,STATION ROAD, MUMBAI Phone- 022 67973578 Pincode : 400 088 Email : ajmera@ajmera.net, jmaimera@yahoo.com
10	LEVEL GAUGE	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com
		BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B, IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com
		SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
11	LEVEL SWITCH-CAPACITANCE TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
		V. AUTOMAT & INSTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com
		LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com
		Flow Star Engineering Pvt. Ltd.,	MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No-7 F/2, Northern India Industrial 20/3, Mathura Road FARIDABAD Phone- 9818176380 Pincode : 121005 Email : khalid@flowstar.co.in
		Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
		Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
12	LEVEL SWITCH-CONDUCTIVITY TYPE	Sapcon Instrument Pvt Ltd.	131, PALSHIKAR COLONY Contact Person- Mr. Ashwin (9826080207) INDORE Phone- +91-731-4085751, Pincode : 452004 Email : sales@sapconinstruments.com
		LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com
		BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B, IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com
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		HI-TECH SYSTEMS & SERVICES LTD.	Mr. Vikash Agrawal/Mr. Tarun Debnath 119, PARK STREET , KOLKATA Phone- 033-22290045 Pincode : 700016 Email : sandeep@hitech.in
		RAMAN INSTRUMENTS PVT.LTD.	Mr. N R Shenoy/Mr G B Vijh 8, First Floor.Plot : 160A Bait-Ush-Sharaf, 29th Road,Bandra(W) MUMBAI Phone- 09892331381 Pincode : 400050 Email : ramanbpl@vsnl.com
		SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
		SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,
	LEVEL SWITCH-FLOAT TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com,
		Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
		D.K. INSTRUMENTS PVT.LTD.	N.SIKDAR/ SUMIT SIKDAR 76/2,SELIMPUR RD DHAKURIA Kolkata Phone- 033-2415-1310. Pincode : 700031 Email : dkinst@vsnl.net
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		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com

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		GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com
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		SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in
		SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
14	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in
		H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net
		BOSE PANDA INSTRUMENTS PVT.LTD.	Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, Sarani, Kolkata Phone- +91 33 2548 7220 Pincode : 700074 Email : parthabosebpi@gmail.com; bosepanda@vsnl.net
		PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com
		Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
		H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com
		FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com
		GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : qicdelhi@general-gauges.com,
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
		Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in
15	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode : 66215 Email : ldegarmo@sorinc.com, avdhesh@sherman-india.com,
		DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com
		Barksdale GmbH, Germany	Michael Weileder Dorn Assenheimer, Strasse 27 Reichelsheim Phone- +91-9999107840 Pincode : D-61203 Email : msingh@barksdale.de
		GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, Off. Pandurang Naik Marg, Mahim Mumbai Phone- 9323195251 Pincode : 400016 Email : amarendra@general-gauges.com
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		INDFOS INDUSTRIES LIMITED	B-20-21, INDUSTRIAL AREA, MEERUT ROAD, GHAZIABAD Phone- 0120-2712016 Pincode : Email : mktg@indfos.com
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		Kaustubha Udyog,	S.No. 36/1/1, Sinhgad Road, Vadgaon Khurd, Near Lokmat Press, Pune, Phone- 020-24393577, Pincode : Email : pressure@vsnl.com,
16	ROTAMETER	INSTRUMENTATION ENGINEERS PVT LTD	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD Phone- 9848407365 Pincode : 500055 Email : iedelhi@ieflowmeters.com
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		EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.	Mr V. K. Pandit/Mr Ashish Shaha 17-20, Royal chambers, Paud Road Pune Phone- 9370469466 Pincode : 411038 Email : sales@eurekaflow.com

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18	TEMP. ELEMENT	PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD.	M. D. BICHU/R. M. BICHU G.B, HILL CROWN APARTMENTS, COLLEGE ROAD, MAPUSA Phone- 9326114601 Pincode : 403507 Email : priyanka.marketing@pyro-electric.in
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		Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in
		Thermal Instrument India Pvt. Ltd.	Mr. Raghavendra M. Kulkarni 194/195, Gopi Tank Road Behind Citylight Cinema,Mahim Mumbai Phone- 09322664709 Pincode : 400016 Email : ramk@giconindia.com
		TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,
		GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,
		GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com,
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
		Tempsens Instrument (I) Pvt Ltd	MR. V.P.RATHI/MR. HEMANT RATHI B-188A ROAD NO.5 , M.I.A UDAIPUR Phone- 09352420069 Pincode : 313003 Email : info@tempsens.com
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20	TEMPERATURE SWITCH	SOR INC.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
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		DRESSER INDUSTRIES INC.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com
		INDFOS (INDIA) LIMITED	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode : 382729 Email : Nishit.patel@ashcroftindia.com
			MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com

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21	TRANSMITTERS	ABB LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com
		Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
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		Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@miinet.com
		PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,
		TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,
		Endress + Hauser (India) Pvt. Ltd.,	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,
		YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com,
		SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in
		Honeywell Automation India Limited	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com
		EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Paithankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com
		SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@delbby.rpgms.ems.vsnl.net.in
		SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com
22	ULTRASONIC FLOW METERS	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com
		Adept Fluidyne Pvt. Ltd.	Vinayak Gadre Plot No 4,S.No.17/1-B Kothrud Industrial Estate Pune Phone- 020 25464551 Pincode : 411038 Email : info@adeptfluidyne.com
		FLEXIM Flexible Industriestechnik GmbH	Boxberger Str., 4, Berlin Berlin Phone- 0049 30 93 66 76 60 Pincode : 12681 Email : info@flexim.de
		Rockwin Flowmeter India Pvt. Ltd.	B-24, Site-IV, Sahibabad Industrial Area Ghaziabad, Phone- 9810129687 Pincode : 201010, Email : amiya@rockwin.com
		FLASH FORGE PVT LTD	Mr. Gautam Makker, 503, 'A'-wing, Delphi, Orchard Avenue Road, Powai Mumbai Phone- 022-42784300 Pincode : 400076 Email : hemendrapatil@f-f.co.in
		Electronet Equipments Pvt Ltd.	Plot No. 84, 85 & 86, Tiny Industrial Estate Kondhwa Budruk, Pune Phone- 020-2026932039 Pincode : 411048 Email : ho@eeplindia.com
		NIVUS GMBH	Mr. Marcus Fischer Im Taele 2, D - 75031 Eppingen Phone- 00491712233770 Pincode : Email : carolin.schuster@nivus.com

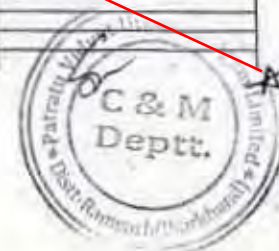
Note:

1. The above sub-vendor list is tentative & reference only. However Sub-Vendor List is subject to BHEL/end user approval without any commercial/ delivery implication.
2. New Sub-Vendor if proposed by Vendor during contract stage shall subject to BHEL/ end user approval without any commercial/ delivery implication.

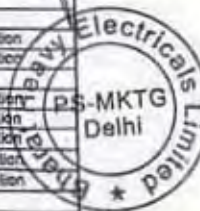
NTPC		PROJECT : Patratu STPS Phase-I (3 X800MW)				LIST OF ITEMS REQUIRING QP				REVISION NO : 00		
		PACKAGE : EPC PACKAGE				APPROVAL & ACCEPTABLE				DATE : 28.04.2017		
		CONTRACTOR :BHEL Ltd				VENDOR AS APPROVED BY						
		CONTRACT NO : GS-9585-001-2										
No.	Major Equipment	QP Inspection Category	QP No. 9585-001-QVI-Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub SCH	SS Approval SCH	Sub QR	Remark
		II				Forbes Arca	Pune	A				Approved up to 4" and 300 Class "OR" for Higher rating and size. M/s BHEL will forward only three proposals after details review of NTPC Technical specification requirements.
						Daume Regelmotoren GmbH	Germany	DR				
						Melco Singapore PTE Ltd.	South Korea	DR				
						Seyern Glocon	Chennai	DR				
						Spx Corporation	USA	DR				
						Ringo Valvulas SL	Spain	DR				
						Valvitalia SPA	Italy	DR				
						R K Controls	Thane	DR				
						Circor (Leslie)	Coimbatore	DR				
						Spx Flow Technologies	USA	DR				
						Circor (Leslie)	Coimbatore	DR				
						Schenjeng valve co. Ltd.	China	DR				
						Spx Flow Technologies	Ahmadabad	DR				
						WEIR Valves and Controls	UK	DR				
						WALDEMAR PRUSS	Germany	DR				
						ARMATURENFABRIK GMBH						
						BOMABA Special valve solutions Pvt. Ltd.	Ahmedabad	DR				
						Suzhou Delan Enery science and technology co. Ltd.	China	DR				
22	Temperature Transmitter (Single and Dual Input)	III				EMERSON	USA/Pawana / Singapore	A			Sub QR	Final testing at M/S YIL, Bangalore is also acceptable.
		III				Yokogawa	Japan	A				
		II				Moore	USA	A				
		II				M System	JAPAN	A				
		II				ABB	GERMANY/ Bangalore	A				
		III				ENDRESS & HOUSER	Aurangabad	A				
						Krone		DR				
						Tokyo Kelco	Japan	DR				
						Honeywell	Pune	DR				
						INOR	Sweden	DR				
						P & F	Bangalore	DR				
						Siemens		DR				
						Yamatoka	JAPAN	DR				
						Yemari	JAPAN	DR				
						Foxboro		DR				
23	Conduits/Pipe(GI)					Refer Electrical List						Testing and Calibration at M/s YIL, Bangalore is also acceptable.
✓	Electronic transmitters (pressure, DP, Flow)	III				EMERSON (Rosemount)	USA/ Pawana	A			Sub QR	
		III				FUJI ELECTRIC	France	A				
		III				YOKOGAWA	JAPAN	A				



NTPC		PROJECT : Patratu STPS Phase-I (3 X800MW)				LIST OF ITEMS REQUIRING QP			REVISION NO : 00			
		PACKAGE : EPC PACKAGE				APPROVAL & ACCEPTABLE			DATE : 28.04.2017			
		CONTRACTOR : BHEL Ltd				VENDOR AS APPROVED BY						
		CONTRACT NO : CS-9585-001-2										
No.	Major Equipment	QP Inspect on Category	QP No. 9585-001-QV1 Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Sub QR	Remark
		III				YOKOGAWA	Bangalore	A				EJA- E series 110.430.530
		III				ABB	Bangalore	A				Model - 2600 T
		III				ABB	GERMANY / Italy	A				Model - 2600 T
		III				Siemens	France / Kalya	A				
		III				Honeywell	Pune	A				
		III				Laxson Automation	Daman	A				SMAR Make
		III				Baldota	Mumbai	A				SMAR Make
		*				ENDRESS & HOUSER	Aurangabad/ Germany	DR				
		*				CHINO	Ghagabed	DR				
	Thermocouples, RTD & Thermowells	III				HERAUS SENSOR	GERMANY	A			Sub QR	
		III				WISE Control	Korea	A				
		II				Tempens	Udaipur	A				
		II				Pyroelectric	Goa	A				
		II				Getrie Instrumentation & Electronics Ltd	Mumbai	A				
		III				Minco	USA	A				
		III				OKAZAKI corporation	JAPAN	A				
		III				Yamari	JAPAN	A				
		III				Yamari	Singapore	A				For RTD Reference list and Performance feedback is to be submitted.
		III				ABB/SENSYCON	Germany	A				
		II				EMERSON (Rosemount)	Germany	A				
		II				EMERSON (Rosemount)	Pawane	A				Imported from Emerson, Germany (make)
		II				Thermal Instruments(GIC)	Savantwadi	A				
		II				Techno Instruments	Ahmadabad	A				
		II				GOA Instrument Industries	GOA	A				For Thermowells only
		*				GOA Instrument Industries	GOA	OR				M/s BHEL will forward only two proposals after details review of NTPC Technical specification requirements.
		*				Wika	Pune	OR				
		*				Technical Industries	Ajmer	OR				
		*				L & H	Aurangabad	OR				
		*				Nestech	Vapi	OR				
		*				Industrial Instruments	Kolkata	OR				
		*				Exotherm	Thane	OR				
		*				Baumer Technologies	Vapi	OR				
		*				Elaind Engineering	Noida	OR				
		*				Siemens India	Gurgaon	OR				
		II				Jindal Electronics	Roorkee	A				For Generator turbine & Motor
26	Ultrasonic type level Transmitter	III				E & H	Aurangabad/ Germany	A			Sub QR	
		III				EMERSON	Pawane	A				
		III				SIEMENS MILTRONICS	CANADA	A				
		III				Nivelco	Hungary	A				
		*				Vega	Germany	OR				



NTPC		PROJECT : Patratu STPS Phase-I (3 X800MW)				LIST OF ITEMS REQUIRING QP				REVISION NO : 00		
		PACKAGE : EPC PACKAGE				APPROVAL & ACCEPTABLE				DATE : 28.04.2017		
		CONTRACTOR :BHEL Ltd				VENDOR AS APPROVED BY						
		CONTRACT NO : CS-555-001-2										
No.	Major Equipment	QP Inspect on Category	QP No. 555-001-QVI Q	QP Submis sion SCH	QP Appro val SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Sub QR	Remark
		*				Khrona	France / USA / Pune	DR				M/s BHEL will forward only two proposals after details review of NTPC Technical specification requirements.
		*				Yokogawa	Bangalore	DR				
		*				P&F	Germany	DR				
		*				Magnetrol	Belgium	DR				
		*				ABB	Germany / India	DR				
		*				Forbes Marshall	Pune	DR			Sub QR	
✓	Orifice plate assembly	III				Instrumentation Limited	Palghat	A				
		III				Microprecision	Palwal	A				
		III				Siemens	Pune	A				
		III				Flow Star	Fardabad	A				
		III				SFIKO	Austria	A				
		III				MINCO India Pvt. Ltd.	GOA	A				Up to 32"
		III				MINCO India Flow Elements Pvt. Ltd.	GOA	A				Up to 28"
		III				WISE Control	Korea	A				
		III				T M Technomatic	Italy	A				
		*				IEPL	Hyderabad	DR				
		*				Engg. Specialites	Kolkata	DR				
		*				BALIGA	CHENNAI	DR				
		*				Pyroelectric	Mumbai	DR				
		*				Hydro Pneumatics	Mapusa	DR				
		*				Tansa Equipment Pvt. LTD.	Thane	DR				
		*				Dynamic Fluid Vales Pvt. Ltd.	Balsam	DR				
✓	Pressure, OP Gauge	III				BUDENBERG	UK	A				
		III				ASHCROFT	USA/Germany/ India	A				
		III				Wika	GERMANY	A				
		III				WISE Control	Korea	A				
		III				Nagano KEIKI	Japan	A				
		III				H.Guru South India	Bangalore	A				Not for MS & FW application
		III				A.N. Instruments	Kolkata	A				Not for MS & FW application
		III				Gauge Bourdon	Palwal	A				
		III				Goa Thermostatic	GOA	A				Not for MS & FW application
		III				Wika	Pune	A				DR for MS & FW application
		III				Baumer	Vapi	A				DR for MS & FW application
		III				Precision mass products Pvt. Ltd.	Gandhinagar	A				Not for MS & FW application
		III				H.Guru	Rishra/Muzaffarpur	A				Not for MS & FW application
		*				US Gauge	USA	DR				
		*				Winters	USA	DR				
		III				Forbes Marshall	Hyderabad	A				
		*				Manometer	Mumbai	DR*				
		III				Welchandnagar Industries Ltd.	Dharwad	A				
		III				Nesstech	Vapi	A				
		*				Gauges Bourdon	UK	DR				OP Gauge for M/s Nesstech, Japan
		*				Fisher Mess	Germany	DR				

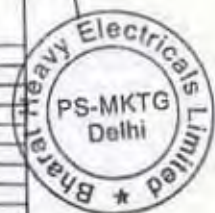


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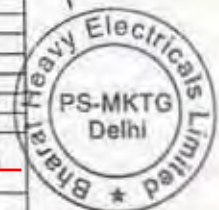
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NTPC		PROJECT : Patratu STPS Phase-I (3 X600MW)				LIST OF ITEMS REQUIRING QP				REVISION NO : 00		
		PACKAGE : EPC PACKAGE				APPROVAL & ACCEPTABLE				DATE : 29.04.2017		
		CONTRACTOR : BHEL Ltd				VENDOR AS APPROVED BY						
		CONTRACT NO : CS-9985-001-2										
No.	Major Equipment	QP Inspection Category	QP No. 9985- 001-QVI Q	QP Submis- sion SCH	QP Appro- val SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Sub QR	Remark
						Protech Control	Kolkata	DR				
						New Scientific	Kolkata	DR				
						PTCI	Kolkata	DR				
						Main Contractor approved Sources		A				
29	Level gauge (Transparent & Reflex, Tubular type)	III				SOR	USA	A			Sub QR	
30	Press. DP, Vacuum Switch	III				DRESSOR (ASHCROFT)	USA/Germany	A				
		III				ITT BARTON	USA	A				
		III				HERION	GERMANY	A				
		III				BARKEDALE	GERMANY	A				
		*				Nagano KEIKI	Japan	DR				
		II				Switzer Process Instrument	Chennai	A				Up to 40kg/cm2 & not for Compound Switch and except 900 series
		II				Trafag	Gurgaon	A				Up to 40kg/cm2 & not for Compound Switch
		II				Switzer Process Instrument	Ghaziabad	A				Up to 40kg/cm2 & not for Compound Switch
		III				Delta control	UK	A				
		I				Gauges Bourdon (GIG)	Panvel	A				Up to 40kg/cm2 & not for Compound Switch
		I				ASHCROFT	Gandhinagar	A				
		*				Wika	Pune	DR				
		III				Gorgeon	France	A				
		III				United Electric	USA	A				
		*				SMC	Japan	DR				
		*				Neodyne	USA	DR				
		*				IMI NORGEN	Noida	DR				
		*				WISE Control	Korea	DR				
		*				Baum	Vapi	DR				
		*				Vista Tech	New Delhi	DR				
		III				Bell & Krich	Germany	DR				
31	Temperature Switch	III				SOR	USA	A			Sub QR	
		III				DRESSOR (ASHCROFT)	USA/Germany	A				
		III				ITT BARTON	USA	A				
		III				DELTA CONTROLS	UK	A				
		I				Switzer Process Instrument	Chennai	A				up to 200 Deg. C
		I				Switzer Process Instrument	Ghaziabad	A				up to 200 Deg. C
		II				Trafag	Gurgaon	A				up to 200 Deg. C
		I				ASHCROFT	Gandhinagar	A				
		*				Wika	Pune	DR				
		III				Gorgeon	France	A				
		III				United Electric	USA	A				
		*				SMC	Japan	DR				
32	Flow switch	III				UNIVERSAL FLOW METER	USA	A			Sub QR	
		III				Switzer	Chennai	A				



NTPC		PROJECT : Palvelu STPS Phase-I (3 X800MW)				LIST OF ITEMS REQUIRING QP				REVISION NO : 00		
		PACKAGE : EPC PACKAGE				APPROVAL & ACCEPTABLE				DATE : 26.04.2017		
		CONTRACTOR : BHEL Ltd				VENDOR AS APPROVED BY						
		CONTRACT NO : CS-9585-001-2										
No.	Major Equipment	QP Inspecti on Category	QP No. 9585-001-QVI-Q	QP Submis sion SCH	QP Appro val SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Sub QR	Remark
		-				Universal Instrument manufacturing co P Ltd	India	DR				
		-				Hind Rectifier Ltd	India	DR				
37	Battery Health Monitoring System	III				Emerson	Mumbai	A				
		III				Flack SQS Pvt Ltd	Gurgaon	A				
		-				B Tech Inc	USA	DR				
		III				Hitachi Hi Rel	Gandhinagar	A				
		-				Hopcke	Germany	DR				
		-				Hitachi Hi Rel	Gandhinagar	DR				
38	Battery (Ni-cd)	I				AMCO SAFT	Bangalore	A				
		II				SAFT	France/Sweden	A				
		I				HBL POWER	Hyderabad	A				
		II				Hopcke	Germany	A				
39	Socket weld fittings	III				BHEL Approved Sources						
40	Impulse pipe & tubes	II				Maharashtra Seamless	Raigarh	A				Carbon steel only
		II				Sumitomo/Kawasaki/Nippon	Japan	A				
		II				TPS TECHNITUBE	Germany	A				
		II				Veluric & mannemann	Germany	A				
		II				BHEL	Trichy	A				
		II				Trouvay and Carvin	France	A				Makes shall be as per approved list (Sr. No. 41)
		II				ISMT	Ahmadnagar	A				Carbon steel only.
		II				Sandvik		A				For SS only.
		-				TUBACES	Spain	DR				
		-				Saltgitter Mannesmann International	Germany	DR				
		-				Jindal saw	India	DR				
		II				Ratanam Metal and Tubes	Ahmadabad	A				SS only
		II				Heavy metals and Tubes	Ahmadabad	A				SS and CS only.
		-				Shubhaxmi Metal and Tubes	Mumbai	DR				
41	Compression fittings	II				Parker	USA	A				
		III				Precision	Mumbai	A				
		III				Aslech	Mumbai	A				
		III				Fluid control Pvt. Ltd.	Pune	A				
		III				HP Valves and fittings	CHENNAI	A				Ferrules are to be hardened at Exim Island for pressure above 9000 psi.
		III				Excel hydro	Mumbai	A				Ferrules are to be hardened at Exim Island for pressure above 9000 psi.
		III				Swagelok	USA	A				
		III				Panam	Mumbai	A				
		III				Melpress	Kolkata	DR				
		-				AURA INC	New Delhi	DR				
		-				Prime Engineers		DR				
		-				Arya Craft		DR				

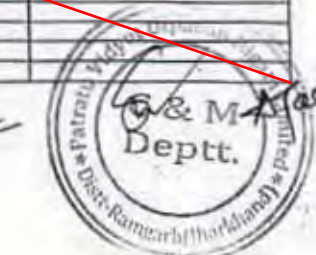


NTPC		PROJECT : Patratu STPS Phase-I (3 X800MW)				LIST OF ITEMS REQUIRING QP				REVISION NO : 00		
		PACKAGE : EPC PACKAGE				APPROVAL & ACCEPTABLE				DATE : 28.04.2017		
		CONTRACTOR :BHEL Ltd				VENDOR AS APPROVED BY						
		CONTRACT NO : CS-9585-001-2										
No.	Major Equipment	QP Inspecti on Categor y	QP No. 9585- 001-QV1 Q	QP Submis sion SCH	QP Appro val SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Sub QR	Remark
		*				PMT Engineers	Ahemdabad	DR				
		*				Flowtech	Kolkata	DR				
		*				Parker Hannfin India Pvt Ltd		DR				
43	Instrument valves	III				BHEL	Trichy	A				
		II				Excel Hydro	Mumbai	A				
		II				Instrumentation Ltd.,	Palghat	A				
		II				Swagelok	USA	A				
		II				Parker	USA	A				
		II				HP Valves and fittings	CHENNAI	A				
		II				Fluid control Pvt. Ltd.	Pune	A				
43	Valve manifolds	II				Baldota	Mumbai	A				
		II				Excel hydro	Mumbai	A				
		II				SCHNEIDER	Germany	A				
		II				Anderson Greenwood	USA	A				
		II				Astech	Mumbai	A				
		II				HP Valves and fittings	CHENNAI	A				
		II				Fluid control Pvt. Ltd.	Pune	A				
		II				Microprecision	Fardabad	A				
		II				Parker	USA	A				
		II				Swagelok	USA	A				
		II				Baldota	Mumbai	A				
		*				Melbress Engg. works	Kolkata	DR				
		*				Flow tech	Kolkata	DR				
44	Local Instrument Endosum/Rack	I				Pyrotech	Udaipur	A				
		I				Instrumentation Limited	Kota	A				
		I				Sejas electrical	Trichurapalli	A				
		I				Prammen	Puddukottai	A				
		I				Chemlin	Pondicherry	A				
		*				Forbes Marshall	Pune	DR				
		*				Peeltronics	Vadodara	DR				
		*				Procon	Chennai	DR				
45	Instrument Cables	I				Paramount	Khushkhera	A				PVC,FRLS type,RQP
		I				Polycab	Daman	A				PVC,FRLS type,RQP
		I				Dellon	Fardabad	A				PVC,FRLS type,RQP
		I				KEI	Udhvadi	A				PVC,FRLS type
		I				Ekkey Telelinks	Fardabad	A				PVC,FRLS type
		I				CORDS	Chopanki	A				PVC,FRLS type,RQP
		I				CORDS	Kaharani	A				PVC,FRLS type,RQP
		I				Nicox	Kolkata	A				PVC,FRLS type
		II				TEW & C	USA	A				
		II				Habia cables	Sweden	A				
		II				Kerpen cables	Germany	A				
		II				Lapp cables	Germany	A				
		II				Thermo electra Bv	Netherlands	A				
		I				Universal Cable	Saina	A				PVC,FRLS type
		I				Thermocables	Hyderabad	A				PVC,FRLS type

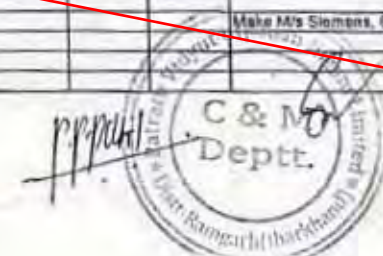
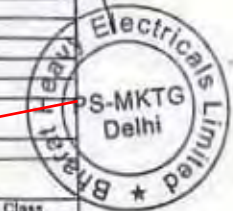


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NTPC		PROJECT : Patratu STPS Phase-I (3 X800MW)				LIST OF ITEMS REQUIRING QP				REVISION NO : 00		
		PACKAGE : EPC PACKAGE				APPROVAL & ACCEPTABLE				DATE : 26.04.2017		
		CONTRACTOR :BHEL Ltd				VENDOR AS APPROVED BY						
		CONTRACT NO : CS-9585-001-2										
No.	Major Equipment	QP Inspecti on Categor y	QP No. 9585- 001-QV1 Q	QP Submis sion SCH	QP Appro val SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Sub QR	Remark
		I				Finolex Cable	Pune	DR *				
		I				Incab	Pune	DR *				
		I				Gupta Power Infrastructure Ltd.	Khurda	A				
		*				Lapp cables	India	DR				
		*				Uoni cable	Pune	DR				
		*				RR Kabel	Shyva	DR				
		*				Gemacab	Bhivadi	DR				
		*				KEC International	Mysore	DR				
		*				Advance cable Technologies	Bangalore	DR				
		*				Suyog Electricals Ltd.	Vadodara	DR				
		*				Special Cable	India	DR				
		*				CMI	Fardabab	DR				
		*				Govind Cables	Kolkata	DR				
		*				Associate Cables	Mumbai	DR				
		*				Radiant RSCC Specialty	Hyderabad	DR				
		*				APAR Industries	Banglore	DR				
		*				Tempsana Cable	Udaipur	DR				
		*				Mansfield cables co. Ltd.	Hyderabad	DR				
		*				Servel India Pvt. Ltd.	Neemrana	DR				
		*				TC Communication Pvt. Ltd.	Ghaziabad	DR				
46	Electrical actuator	II				Auma	Germany	A				
		II				Uimtorq	USA	A				
		II				Rolork	UK	A				
		II				Uimtorque	Fardabab	A				
		II				Rolork	Chennai/Bangalore	A				
		III				Hiipon gear	Japan	A				
		II				Auma	Bangalore	A				
		III				Harold Beck	USA	A				
		III				Drehmo	Germany	A				
		I				Anhals	Chennai	A				
		*				Lindos	USA	DR				
		*				Siemens	Germany	DR				
47	Electrical actuator for ID/FD/PA Blade pitch and Guide vane control	III				Harold Beck	USA	A				
		III				SIPOS Aktorik GmbH	Germany	A				
		*				ABB	Germany	DR				
48	Flow nozzle / Venturi assembly	II				Microprecision	Fardabab	A			Sub QR	
		II				SEIKO	Austria	A				
		II				TECHNOMATIC	Italy	A				
		II				Insurgation Limited	Palghat	A				
		I				Starmach	Pune	A				
		II				WISE Control	Korea	A				

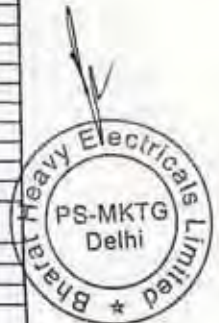


NTPC		PROJECT : Patratu STPS Phase-I (3 X800MW)				LIST OF ITEMS REQUIRING QP			REVISION NO : 00			
		PACKAGE : EPC PACKAGE				APPROVAL & ACCEPTABLE			DATE : 28.04.2017			
		CONTRACTOR : BHEL Ltd				VENDOR AS APPROVED BY						
		CONTRACT NO : CS-9585-001-3										
No.	Major Equipment	QP Inspecti on Category	QP No. 9585-001-QVI Q	QP Submis sion SCH	QP Appro val SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub SCH	SS Approval SCH	Sub QR	Remark
		III				Gauges Bourdon (GIC)	Panvel	A				
		*				Nisan Scientific Process	Navi Mumbai	DR				
57	Air filter regulator	III				Fairchild	USA	A				
		III				Shayo Norgen	Mumbai	A				
		III				SMC Pneumatics	NOIDA	A				
		III				Emerson (Asco)	Chennai	A				
		III				Festo	Bangalore	A				
		III				Festo	Chennai	A				
		III				Divya Control Elements	Gujarat	DR				
58	Copper tubing/Brass connectors	III				Main Contractor approved Sources		A				
59	Coupling / Interposing relays	III				PARAMOUNT	BANGALORE	A				
		III				OMRON		A				
		III				OEN		A				
		III				Jyoti	Baroda	A				
		*				ELSTA	SWITZERLAND	A				
		*				Schneider	Germany	DR				
		*				Siemens	Germany	DR				
		*				Phoenix	Germany	DR				
		*				Finder		DR				
60	Solenoid valve	III				Rolex	Vadodara	A			Sub QR	
		III				Avcon	Mumbai	A				
		III				Herion	Germany	A				
		III				IMI NORGREN	GERMANY	A				
		III				Jafferson	Argentina	A				
		III				Asco	Chennai/USA	A				
		III				Festo	Bangalore	A				
		III				SMC	Noida	A				
		III				Parker	Brand Name	A				
		*				Schneider	Germany	DR				
		*				Neuson Industries Pvt. Ltd.		DR				
61	Lube oil control valve - Self Regulating	III				NUOVO PIGNONE	ITALY	A				
		III				EMERSON	CHENNAI	A				
		III				SAMSON	GERMANY / PUNE	A				
		III				Forbes marshall arco pvt. Ltd.	Pune	A				Approved up to 16", 900 Class.
62	Guided wave/Radar type level transmitter	III				Magnetrol	Belgium	A			Sub QR	
		III				Endress & Houser	Germany/ Aurangabad	A				
		III				Emerson Process Management	Sweden/ PAWANE	A				
		III				ABB(X-Tech)	USA	A				
		*				Supreme Technology	Thane	A				Make M/s Siemens, Canada
		*				Yokogawa	Japan	DR				
		*				ABB	India	DR				
		*				IP & F	Bangalore	DR				



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NTPC		PROJECT : Patratu STPS Phase-I (3 X600MW)				LIST OF ITEMS REQUIRING QP				REVISION NO : 00		
		PACKAGE : EPC PACKAGE				APPROVAL & ACCEPTABLE				DATE : 26.04.2017		
		CONTRACTOR : BHEL Ltd				VENDOR AS APPROVED BY						
		CONTRACT NO : CS-9585-001-2										
No.	Major Equipment	QP Inspecti on Category	QP No. 9585-001-QVI Q	QP Submis sion SCH	QP Appro val SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Sub QR	Remark
		*				Forbes Marshall Codel	Pune	DR				
						ICE(Asia) Private India	Mumbai	DR				
89	Graphic Interface Unit	III				Rockwell Automation		A				
		III				Digital Instruments and Control System (Proface)	Bangalore	A				Proface Brand
		III				Red Lion	USA	A				
		III				Schnieder Electric		A				
90	Hand Held Calibrator	II				Main contractor approved sources		A				Compatible with the Transmitter to be Supplied & Subject to meeting NTPC specification requirement
91	Hart Management System	III				Yokogawa	India	A				
		III				Emerson Process Mgmt	USA / Singapore / India	A				
		III				P & F	Germany / Bangalore	A				
		III				MTL	Chennai	A				
		*				Stahl	Germany	DR				
92	Impact Head Type Flow Element	II				Detriech / Emerson	USA	A			Sub QR	
		II				Midwest	USA	A				
		II				Veris Inc	USA	A				
		*				TIA Technomatic SPA	Italy	DR				
93	Isolator	III				Main contractor approved sources						
94	Master Slave Clock System	II				Hopf	Germany	A				
		I				Serial	Chennai	A				
		II				Halfway	USA	A				
		II				Moser Baer AG	Switzerland	A				
		II				Meln Berg	Germany	A				
		I				Sands	Chennai	A				
		I				Masibus	Gandhinagar	A				
		*				Signals & System	Chennai	DR				
95	Mosaic Tiles / Console Items	III				Pro-Plan	Germany	A				Earlier Boyko Stray
		III				Tew	Germany	A				Earlier Subklew
96	Network Components	III				Main contractor approved sources						
98	Online Mercury Analyser	III				Durg	Bangalore	A			Sub QR	Make Durg, Germany
		*				Mahak	Germany	DR				Main Contractor Can propose additional vendor for this item
		*				Thermo	USA	DR				
97	P A System (IP Based)	*				Commend	Austria	DR				
		*				Stantophone Zenitel	Norway	DR				
		*				Armet	Russia	DR				
		*				Industronic Industrie Electronic GmbH and Co. KG	Germany	DR				
		*				LARAON Enginners and Consultants Pvt. Ltd.	Gurgaon	DR				
		*				Aishan Technologies India Pvt. Ltd.	Bangalore	DR				



NTPC		PROJECT : Patratu STPS Phase-I (3 X800MW)					LIST OF ITEMS REQUIRING QP					
		PACKAGE : EPC PACKAGE					APPROVAL & ACCEPTABLE			REVISION NO : 00		
		CONTRACTOR : BHEL Ltd					VENDOR AS APPROVED BY			DATE : 26.04.2017		
		CONTRACT NO : CS-9585-001-2										
No.	Major Equipment	QP Inspecti on Category	QP No. 9585-001-QVI Q	QP Submis sion SCH	QP Appro val SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Sub QR	Remark
		I				Cords Cable	Bhilwadi / Koharani	A				

LEGENDS :**1.0 SYSTEM SUPPLIER / SUB SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY NTPC)**

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

DR - For those items "Detailed Required" for NTPC review. To be identified with letter "DR" in the list.

NOTED : For those items vendors are approved by Main Supplier and accepted by NTPC without specific vendor approval from NTPC. To be identified with "NOTED"

2.0 QP INSPECTION CATEGORY :

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

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

CAT-III:

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

* - Inspection category will be decided during vendor evaluation.

NOTE - 1 : EMPTY CABINETS, COMPUTERS, SIGNAL ISOLATOR, MULTIPLIER, MCB, TB, POWER SUPPLY ETC. SHALL ALSO BE ACCEPTABLE FROM INDEGENEOUS SOURCES AGREED BY NTPC IN QP. IF THE TOTAL INTEGRATED PANEL AND FAT IS CONDUCTED INDEGENEOUSLY ITEM TO BE TREATED AS CAT - I.

NOTE - 2 : Mandatory Sapre will be treated as CAT-III

NOTE - 3 : For the items not appearing in the preaward list, bidder and NTPC will mutually discussed in future.

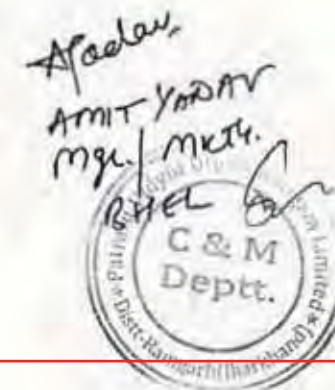
NOTE - 4 : Intergration testing of DDCMIS shall be done with monitor connected to the LVS workstation. This would be tied up in the QAP/ATST. Dispatch of LVS can be allowed like a CAT-III item but only after successful testing of functionality as indicated in QP and completion of ATST of first unit.

NOTE - 5 : C&I Items Integral for skid, Fan, Motor, Pump etc Instrument shall be supplied as per OEM standard/ approved sources.

NOTE - 6 : for instrumentation cable quantity less than 1 km of each type inspection category is III and for less than 2.5 km of each type inspection category is CAT-II
FORMAT NO. : QS-01-QAP-P-1/F3-R0 Engg. Div/Q&I



P.P. Patel
PRASHANT P. PATIL
DGM (QA-C&I)





TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO.: PE-TS-434-154-A101

SUB-SECTION: IA

REV. NO.: 00

DATE: 12.04.2019

ANNEXURE - III

DRAWING DOCUMENTS DISTRIBUTION SCHEDULE



TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO.: PE-TS-434-154-A101

SUB-SECTION: IA

REV. NO.: 00

DATE: 12.04.2019

ANNEXURE III

DRAWING DOCUMENTS DISTRIBUTION SCHEDULE

Documents:	PEM-Engineering
Documents for approval	8
Documents for information	8
Schedules, diagrams, lists, tables, calculation, specifications and other documents	8
Final as-built drawings	
CD-ROMs of final as-built drawings	10
Final as-built drawings (hard copy)	14
Final O&M manuals	18
CD-ROMs of Final O&M Manuals	10
Detailed project time schedules	5

Note:

- Quantity of prints may change during detailed engineering stage based on BHEL/ Customer requirement. However the same will be adhered by the bidder without any delivery/commercial implication to BHEL.
- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.
- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.
- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copies whichever is later.
- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying these requirements shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.
- Bidder has to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.
- Bidder to submit instrument schedule, cable schedule and valve schedule (as applicable) in MS- Excel format during detailed engineering.
- Bidder to also furnish the auto cad copy/ MS-word (as applicable) of the following documents after award of contract. However any other auto cad copy/ MS-Excel/ MS-word of any other document as per the insistence of BHEL/ customer will also be submitted by the bidder without any delivery/ commercial implication to BHEL/ Customer.
 - P&IDs.
 - GA & Foundation Drawing.
 - Local Control Panel/ Junction Box Wiring Diagram.



TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO.: PE-TS-434-154-A101

SUB-SECTION: IA

REV. NO.: 00

DATE: 12.04.2019

ANNEXURE - IV
PAINTING SPECIFICATION

SUB – SECTION – A-12

SURFACE PREPARATION & PAINTING

**EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE –I (3X 800MW)**

**TECHNICAL SPECIFICATION
SECTION-VI
BID DOC. NO.: CS:9585-001-2**

CLAUSE NO.	THIS IS THE PART OF TECHNICAL SPECIFICATION NO. PE-TS-434-154-A101.  TECHNICAL REQUIREMENTS			
1.00.00	SPECIFICATION OF SURFACE PREPARATION & PAINTING			
1.01.00	Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.			
1.02.00	All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labelled by the manufacturer with the manufacturer's name, type of paint, batch number and colour.			
1.03.00	Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.			
1.04.00	All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering.			
1.05.00	SURFACE PREPARATION			
1.05.01	All surfaces to be painted shall be thoroughly cleaned of oil. Grease and other foreign material. Surfaces shall be free of moisture and contamination from chemicals and solvents.			
1.05.02	The following surface preparation schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer. SP1 Solvent cleaning SP2 Application of rust converter (Ruskil or equivalent grade) SP3 Power tool cleaning SP4 Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer) SP4* Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns SP5 Shot blasting/ abrasive blasting. SP6 Emery sheet cleaning/Manual wire brush cleaning.			
1.06.00	APPLICATION OF PRIMER/PAINT			
1.06.01	The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.			
1.06.02	Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.			
1.06.03	Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO. CS-9585-001-2 51 of 171	SUB-SECTION - A-12 SURFACE PREPARATION & PAINTING	Page 1 of 9

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
	as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats. 1.06.04 Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected.Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured. 1.06.05 Following are the Primer/painting schemes envisaged herein: PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104. PS3* - Zinc Chrome primer (Alkyd base) by dip coat. PS4 - Synthetic Enamel (long oil alkyd) to IS2932. PS5 - Red Oxide Zinc Phosphate primer (Alkyd base) to IS 12744 PS9 - Aluminium paint to IS 2339. PS9* - Heat resistant Aluminium paint to IS-13183 Gr.-1 PS13 - Rust preventive fluid by spray, dip or brush. PS14 - weldable primer-Deoxaluminate or equivalent. PS16 - High Build Epoxy CDC mastic `15' . PS17 - Aliphatic Acrylic Polyurethane CDE134 ,%V=40.0(min.) PS18 - Epoxy based TiO2 pigmented coat PS19 - Epoxy Zinc rich primer (92% zinc in dry film (min.), %VS=40.0(min.) PS-20 - Epoxy based finish paint 1.06.06 All weld edge preparation for site welding shall be applied with one coat of weldable primer. 1.06.07 For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies. 1.06.08 SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection. 1.06.09 a) All un-insulated equipments, pipes, valves etc covered in sub-section A-08 (Steam Turbine & Auxiliary system) shall be painted with paint not inferior to Epoxy resin based paints with minimum DFT of 150 micron. The paint shall be applied in three stages i.e. primer, intermediate and finish coats in following manner: ▪ Primer coat – Epoxy based zinc phosphate ▪ Intermediate - Epoxy based TiO2 pigmented coat ▪ Finish coat - Epoxy based finish coat b) Equipment, pipes etc. with high temperature shall be painted with heat resistant aluminum paint (to be selected based on the service condition of component as per IS-13183). Two coats of paint shall be applied with total DFT 40 micron. c) Surface preparation before painting shall be carried out according to requirement indicated in this sub-section and international standard	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO. CS-9585-001-2 52 of 171	SUB-SECTION - A-12 SURFACE PREPARATION & PAINTING
		Page 2 of 9

THIS IS THE PART OF TECHNICAL SPECIFICATION NO. PE-TS-434-154-A101.		एनटीपीसी NTPC	
CLAUSE NO.	TECHNICAL REQUIREMENTS		
1.06.10	A) Specification for the application of Epoxy coating for internal protection of DM tank & other vessels/tanks (as applicable) shall be as follows: Primer : One coat of unmodified epoxy resin along with polyimide hardener. Paint : Two (2) coats unmodified epoxy resin along with Aromatic adduct hardener. Total thickness of primer and paint should not be less than 400 microns. B) Specification for application of chlorinated Rubber paint for external protection vessel, tanks, piping, valves & other equipments shall be as follows: i) For Indoor vessel, tanks, piping, valves & other equipments: (a) Surface preparation shall be done either manually or by any other approved method. (b) Primer coat shall consist of one coat of chlorinated rubber based zinc phosphate primer having minimum DFT of 50 microns. (c) Intermediate coat (or under coat) shall consist of one coat of chlorinated rubber based paint pigmented with Titanium dioxide with minimum DFT of 50 microns. (d) Top coat shall consist of one coat of chlorinated rubber paint of approved shade and colour with glossy finish and DFT of 50 microns. Total DFT of paint system shall not be less than 150 microns. ii) For Outdoor vessel, tanks, piping, valves & other equipments: (a) Surface preparation shall be blast cleared using non-siliceous abrasive after usual wire brushing, which shall conform to Sa 2-1/2 Swiss Standard. (b) Primer coat shall consist of one coat of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns. (c) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns. (d) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided. The paint may be applied in one coat, in case high built paint is used, otherwise two coats shall be applied. Total DFT shall not be less than 300 microns.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO. CS-9585-001-2 53 of 171	SUB-SECTION - A-12 SURFACE PREPARATION & PAINTING
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1.06.11 Primer/Painting Schedule

Sl. No	Description		Surface Preparation	Primer Coat			Intermediate Coat			Finish Coats			Total Min. Painting DFT (Microns)	Colour Shade
				Type of Primer	No. of Coats	Min. DFT / coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)	Type of coating	No. Coats	Min. DFT/ Coat (Microns)		
A) Power Cycle Piping														
1.	All insulated Pippings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.		SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	As per NTPC Colour shade/ coding scheme
2.	All un-insulated Pippings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.	Design temperature < or equal to 60°C	SP3/SP4	PS 5	2	25	-	-	-	PS 4	3	35	155	
		Design temperature above 60°C- 200°C	SP3/SP4	PS 9*	1	20	-	-	-	PS9*	1	20	40	
		Design temperature > 200°C	SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	
3	Constant Load Hanger (CLH) and Variable Load Hanger (VLH)		SP4*	PS19	1	40	-	-	-	PS17	1	30	70	

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	BID DOC. NO. CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	TECHNICAL REQUIREMENTS	SUB-SECTION -A-12 Surface Preparation & Painting	Page 4 of 9
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4	Piping hangers/ supports (other than (3) above. (un-insulated)		SP4 (SP6 - for cleaning of weld joints after erection,)	PS 5	1	40	PS 4	1	40	PS 17	1	40	120
	Valves												
5.	Cast/Forge d	Design temperature < or equal to 60 degC	SP1/SP2/S P3	PS4/P S9	1	40	Polya mide Epoxy	1	100	PS17	1	40	180
		Design temperature above 60 degC and up to 200 degC	SP1/SP2/S P3	PS 9*	1	20	-	-	-	PS9*	1	20	40
		Design temperature above 200 degC	SP1/SP2/S P3	PS9*	1	20	-	-	-	PS9*	1	20	40
6.	All auxiliary Structural Steel components for pipe supports	Outside TG building and in SG envelope	SP4*	Inorga nic Ethyl Zinc Silicat e	1	75	PS18	1	75	a))Epoxy coat b)Final coat of paint PS17	2 1	35 30	250

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	BID DOC. NO. CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	TECHNICAL REQUIREMENTS	SUB-SECTION -A-12 Surface Preparation & Painting	Page 5 of 9
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		Within building	TG	SP4*	-do-	1	35	PS18	1	35	a))Epoxy coat b)Final coat of paint PS17	2 1	25 30	150	
7.	Weld Edges			SP6 (Hand cleaning by wire brushing)	PS13 (Weldable primer)	1	25	-	-	-	-	-	-	25	
1. \$ The first 2 finished coats (total min. DFT of 70 microns) shall be done at shop and the 3rd finish coat (min. DFT 35 Microns) shall be applied at site. 2. For valves below 65NB and temperature upto and including 540 DegC, Parkerizing/zinc phosphate corrosion resistant coating as per ASTM F1137 is also acceptable in lieu of Aluminum paint. 3. For corrosion protection of threaded hanger rods and variable spring cages, electro galvanizing in full compliance to minimum Corrosion category C3 as per EN ISO12944 is also acceptable. 4. For spring cages, 2 coats of 30 µm (min) zinc-rich epoxy resin primer with zinc content > 80 weight% in dry film followed by 2 coats of 30 µm (min) top coat of Acrylic resin Co-polymerisate with a total combined minimum DFT of 120µm is also acceptable in lieu of above specified paint scheme. 5. For corrosion protection for all inner parts of the hangers shall be at least in full compliance to Corrosion category C3 as per EN ISO12944.															
B) Steam Generator & Auxiliaries:															
1	All surfaces with temperature 95°C or less and which are insulated			SP3/SP4	PS 5	2	30	-	-	-	PS 4	2 \$	20 \$	100 \$	
2	All surfaces with temperature above 95°C and which are insulated			SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	BID DOC. NO. CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	TECHNICAL REQUIREMENTS	SUB-SECTION -A-12 Surface Preparation & Painting	Page 6 of 9
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Note: 1) SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection.

2) For valves below 65NB and temperature upto & including 545 Deg.C, Parkerizing/zinc phosphate corrosion resistant coating as per ASTM F1137 is also acceptable in lieu of Aluminum paint.

C) LOW PRESSURE PIPING

1	All Pipes, fittings / components, valves, Equipments etc.	SP3/SP5	PS3/ PS5	2	25	PS 4	1	30	PS 4	2	35	150	As per NTPC Colour shade/ coding scheme
2	Stainless steel surface, Galvanized steel surface and gun metal surface.	No Painting											
3	On the internal surface for pipes 1000 Nb and above	A coat of primer followed by hot coal-tar enamel or coal tar epoxy painting (cold) shall be applied.											

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	BID DOC. NO. CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	TECHNICAL REQUIREMENTS	SUB-SECTION -A-12 Surface Preparation & Painting	Page 7 of 9
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D) Fire Detection & Protection System, Compressed air system, Hydrogen generation plant and Air-conditioning & Ventilation System

For Fire Detection & Protection System, Surface preparation and painting of Fire Water Storage Tanks, all Steel Surfaces (external) exposed to atmosphere (outdoor & indoor installation), Deluge Valves, Alarm Valves, Foam monitors, Water monitors, Foam Proportioning equipments, Foam makers, etc. should be as per the Part-B, Sub Section-A-18, Fire Detection & Protection System

For Air Conditioning System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-17, Air Conditioning System.

For Ventilation System, Surface preparation and painting of all the steel surfaces (external) exposed to atmosphere (outdoor & indoor installation), centrifugal fans – Casing etc. should be as per the Part-B, Sub Section-A-30, Ventilation System.

For compressed air system, Surface preparation and painting of all the steel surfaces should be as per the Part-B, Sub Section-A-16 compressed air system.

For hydrogen generation plant, Surface preparation and painting should be as per the Part-B, Sub-Section-A-19 hydrogen generation plant.

E) ESP

1	All surfaces with surface temperature 95°C or less (with insulation)	SP3/SP4	PS3/ PS5	1	25	-	-	-	PS 4	1	30	55
2	All surfaces with surface temperature above 95°C (with or without insulation)	SP3/SP4	PS5	2	30	-	-	-	-	-	-	60

General Notes (Applicable for all above points A to E)

- i) Painting specification for all surfaces with surface temperature 95°C or less (un-insulated) that are not covered above shall be same as that given in Civil Sub-section, Part-B, Section-VI for corrosion protection of steel structures.

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	BID DOC. NO. CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	TECHNICAL REQUIREMENTS	SUB-SECTION -A-12 Surface Preparation & Painting	Page 8 of 9
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- ii) Painting specification for inside surfaces (such as inner surfaces of ducts/ tanks/ mills/ dampers/ ESP etc.) that are not covered specifically in above clauses, shall be provided with 2 coats of suitable primer i.e. PS5/ PS9 (Total DFT 60/40 micron) based on the temperature.

F) FGD System

- (i) Surface preparation shall be blast cleaned conforming to Sa 2-1/2 Swiss Standard.
- (ii) Primer coat shall consist of epoxy resin based zinc phosphate primer having minimum DFT of 100 microns.
- (iii) Intermediate coat (or under coat) shall consist of epoxy resin based paint pigmented with Titanium dioxide with minimum DFT of 100 microns.
- (iv) Top coat shall consist of one coat of epoxy paint suitable pigmented of approved shade and colour with glossy finish and DFT of 75 microns. Additionally finishing coat of polyurethane of minimum DFT of 25 microns shall be provided.

EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	BID DOC. NO. CS-9585-001-2	TECHNICAL SPECIFICATIONS SECTION VI, PART-B	TECHNICAL REQUIREMENTS	SUB-SECTION -A-12 Surface Preparation & Painting	Page 9 of 9
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TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO.: PE-TS-434-154-A101

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DATE: 12.04.2019

ANNEXURE - V
MANDATORY SPARES LIST



TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

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ANNEXURE - V

MANDATORY SPARES LIST

MANDATORY SPARES FOR OXYGEN DOSING SYSTEM		
S. No.	ITEM	QUANTITY
1.	MEASURING INSTRUMENTS	
a.	Transmitters of all types, ranges and model no. (For measurement of Pressure, Differential Pressure, Temperature, flow, level, etc.).	10% or 1 No. of each type, range, and model whichever is more.
b.	Local Indicators like temperature gauges, pressure gauges, differential pressure gauges, flow gauges, flow meters etc.	5% or 1 no. of each make, model and type whichever is more (to be divided to various ranges in proportion to main of all make, model, type population).

Notes: -

- Wherever quantity has been specified as percentage (%), the quantity of mandatory spares to be provided by the bidder shall be the specified percentage (%) of the total population of the plant. In case the quantity so calculated happens to be a fraction, the same shall be rounded off to next higher whole number.
- The Mandatory spares for the equipment under the contract provided by the vendor will strictly conform to the specifications and documents and will be identical to the corresponding main equipment/components supplied under the contract.
- The quality plan and the inspection requirement finalized for the main equipment will also be applicable to the corresponding mandatory spares.
- In case, mandatory spares are not applicable as per equipment / item selected, bidder has to provide equivalent mandatory spare as per for selected equipment / item in line with list of mandatory spares.

The vendor warrants:

- That all spares supplied will be new and in accordance with the contract document and will be free from defects in design, material and workmanship and shall further guarantee as under:
- In case of any failure in the original component/equipments due to faulty designs, materials and workmanship, the corresponding spare parts if any, supplied will be replaced without any extra cost to the BHEL and customer unless a joint examination and analysis by BHEL and/or customer of such spare parts prove that the defect found in the original part that failed can safely be assured not to be present in spare parts.
- The long term availability of spares to the BHEL and the customer for the full life of the equipment covered under the contract and that before going out of production of spare parts of the equipment covered under the contract, vendor and his sub-vendors shall give the BHEL and the customer at least 24 (Twenty Four) months advance notice so that the latter may order his bulk requirements of spares, if he so desires. The same provision will also be applicable to the sub-vendors. Further, in case of discontinuance of manufacture of any spares by the vendors or his sub-vendors the vendors and his sub-vendors, will provide the BHEL and the customer, 2 (two) years in advance, with full manufacturing drawings, material specifications and technical information required by the BHEL and the customer for the purpose of manufacture of such items and also the right to manufacture such spares for their own requirements.



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4. Further in case of discontinuance of supply of spares by the vendors or his sub-vendors, the vendor will provide the BHEL and the customer with full information for replacement of such spares with other equivalent makes, if so required by the BHEL and the customer.
5. Notwithstanding the above, the vendor shall be responsible for supply of spares for the lifetime of the package at reasonable prices. The prices of all future requirements of spares shall be derived from the corresponding ex-works price at which the orders for such spares have been placed by the BHEL and the customer as a part of the mandatory or long term or any other kind of spares. The base indices for calculating ex-works price shall be commissioning of last equipment under main contract.
- v) In case of emergency requirements of spares, the vendor would make every effort to expedite the manufacture and delivery of such spares on the basis of mutually agreed time schedule.
- vi) In case the vendor fails to supply the mandatory or long term or any other kind of spares on the terms stipulated above, the BHEL and the customer shall be entitled to purchase the same from the alternate sources at the risk and the cost of the vendor and recover from the vendor, the excess amount paid by the BHEL and the customer over the rates as per the contract. In the event of such risk purchase by the BHEL or the customer, the purchases will be as per the works and procurement policy of the BHEL and the customer prevalent at the time of such purchases and BHEL & the customer at his option may include a representative from the vendor in finalizing the purchases.
- vii) It is expressly understood that the final settlement between the parties in terms of relevant clauses of the tender document shall not relieve the vendor of any of his obligations under the provision of long term availability of spares and such provisions shall continue to be enforced till the expiry of 30 (thirty) years period reckoned from the scheduled date of completion of trial operation of the last equipment unless otherwise discharged expressly in writing by the BHEL or the customer.



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ANNEXURE - VI

DRAWING/ DOCUMENTS SUBMISSION SCHEDULE



TITLE: PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE- I (3 X 800 MW) TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM	SPECIFICATION NO.: PE-TS-434-154-A101	
	SUB-SECTION: IA	
	REV. NO.: 00	DATE: 12.04.2019

ANNEXURE - VI

MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION

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

S. NO.	DOCUMENT NO.	DOCUMENT TITLE	No. of weeks from LOI dated for submission
1	PE-V0-434-154-A101	P&ID for Oxygen Dosing System	2
2	PE-V0-434-154-A102	GA drawing and foundation detail for Oxygen Dosing System	2
3	PE-V0-434-154-A103	Technical Data sheet for Oxygen Dosing System	4
4	PE-V0-434-154-A104	Junction Box Termination Dwgs. for Oxygen Dosing System	4
5	PE-V0-434-154-A105	QAP for Oxygen Dosing System	2
6	PE-V0-434-154-A106	O&M Manual for Oxygen Dosing System	16

For drawings/ documents submission procedure, please refer above details. Bidder has to submit the revised drawing/ document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments/ observations. Without compliance sheet the submission of the drawings/ documents will not be considered and the delay on this account will be solely on bidder's side only. The number of drawing/ documents to be submitted by the bidder shall be as per enclosed Annexure-III.

Bidder to note that drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. Engineering meeting shall be held fortnightly, for which the bidder shall depute his concerned engineers along with project manager to PEM office or at customer office without fail.

Bidder to note that drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account.

Drawing/document submission shall be done through web based Document Management System (DMS). Bidder would be provided access to the DMS for drawing/document approval. Detailed methodology would be finalized during detail engineering. Bidder to ensure following at their end:

- Internet explorer version – Minimum Internet Explorer 7
- Internet speed – 2 mbps (Minimum preferred)
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- Vendor's internal proxy setting should not block DMS application's link (<http://124.124.36.198/wrenchwebaccess/login.aspx>)



TITLE: PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE- I (3 X 800 MW) TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM	SPECIFICATION NO.: PE-TS-434-154-A101	
	SUB-SECTION: IA	
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ANNEXURE – VII

FORMAT FOR OPERATION & MAINTENANCE MANUAL



TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO.: PE-TS-434-154-A101

SUB-SECTION: IA

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ANNEXURE-VII

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

Bidder to submit operation and Maintenance manual with minimum information as listed in below check list during contract stage.

Check List for Operation & Maintenance Manual

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

Sl.no. & Sections	Description	Tick (✓) if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	Cover page				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address, Emergency Contact number				
1.5	Name and sign of prepared by, checked by & approved by				
1.6	Revision history with approval Details				
2.0	Index				
2.1	Showing the sections & related page nos. All the pages should be numbered section wise				
3.0	Description of Plant/ System				
3.1	Description/ write up of operating principle of system equipment/ associated sub-systems & accessories/controls system, operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/ for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface/ terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings, Actual photograph of items/ system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/ wiring diagrams				
3.8	Control philosophy/ control write-ups				
4.0	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				



TITLE: PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE- I (3 X 800 MW)	SPECIFICATION NO.: PE-TS-434-154-A101		
	TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM		
	SUB-SECTION: IA	REV. NO.: 00	DATE: 12.04.2019

4.2	Handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/ user/ operator				
5.1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5.2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5.3	Do's & Don't of the equipments.				
5.4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5.5	Parameters to be monitored with normal values and limiting values				
5.6	Trouble shooting with causes and remedial measures				
5.7	Routine operational checks, recommended logs & records				
5.8	Changeover schedule if more than one auxiliary for the same purpose is given				
5.9	Painting requirement and schedule				
5.10	Inspection, repair, Testing and calibration procedures				
6.0	Maintenance guidelines for plant personal				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/ calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				



TITLE:
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STATION EXPANSION PHASE- I (3 X 800 MW)
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6.7	List of vendors & Sub-vendors with their latest addresses, service centres, Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	Statutory and other specific requirements considerations.				
8.0	List of reference documents				
9.0	Binding as per requirement				



TITLE:
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TECHNICAL SPECIFICATION FOR OXYGEN
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P&IDs FOR OXYGEN DOSING SYSTEM

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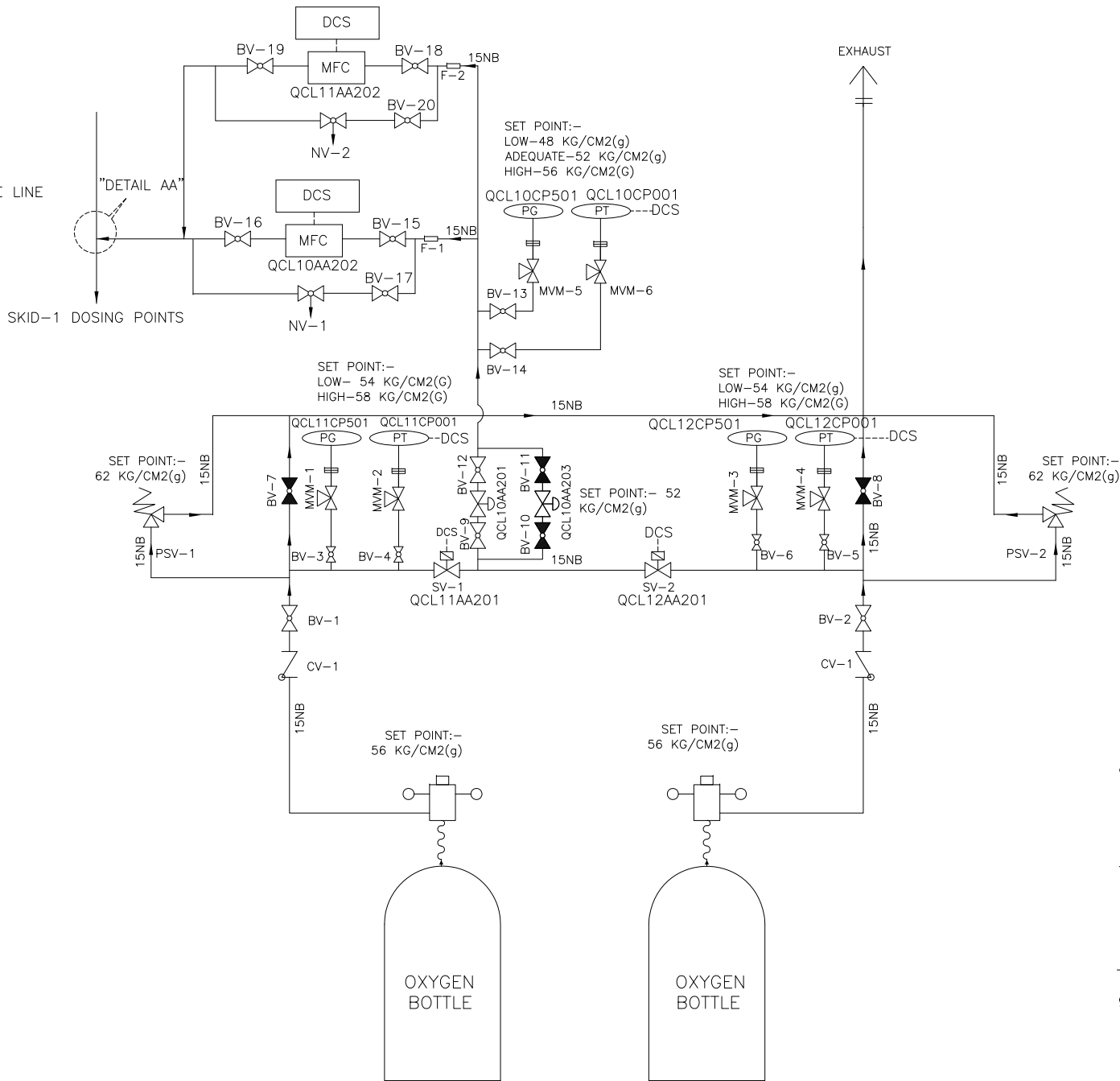
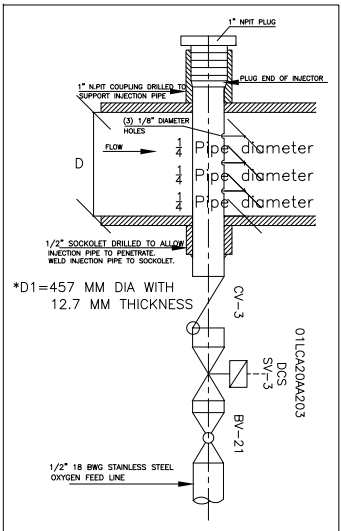
FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

DRAWING No.

LEGEND

	PRESSURE REDUCING VALVE
	NEEDLE VALVE
	PRESSURE TRANSMITTER
	SOLENOID ACTUATED VALVE
	PRESSURE GAUGE
	NON RETURN VALVE
	MULTI-VALVE MANIFOLD(SEE NOTES)
	BALL VALVE
	PRESSURE REGULATOR
	PRESSURE SAFETY VALVE
	DISCHARGE TO ATMOSPHERE FOR GAS/SYSTEM
	CHEMICAL SEAL DIAPHRAGM
	THERMAL MASS FLOW CONTROLLER (INCLUDING FLOW CONTROL VALVE)



NOTES: -

- 1 THE ENTIRE SYSTEM INCLUDING THE JUNCTION BOX SHALL BE SKID MOUNTED.
- 2 ONE NUMBER SKID PER UNIT SHALL BE PROVIDED FOR DOSING AT CEP DISCHARGE (TOTAL=3 NOS).
- 3 ONE NUMBER INJECTION ASSEMBLY PER UNIT SHALL BE SUPPLIED LOOSE (TOTAL = 3 NOS).
- 4 ALL THE VALVES SHALL BE OF SS 316.
- 5 ALL TUBING SHALL BE OF SS 316, 15 NB AND 18 BWG.
- 6 100 M OF TUBING PER UNIT (TOTAL 300 M) OF SAME SPECIFICATION SHALL BE LOOSE WITH THE SKID,
- 7 ALL THE MULTI VALVE MANIFOLD SHALL BE 3-WAY VALVE MANIFOLDS (MOC: SS316).
- 8 THE FOLLOWING SHALL BE THE TERMINAL POINT DETAILS:-,
- TP 1:- ALL FIELD INSTRUMENTS (PRESSURE AND FLOW TRANSMITTERS), AND SOLENOID VALVES (SV1 & 2 ONLY) SHALL BE TERMINATED AT THE JB BY OXYGEN DOSING VENDOR FOR FURTHER CONNECTION TO DCS BY BHEL.
- TP 2:- ALL VENT CONNECTIONS SHALL BE TERMINATED AT ONE POINT BY OXYGEN DOSING VENDOR FOR FURTHER CONNECTION TO ATMOSPHERE, IF REQUIRED, BY BHEL.
- TP 3: DOSING TERMINAL POINT SHALL BE AFTER MFC AND TERMINATED BY THE OXYGEN DOSING SUPPLIER FOR FURTHER INTERCONNECTION TILL DOSING LOCATIONS BY BHEL.
- TP 4:- 24 V-DC CONNECTION TO SV-3 SHALL BE DIRECTLY CONNECTED BY BHEL.
- 9 BHEL SHALL TERMINATE ALL INSTRUMENTS/ DEVICES AS PER NTPC PROVIDED TERMINATION DRAWINGS AND WILL PROVIDE JB'S AND CABLES ACCORDINGLY.

PATRATU VIDYUT UTPADAN NIGAM LIMITED
PATRATU STPS EXPANSION PHASE- I (3X800 MW)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

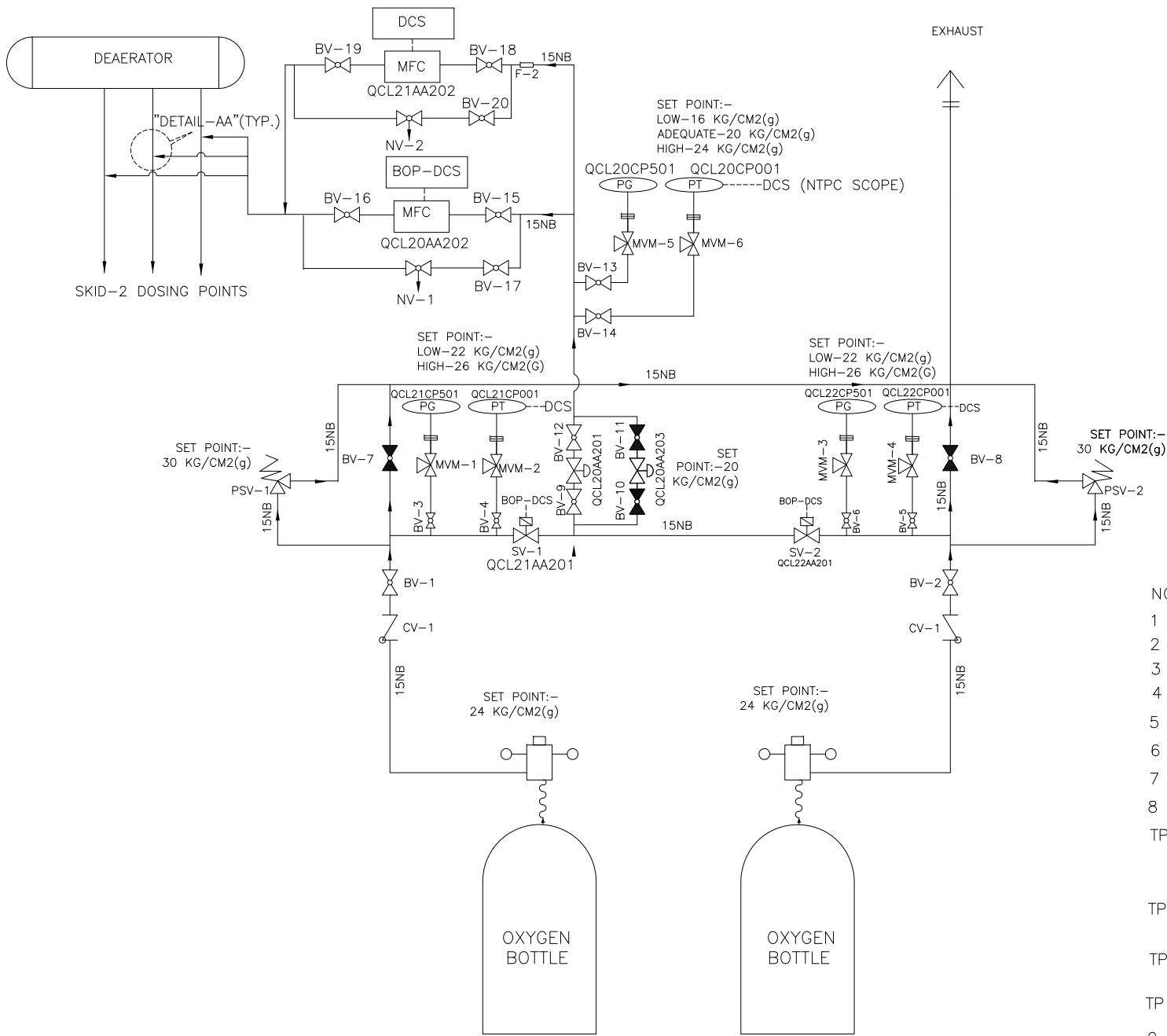
DEPT CODE		NAME	SIGN	DATE
A	DRN	MA		12.04.2019
	DESN	MA		12.04.2019
	CHD	AKS/ JP		12.04.2019
	APPD	SB		12.04.2019

TITLE P&ID FOR OXYGEN DOSING
SKID AT CEP DISCHARGE

DRAWING No. PE-DG-434-154-A101			
SHEET	01	OF	02
REV		0	

SIZE-A3

DRAWING NO.



L E G E N D

	PRESSURE REDUCING CUM REGULATING VALVE
	NEEDLE VALVE
	PRESSURE TRANSMITTER
	SOLENOID ACTUATED VALVE
	PRESSURE GAUGE
	NON RETURN VALVE
	MULTI-VALVE MANIFOLD(SEE NOTES)
	BALL VALVE
	PRESSURE REGULATOR
	PRESSURE SAFETY VALVE
	DISCHARGE TO ATMOSPHERE FOR GAS/SYSTEM
	CHEMICAL SEAL DIAPHRAGM
	THERMAL MASS FLOW CONTROLLER (INCLUDING FLOW CONTROL VALVE)

NOTES:-

- 1 THE ENTIRE SYSTEM INCLUDING THE JUNCTION BOX SHALL BE SKID MOUNTED.
- 2 ONE NUMBER SKID PER UNIT SHALL BE PROVIDED FOR DOSING AT DEAERATOR OUTLET (TOTAL=3 NOS).
- 3 THREE NUMBERS INJECTION ASSEMBLY PER UNIT SHALL BE SUPPLIED LOOSE (TOTAL = 9 NOS).
- 4 ALL THE VALVES SHALL BE OF SS 316.
- 5 ALL TUBING SHALL BE OF SS 316, 15 NB AND 18 BWG.
- 6 100 M OF TUBING PER UNIT (TOTAL 300M) OF SAME SPECIFICATION SHALL BE LOOSE WITH THE SKID.
- 7 ALL THE MULTI VALVE MANIFOLD SHALL BE 3-WAY VALVE MANIFOLDS (MOC: SS 316).
- 8 THE FOLLOWING SHALL BE THE TERMINAL POINT DETAILS:-
TP 1:- ALL FIELD INSTRUMENTS (PRESSURE AND FLOW TRANSMITTERS), AND SOLENOID VALVES(SV1 & 2 ONLY) SHALL BE TERMINATED AT THE JB BY OXYGEN DOSING VENDOR FOR FURTHER CONNECTION TO DCS BY BHEL.
TP 2:- ALL VENT CONNECTIONS SHALL BE TERMINATED AT ONE POINT BY OXYGEN DOSING VENDOR FOR FURTHER CONNECTION TO ATMOSPHERE, IF REQUIRED, BY BHEL.
TP 3:- DOSING TERMINAL POINT SHALL BE AFTER MFC AND TERMINATED BY THE OXYGEN DOSING SUPPLIER FOR FURTHER INTERCONNECTION TILL DOSING LOCATIONS BY BHEL.
TP 4:- 24 V-DC CONNECTION TO SV-3, SV-4, AND SV-5 SHALL BE DIRECTLY CONNECTED BY BHEL.
- 9 BHEL SHALL TERMINATE ALL INSTRUMENTS/ DEVICES AS PER NTPC PROVIDED TERMINATION DRAWINGS AND WILL PROVIDE JB's AND CABLES ACCORDINGLY.

PATRATU VIDYUT UTPADAN NIGAM LIMITED
PATRATU STPS EXPANSION PHASE- I (3X800 MW)



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE	NAME	SIGN	DATE
DRN	MA		12.04.2019
DESN	MA		12.04.2019
CHD	AKS/ JP		12.04.2019
APPD	SB		12.04.2019

TITLE P&ID FOR OXYGEN DOSING
SKID AT DEAERATOR OUTLET

DRAWING No.	PE-DG-434-154-A101
SHEET 02 OF 02	REV 0



TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO.: PE-TS-434-154-A101

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DATA SHEET- A



TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
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DATA SHEET-A

Sl. No	Description	Parameter
Mechanical Items		
1.0	No. of skid(s) for project	Six (Two per unit)
2.0	Cylinders:	
2.1	Quantity mounted on skid	Two per skid (Total twelve)
2.2	Loose supply of filled Oxygen cylinders	32 loose on a storage rack for each unit (Total 96)
2.3	Design Standard of empty oxygen cylinder	IS-7285 Part 1
2.5	Water Capacity	50 liters
2.6	Gas Capacity	10 m ³
2.7	Max Working pressure at 15°C	204 Kg/cm ²
2.8	Painting of oxygen cylinder	As per IS 4379
2.10	Accessories	Three numbers (one per unit) Cylinder storing rack (MS), each with capacity to hold 32 cylinders
3.0	All Tubing:	
3.1	Material	SS 316
3.2	Diameter	15 NB (1/2" OD), 18 BWG
4.0	Ball valves	
4.1	Body, Bonnet, stem	SS 316
4.2	Trim Material	SS 316
4.3	Design standard	MSS-99-2010/ Equivalent
4.4	Test standard	MSS-99-2010/ Equivalent
4.5	Size	15 NB
4.6	End Connections	Ferruled
4.7	Rating	2000 PSI
4.8	Valve operation	Manual or pneumatic as per P&ID
5.0	Check valves/ NRV	
5.1	Body, cover, disc/piston & seat	SS 316
5.2	Design standard	MSS-99-2010/ Equivalent
5.3	Test standard	MSS-99-2010/ Equivalent
5.4	Size	15 NB
5.5	End Connections	Ferruled
5.6	Rating	2000 PSI
5.7	Valve operation	Manual
6.0	Pressure relief valve	
6.1	Type	Spring loaded, angle type
6.2	Body, bonnet, disc & nozzle	SS 316
6.3	Valve discharges to	Atmosphere (vent)
6.4	Back pressure	Constant
6.5	Set pressure	62 Kg/cm ² (g) for skid 1 and 30 Kg/cm ² (g) for skid 2
6.6	Inlet Connections	Ferruled
6.7	Outlet Connections	Ferruled
6.8	Rating	2000 PSI
7.0	Fittings	SS-316
8.0	Pressure Regulator	
8.1	Quantity	Two per skid (total 12), each mounted to an oxygen cylinder
8.2	Body & trim	SS 316/ Brass
8.3	Inlet connection	1/2"
8.4	Outlet connection	1/2"
8.5	Operating pressure	204 Kg/cm ² (g)
8.6	Set outlet Pressure	56 Kg/cm ² (g) for skid dosing at CPU outlet and 24 Kg/cm ² (g) for skid dosing at deaerator outlet.
9.0	Mass Flow Controller/ FMCT	-----SS 316, ANSI B 16.5 CL 400 -----
9.1	Expected Flow of O ₂ in process	50-400 gm./ hr. (for skid dosing at deaerator outlet); 40-300 gm./ hr. (for skid dosing at CPU outlet)
9.2	MOC-wetted parts	SS 316
9.3	Operating pressure	Pressure reducing valve set pressure (refer P&IDs)
10.0	Structural steel	IS 2062
11.0	Nuts & bolts	SS 304



TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO.: PE-TS-434-154-A101

SUB-SECTION: IB

REV. NO.: 00

DATE: 12.04.2019

SECTION – IB
SPECIFIC TECHNICAL REQUIREMENTS (C&I)

SPECIFIC TECHNICAL REQUIREMENTS (C&I) WITH SCOPE OF SUPPLY:

- 1) OXYGEN DOSING shall be operated from DCS through operator work stations located in control room (BHEL Scope).
- 2) The bidder shall comply with detailed technical specification. Further in case of any discrepancy in the requirement shall be noted by the bidder, and shall be submitted to BHEL in the form of pre-bid clarification. In absence of any pre-bid clarification, the more stringent requirement as per interpretation of customer shall prevail without any commercial implication.
- 3) The make/model of various instruments/items/systems shall be as per NTPC approved vendor list. No commercial and delivery implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- 4) All instruments and control elements shall be terminated on JB/LCP in field and both instrument and JB/LCP are in bidder scope. Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 12-15 mtrs) and trunk cable.
- 5) The bidders shall specifically mention any deviation they would like to take on the C&I specification. In absence of only deviation, a No deviation certificate is to be furnished.
- 6) Bidder to supply the field instrumentation, control and solenoid valve (with limit switches for open close feedback) as required and is shown in the P&ID.
- 7) The junction boxes and cables required for termination of instruments, Solenoid valve and Mass flow controller up to junction box are in bidder's scope.
- 8) The cable used shall be 0.5 mm², G type (2P/4P/8P/12P) for Binary signals and F type cable (2P/4P/8P/12P/20P) for Analog signals. For solenoid 2.5mm², 3-core cable shall be used (as shown in Drive controlled philosophy).
- 9) Regarding the supply scope of cables, please refer the "Standard scope of matrix of cables" in Electrical portion of the technical specification.
- 10) The detailed specification of instruments and JB are given in detail in Sec. IIB
- 11) The quantity of instruments for the system shall be as per tender P &ID wherever provided of the respective system as a minimum, for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.
- 12) Bidder to terminate all instrumentation and control elements in junction boxes. Bidder to provide input/output list, drives list, junction box schedule and termination details, recommended control logics / write-up etc. the list of documents to be submitted after award of contract is to be referred by bidder.
- 13) All transmitters shall be suitably grouped together and mounted inside (i) Local Instruments Enclosures (LIEs) in case of open areas of the plant and (ii) In Local

Instrument Racks (LIRs) in case of covered areas. The transmitter racks shall be in Bidder's scope of supply. All transmitters shall be HART compatible.

- 14) Bidder to perform tests of C&I items/instruments/systems as per Quality plans/type test attached in the specification. However, if any test not specified in the quality plan but specified in specification Tests for I&C equipment included elsewhere in specification will have to perform by Bidder without any cost implication. The make/model of various instruments/items/systems shall be as per customer/BHEL approved vendor list. No commercial and delivery implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- 15) Instrument installation and accessories required for the same shall be in Bidder's scope and shall be submitted after award of contract. However any instrument installation not covered in the same shall be subject to customer and BHEL approval during detailed engineering.
- 16) Bidder to furnish electrical load/UPS load data during detailed engineering.
- 17) 230 V AC UPS Power supply shall be provided by BHEL at a single point, further distribution to various instruments/equipment of the system shall be in bidder scope. Bidder to include necessary power distribution board in his scope. Any power supply other than the above, if required by any instrument/equipment has to be derived by the bidder from the above supply & all necessary hardware for the same shall be in bidder scope. Bidder to submit the power requirement along with the bid.
- 18) Contractor shall furnish Instrument Schedule, I/O list, Drive list, Cable Schedule, Cable interconnection, JB grouping, Annunciation list, SOE list, List of Instruments/devices for HART in BHEL approved format. Also reusable database format like MS Excel, MS Access etc. of these documents shall also be provided by Contractor in BHEL approved format. Soft copy of the formats shall be provided to the successful bidder.
- 19) Electrical Actuators with integral starter shall be provided for all on/off and inching type valves along with necessary interface units for linking to corresponding Control System as applicable, typical Hook-up diagram of drives is included for reference.
- 20) Interface of MCC, HT SWGR, field instruments, Actuators etc. with DDCMIS based control system shall be as per Drive Control Philosophy enclosed in specification.
- 21) Local control panel, if any required for operation shall be in bidder scope.
- 22) The solenoid operated valves/Dampers/Gate shall have a limit switch for open/close feedback. The solenoid valve and mass flow controller with read out shall operate at 24V DC from DCS.
- 23) All the wetted parts of the instruments including the accessories like root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments as well as valves shall be of SS-316 material and same shall be in bidder's scope. The contacts of equipment mounted instruments; sensors, switches etc. for external connection including spare contacts shall be wired out to suitably located junction boxes by bidder.

- 24) All field instruments enclosure shall be IP65 local panel/cabinet enclosure shall be IP 55, unless otherwise specified.
- 25) Diaphragm seal shall be provided with Instruments having contact with corrosive media.
- 26) Redundancy of sensors shall be provided by bidder
 - (i) Triple redundancy for all analog and binary inputs required for protection of system/drives.
 - (ii) For all other control functions dual redundancy of the sensors shall be provided by the bidder.
- 27) Double root valve shall be provided for all pressure tapings where the pressure exceeds 40kg/cm².
- 28) Instrument installation shall be as per the attached "Standard Hook-up diagram of instrument.
- 29) Measuring instruments (primary & secondary), SWAS equipment/analyses offered for this package shall have at least one year's satisfactory operation in one power station having unit rating of 200 MW or above. Proven ness certificate shall be provided as per the attached format
- 30) All the outdoor field instruments such as analysers/transmitters/meters etc. shall be provided with suitable Free standing cabinet(s)/panel/rack so that the equipment's are protected against rain/ sunlight etc.
- 31) Drawings/Documents and data to be furnished by bidder after award of the contract:
 - Field instruments data sheet.
 - Solenoid valve datasheet
 - Junction Box GA drawings & Termination details.
 - Cable schedule and cable interconnection drawing.
 - Instrument schedule.
 - Recommended Control write-up
 - Any other document decided during detailed engineering



TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO.: PE-TS-434-154-A101

SUB-SECTION: II

REV. NO.: 00

DATE: 12.04.2019

SECTION – II

GENERAL TECHNICAL REQUIREMENTS

SUB-SECTION IIA - GENERAL TECHNICAL REQUIREMENTS (MECH.)

SUB-SECTION IIB - GENERAL TECHNICAL REQUIREMENTS (C&I)



TITLE: PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE- I (3 X 800 MW) TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM	SPECIFICATION NO.: PE-TS-434-154-A101	
	SUB-SECTION: IIA	
	REV. NO.: 00	DATE: 12.04.2019

SECTION- IIA

GENERAL TECHNICAL REQUIREMENTS (MECH.)



TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO.: PE-TS-434-154-A101

SUB-SECTION: IIA

REV. NO.: 00

DATE: 12.04.2019

1.0 SCOPE

This specification is intended to cover design, engineering, manufacturing, fabrication, assembly, inspection & testing at manufacturer's works, supply and dispatch to power station site of skid mounted **Oxygen Dosing Systems** along with start-up commissioning spares and mandatory spares as specified for the **PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE- I (3 X 800 MW)**. The above system shall be skid mounted. Two numbers skid per unit shall be provided for oxygen dosing system (one number for dosing at CPU outlet and one number for dosing at deaerator outlet).

2.0 DESIGN PHILOSOPHY

The objective of providing the dosing systems is to maintain the chemistry of the boiler feed water and also to comply with different modes of operation i.e. "Combined Water Treatment mode" during continuous plant operation and "Ammoniacal mode or AVT(O) mode" during start-up & shutdown conditions.

The chemical feed for Combined Water Treatment (CWT) involves the feed of only aqueous ammonia and gaseous oxygen. The principles, equipment selection and control philosophy of ammonia feed system has been covered separately in the Design Memorandum and P&ID for Chemical dosing system.

The following philosophy of chemical feed system is considered:-

a) During normal operation:-

- pH is maintained at 8.2-8.5 by dosing aqueous ammonia solution.
- Oxygen dosing rate recommended by BHEL is 30-150 ppb. Exact dosing rate shall be decided by the operator. For sizing of oxygen dosing system, 150 ppb continuous dosing of 99% pure oxygen has been considered.
- Dosing shall normally be done at CPU outlet. However provision shall be given for dosing at deaerator outlet also. For this purpose two separate skid based oxygen dosing systems shall be supplied for each unit. However, dosing shall be done at one place at a time only.
- Dosing rate shall be controlled from DCS by regulating mass flow controller (MFC) provided on each O2 dosing skid under full load conditions based on dissolved oxygen level at economizer inlet. Oxygen dosing rate can be adjusted in the range of 30-150 ppb from DCS. However, NTPC may also choose to manually feed a particular set point within this range and operate the oxygen dosing automatically based on this set point.
- The oxygen dosing shall automatically turn off by closing the mass flow controller (MFC), if cation conductivity in the cycle goes above 0.3 us/cm.

b) Startup sequence:-

- Deaerator vent is kept open.
- Ammonia is dosed at CPU outlet to achieve a pH of 9.2.
- Cation conductivity reaches below 0.15 $\mu\text{S}/\text{cm}$ (at 25°C) and the trend is downwards.
- Deaerator vents are closed.
- Oxygen feed is manually started from DCS.

c) Shut down sequence:-

- Oxygen feed needs to be stopped one hour before shut down and deaerator & LP heater vents needs to be opened.
- Ammonia dosing rate needs to be increased to achieve pH in the range of 9.2.

3.0 Equipment for Oxygen Dosing (2 skids/ unit i.e. total = 6 skids for station)

As mentioned, two oxygen dosing skids shall be supplied for each unit. Each skid shall be identical unless specifically mentioned otherwise. Since per unit only one skid of the two shall be under operation at a time, the cylinder storage for the all the skids shall be common located at the vicinity of the oxygen dosing skids. Each skid shall consist of the following components:-

3.1 Cylinder banks

Each oxygen dosing skid shall consist of a bank of two oxygen cylinders, dosing at downstream of Deaerator/ CPU outlet. Oxygen cylinder bank is provided to cater daily requirement. The automatic change-over of cylinder takes place on the basis of pressure i.e. the cylinder banks dosing at Condensate Polishing Unit (CPU) outlet



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will switch over at 54 kg/cm²(g) and the cylinder banks dosing at deaerator outlet at 22 kg/cm²(g). Separate storage rack for 32 filled cylinders per unit shall be supplied to cater 30 days oxygen requirement.

3.2 Pressure Regulator:

The line pressure regulator is used for reducing a high supply pressure (204 Kg/cm² cylinder pressure) to 56 kg/cm² (g) pressure in skid dosing at CPU outlet and to 24 kg/cm²(g) pressure in skid dosing at deaerator outlet.

3.3 Valves, tubing, vents and instrumentation shall be as per the attached P&ID and the data sheet. The MOC and specification of the equipment shall be as per the attached data sheet.

4.0 CONTROL AND INSTRUMENTATION

The mode of operation of the oxygen dosing system shall be from DCS only. All the logics, controls and interlocks shall be implemented in DCS. Local manual intervention is not envisaged. Both manual/ automatic controls shall be implemented in DCS. The provision to select "Auto" or "Manual" mode shall be provided in DCS OWS only.

The oxygen gas shall be at high pressure (204 Kg/cm²) in the cylinders. The same shall be brought to a lower pressure by the Pressure Regulator (set pressure of 56 Kg/cm² for skid dosing at CPU outlet and set pressure of 24 Kg/cm² for skid dosing at deaerator outlet) attached with each cylinder.

Each of the two oxygen cylinders in the skid shall have a dedicated set of solenoid valve, pressure gauge and pressure transmitter. Two cylinders provided on skid are connected and one cylinder will serve at a time based on the pressure at the inlet of solenoid valve. In case the pressure at the inlet of SV1 reaches at the set point, the solenoid valve SV1 will close and solenoid valve SV2 will open and other cylinder shall be taken in to service provided the pressure at the inlet of SV2 is not low and vice versa. Alarm for pressure low at the inlet of solenoid valves shall be provided in DCS.

A pressure relief valve shall be fitted at the upstream of solenoid valve to relieve system pressure if the system pressure goes above set pressure.

The pressure of the oxygen shall be further reduced by pressure reducing valve in the skid based on the feedback received from pressure transmitter {set point – "ADEQUATE" – (Set points– 52 kg/cm² for skid dosing at CPU outlet & 20 kg/cm² for skid dosing at deaerator outlet) downstream. The flow and pressure of oxygen can be monitored from DCS by the signal from mass flow controller (MFC) and from pressure transmitter provided at the downstream of pressure reducing regulating valve. The flow of oxygen dosing will be controlled manually/ automatically from DCS by adjusting mass flow controller (MFC) provided on skid based on the feedback from the dissolved oxygen analyzer located in the economizer inlet. The MFC shall have a position feedback transmitter that shall transmit the feedback signal to DCS.

All solenoid valves mounted in the oxygen dosing skid shall be 24 V DC powered from DCS and routed through the local skid mounted junction box. All the field instruments, MFC and solenoid valves (SV 1 & SV 2) shall be terminated at a junction box in the skid by oxygen dosing vendor for further connection to DCS.

At each dosing point, viz. CPU outlet and deaerator outlet, an injection assembly containing 15 NB tubing, fixing collar, solenoid valve and NRV shall be supplied loose by oxygen dosing vendor.

The set points indicated below for operation of pressure reducing valve are tentative. Final value of the same shall be decided by oxygen dosing vendor during detailed engineering as per the requirement of the MFC manufacturer.

BIDDER TO FURTHER NOTE IN CASE THE MANUFACTURER OF MASS FLOW CONTROLLER (MFC) RECOMMENDS GAS FILLERS FOR PROPER FUNCTIONING OF THE INSTRUMENT, THE SAME SHALL BE DEEMED INCLUDED IN BIDDER'S SCOPE.

Bidder to provide a flame arrestor in the vent header of each of oxygen dosing skids.



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Following interlocks/alarm annunciation facility shall be provided:

For Skid dosing at CPU Outlet:-

Signal Source	Tag Number	Set Point (suggested)	Interlock	Alarm in DCS	Remarks
<u>During Normal Operation:-</u>					
Pressure transmitter	QCL11CP001	58 Kg/cm ² (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 1 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	QCL11CP001	54 Kg/cm ² (g) (LOW)	Close (QCL11AA201) & Open (QCL12AA201) SV-1 & SV-2	Yes (LOW pressure at cylinder 1 outlet)	Auto - changeover of cylinders. Manually replace cylinder 1 with filled cylinder.
Pressure transmitter	QCL12CP001	58 Kg/cm ² (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 2 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	QCL12CP001	54 Kg/cm ² (g) (LOW)	Close (QCL12AA201) & Open (QCL11AA201) SV-2 & SV-1	Yes (LOW pressure at cylinder 2 outlet)	Auto-changeover of cylinders. Manually replace cylinder 2 with filled cylinder.
Pressure transmitter	QCL10CP001	48 Kg/cm ² (g) (LOW)	Close (QCL10AA202 & QCL11AA202) MFC	Yes (Oxygen dosing stopped due to low pressure)	
Pressure transmitter	QCL10CP001	56 Kg/cm ² (g) (HIGH)	Not applicable	Yes (HIGH dosing pressure)	Manual checking of pressure reducing valve reqd.
Cation Conductivity analyser*		0.3 µs/cm (at 25°C), increasing (HIGH)	Close (QCL10AA202 & QCL11AA202) MFC	Yes (Oxygen dosing stopped due to high cation conductivity in feed water cycle)	Increase ammonia pH set point to raise pH to 9.2-9.5 range
Dissolved oxygen analyser*		30 ppb (LOW), decreasing	Gradually open MFC (QCL10AA202 & QCL11AA202) to increase DO provided signal from QCL10CP001 is "NOT LOW" (i.e. < 48 Kg/cm ² (g))	Yes (Low DO level in feed water cycle)	Initial set point may be chosen as 90 ppb. However, provision may be kept to choose exact set point for operation by operator's plant chemist during commissioning within the range of 30-150 ppb.
Dissolved oxygen analyser*		150 ppb, increasing (HIGH)	Close (QCL10AA202 & QCL11AA202) to decrease DO MFC	Yes (Oxygen dosing stopped due to high DO level in feed water cycle)	
<u>During Start up:-</u>					
Cation Conductivity analyser*		0.15 µs/cm (at 25°C), decreasing (ADEQUATE)	Open (QCL10AA202 & QCL11AA202), provided signal from QCL10CP001 is "NOT LOW" (i.e. < 48 Kg/cm ² (g)) & signal from DO analyser is "NOT HIGH" (i.e. > 150 ppb) MFC	Yes (Oxygen dosing started)	



TITLE:
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REV. NO.: 00

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For Skid dosing at deaerator Outlet:-

Source signal of	Tag Number	Set Point (suggested)	Interlock	Alarm in DCS	Remarks
<u>During Normal Operation:-</u>					
Pressure transmitter	QCL21CP001	26 Kg/cm ² (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 1 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	QCL21CP001	22 Kg/cm ² (g) (LOW)	Close SV-1 (QCL21AA201) & Open SV-2 (QCL22AA201)	Yes (LOW pressure at cylinder 1 outlet)	Auto-changeover of cylinders. Manually replace cylinder 1 with filled cylinder.
Pressure transmitter	QCL22CP001	26 Kg/cm ² (g) (HIGH)	Not applicable	Yes (HIGH pressure at cylinder 2 outlet)	Manual checking of pressure regulator reqd.
Pressure transmitter	QCL22CP001	22 Kg/cm ² (g) (LOW)	Close SV-2 (QCL22AA201) & Open SV-1 (QCL21AA201)	Yes (LOW pressure at cylinder 2 outlet)	Auto-changeover of cylinders. Manually replace cylinder 2 with filled cylinder.
Pressure transmitter	QCL20CP001	16 Kg/cm ² (g) (LOW)	Close MFC (QCL20AA202 & QCL21AA202)	Yes (Oxygen dosing stopped due to low pressure)	
Pressure transmitter	QCL20CP001	24 Kg/cm ² (g) (HIGH)	Not applicable	Yes (HIGH dosing pressure)	Manual checking of pressure reducing regulating valve reqd.
Cation Conductivity analyzer *		0.3 µs/cm (at 25°C), increasing (HIGH)	Close MFC (QCL20AA202 & QCL21AA202)	Yes (Oxygen dosing stopped due to high cation conductivity in feed water cycle)	Increase ammonia pH set point to raise pH to 9.2-9.5 range
Dissolved oxygen analyzer*		30 ppb (LOW), decreasing	Gradually open MFC (QCL20AA202 & QCL21AA202) to increase DO provided signal from QCL20CP001 is "NOT LOW" (i.e. < 16 Kg/cm ² (g))	Yes (Low DO level in feed water cycle)	Initial set point may be chosen as 90 ppb. However, provision may be kept to choose exact set point for operation by operator's plant chemist during commissioning within the range of 30-150 ppb.
Dissolved oxygen analyzer*		150 ppb, increasing (HIGH)	Close MFC (QCL20AA202, QCL21AA202) to decrease DO	Yes (Oxygen dosing stopped due to high DO level in feed water cycle)	
<u>During Start up:-</u>					
Cation Conductivity analyzer *		0.15 µs/cm (at 25°C), decreasing (ADEQUATE)	Open MFC (QCL20AA202 & QCL21AA202), provided signal from QCL10CP001 is "NOT LOW" (i.e. < 16 Kg/cm ² (g)) & signal from DO analyzer is "NOT HIGH" (i.e. > 150 ppb)	Yes (Oxygen dosing started)	

***SHALL BE PART OF SWAS SCOPE.**



TITLE:
**PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)**
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DOSING SYSTEM**

SPECIFICATION NO.: PE-TS-434-154-A101

SUB-SECTION: IIB

REV. NO.: 00

DATE: 12.04.2019

SECTION- IIB

GENERAL TECHNICAL REQUIREMENTS (C&I)

	SPECIFICATION FOR CONTROL & INSTRUMENTATION FOR AUX PACKAGES	SPECIFICATION NO.:	
		VOLUME	
		SUB SECTION	
		REV. NO.	DATE :
		SHEET	OF

GENERAL REQUIREMENT

1.0 Bidder shall provide complete and independent control & instrumentation system with all accessories, auxiliaries and associated equipments for the safe, efficient and reliable operation of auxiliary systems.

2.0 The quantity of instruments for auxiliary system shall be as per tender P & ID wherever provided of the respective system as a minimum, for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.

3.0 Measuring instruments/equipment and subsystems offered by the bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Further all the instruments shall be of proven reliability, accuracy, and acceptable international standards and shall be subject to employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specification, ranges, makes/ numbers as approved by the employer' during detail engineering.

4.0 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments; sensors, switches etc for external connection including spare contacts shall be wired out to suitably located junction boxes.

5.0 The customer specification attached as Specific Technical Requirement will supercede the Data sheets, if there is any mismatch.



**C&I SPECIFICATION FOR
OXYGEN DOSING**

SECTION: C
SUB SECTION: C&I

**MEASURING INSTRUMENTS
(PRIMARY & SECONDARY)
&
SPECIFICATION FOR ELECTRONIC
TRANSMITTERS**

|

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.00.00	MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)			
1.01.00	Measuring instruments/equipment and subsystems offered by the Bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Refer Sub-section Basic Design Criteria. Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance and shall comply with the acceptable international standards and shall be subject to Employer's approval.			
1.02.00	Every panel-mounted instrument requiring power supply shall be provided with easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.			
1.03.00	All transmitters, sensors, switches and gauges for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance as well as for operator and management information (including all computation) of equipment in the system under the scope of specification shall be provided on as required basis with in quoted lump sum price. The Contractor shall furnish all Instrumentation / Control equipment & accessories under this specification as per technical specification, ranges, makes & model as approved by the Employer during detailed engineering.			
1.04.00	The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.			
1.05.00	All instruments envisaged for sea water applications, shall be provided with wetted parts made of Monel/ Hastelloy C or any other material (if provenness experience of the proposed material for such applications is established by contractor). For Chlorine application: Instruments shall be provided with wetted parts (e.g. diaphragm seal, etc.) made of Hastelloy C. Also, filled liquid shall be Fluorolube oil/ Inert Hydrocarbon / CTFE etc., for these applications. For applications of FECL3 solution: Instruments shall be provided with wetted parts (e.g. diaphragm seal, etc.) made of Tantalum.			
1.06.00	For coastal areas, all instruments shall be provided with durable epoxy coating for housings and all exposed surfaces of the instruments.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	PAGE 1 OF 46

CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.00.00	SPECIFICATION FOR ELECTRONIC TRANSMITTERS		
2.01.00	SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, DIFF PRESS AND DP BASED FLOW / LEVEL MEASUREMENTS		
	SI.No.	Features	Essential/Minimum Requirements
	1.	Type of Transmitter	Microprocessor based 2 wire type (loop powered), Hart protocol compatible.
	2.	Accuracy	± 0.1% of calibrated span (minimum)
	3.	Output signal range	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol)
	4.	Turn down ratio (minimum)	10:1 for vacuum/very low pressure applications (i.e. pressure <= 200 mmWC) 5:1 for very high pressure application (i.e. pressure >= 200 Kg/cm2) 30:1 for other applications
	5.	Stability	± 0.1% of calibrated span for six months for Ranges up to and including 70 Kg/cm² ± 0.25% of calibrated span for six months for Ranges more than 70 Kg/cm²
	6.	Zero and span drift	+/- 0.015% per deg.C at max span +/-0.11% per deg.C at min. Span
	7.	Load impedance	500 ohm (minimum)
	8.	Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistant coating
	9.	Over Pressure	150% of max. Operating pressure
	10.	Connection (Electrical)	Plug and socket type
	11.	Process connection	1/2 inch NPT (F)
	12.	Span and Zero	Continuous, tamper proof, Remote as well as manual adjustability from instrument with zero suppression and elevation facility.
	13.	Accessories	-Diaphragm seal, pulsation dampeners, syphon etc. as required by service and operating condition. -2 valve manifold for absolute & Gauge pressure transmitters, 3-valve and 5 valve manifold for DP/Level/Flow applications. The valve manifold shall be non integral type (except Fuel Oil area).
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY) PAGE 2 OF 46

CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.02.00		-For hazardous area, explosions proof enclosure as described in NEC article 500 Mounting: 2 inch pipe mounting. 14. Diagnostics & display Self-Indicating feature and digital display on transmitter 15. Power supply 24V DC ± 10%. 16. Adjustment/calibration/maintenance From hand held HART calibrator/ centralized PC based system (as applicable). Notes - For primary air/ secondary air/flue gas applications, DP type transmitters shall be provided for pressure measurement. - LVDT type is not acceptable. - Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.	
	GUIDED WAVE RADAR TYPE LEVEL TRANSMITTER		
	Type	Microprocessor based 2 wire type (loop powered), HART protocol compatible Guided wave radar transmitter.	
	Principle	TDR (Time domain reflectometry)	
	Probe Type & Material	(i) Coaxial probe of SS316/316L. If required, probe shall be suitable for overfill prevention. (ii) Rod probe, cable probe of SS316/SS316L can be used for applications wherever coaxial probe is not suitable.	
	Output signal	4-20 mA DC along with superimposed digital signal (based on HART protocol), suitable for over fill prevention.	
	Accuracy	+/- 0.5% of calibrated span or minimum 5mm.	
	Power supply	24 VDC +/- 10%.	
	Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistance coating.	
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2
		PAGE 3 OF 46	

CLAUSE NO.	TECHNICAL REQUIREMENTS			
15.00.00	The measurement accuracy of the transmitter shall be better than +0.2%. The transmitter shall provide suitable 4-20mA dc output signal for control and indication/recording. Converters if necessary shall be provided to generate the 4-20mA signal. A local indicator of fuel oil flow shall also be provided. The instrument shall be calibrated in Tons/hr. Suitable strainer shall be provided before the transmitter for the protection of oval wheel meters against foreign matter contained in the fuel oil. The exact model no. and type of material being used, etc., shall be subject to Employer's approval during detailed engineering without any price repercussion to Employer.			
	PROCESS ACTUATED SWITCHES			
	FEATURES	ESSENTIAL / MINIMUM REQUIREMENTS		
		Pressure/ Draft Switches/ DP Switches	Temperature switches	Level switches
	Sensing Element	Piston actuated for high pressure and diaphragm or bellows for low pr./ vacuum	Vapor pressure sensing, liquid filled bellow type with SS bulb and capillary (5 m minimum, to suit application)	Capacitance types, float type, conductivity type, RF type, Ultrasonic type as per suitability to the application. .
	Material	316 SS	Bulb 316 SS/ capillary 304 SS	316 SS
	End connection	½ inch NPT (F)	½ inch NPT (F)	Manufacturer standard
	Over range/ proof pressure	150% of maximum operating pr.	-	150% of maximum operating pr.
	Repeatability	+/- 0.5% of full range		
	No. of contacts	2 No.+2NC. SPDT snap action dry contact		
	Rating of contacts	60 V DC, 6 VA (or more if required by DDCMIS)		
Elect. Connection	Plug in socket.			
Set point adjustment	Provided over full range.			
Dead band adjustment	Adjustable/ fixed as per requirement of application.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE –I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	PAGE 38 OF 46

CLAUSE NO.	TECHNICAL REQUIREMENTS					
	Enclosure	Weather and dust proof as per IP-55, metallic housing.				
	Accessories	Siphon, snubber, chemical seal, pulsation dampeners as required by process	Thermo well of 316 SS and packing glands	All mounting accessories		
	Mounting	Suitable for enclosure/ rack mounting or direct mounting	Suitable for rack mounting or direct mounting	-		
	Power Supply (wherever required)	As per Contractor's Standard practice.				
	Notes :- 1) Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application. 2) Pressure/ Diff pressure switches for very low press/ DP measurements can have sensor material other than SS316 in case of any technical limitation and the offered product is standard product of the manufacture for very low pressure applications. 3) Repeatability can be upto +/-1% of full range in case of switches with diaphragm seals or very low pressure/DP range. 4) The specifications of switches for air conditioning & ventilation system / process can be as per system manufacturer's standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice.					
16.00.00	NOT USED					
17.00.00	SOLENOID VALVES Solenoid valves shall fulfil the following requirements: a. Type 2/3/4 way SS 316/Forged Brass (depending on the application subject to Employer's approval during detailed Engg.) b. Power supply : 24 V DC $\pm$ 10%. c. Plug and socket electrical connection. d. Insulation : Class 'H'					
18.00.00	REVERSE ROTATION INDICATOR (RRI) Reverse rotation indicator comprising of proximity sensors, processing electronics with output of 4-20mA (corresponding to speed) interconnecting cables, speed display in rpm,					
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE -I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)		PAGE 39 OF 46

10.00.00	CONTROL CABINETS / PANELS / DESKS
10.01.00	The cabinets shall be IP-22 protection class. The Contractor shall ensure that the packaging density of equipment in these cabinets is not excessive and abnormal temperature rise, above the cabinet temperature during normal operation or air-conditioning failure, is prevented by careful design. This shall be demonstrated to the Employer during the factory testing of the system. The Contractor shall ensure that the temperature rise is limited to 10 deg. C above ambient and is well within the safe limits for system components even under the worst condition and specification requirements for remote I/O cabinets. Ventilation blowers shall be furnished as required by the equipment design and shall be sound proof to the maximum feasible extent. If blowers are required for satisfactory system operation, dual blowers with blower failure alarm shall be provided in each cabinet with proper enclosure and details shall be furnished with proposal. Suitable louvers with wire mesh shall be provided on the cabinet.
10.01.01	The cabinets shall be designed for front access to system modules and rear access to wiring and shall be designed for bottom entry of the cables.
10.01.02	The cabinets shall be totally enclosed, free standing type and shall be constructed with minimum 2 mm thick steel plate frame and 1.6 mm thick CRCA steel sheet or as per supplier's standard practice for similar applications, preferred height of the cabinet is 2200 mm. The cabinets shall be equipped with full height front and rear doors. The floor mounting arrangement for other cabinets shall be as required by the Employer and shall be furnished by the Contractor during detailed engineering.
10.01.03	Cabinet doors shall be hinged and shall have turned back edges and additional bracing where required ensuring rigidity. Hinges shall be of concealed type. Door latches shall be of three-point type to assure tight closing. Detachable lifting eyes or angles shall be furnished at the top of each separately shipped section and all necessary provisions shall be made to facilitate handling without damage. Front and rear doors shall be provided with locking arrangements with a master key for all cabinets. If width of a cabinet is more than 800 mm, double doors shall be provided.
10.01.04	Two spray coats of inhibitive epoxy primer-surface shall be applied to all exterior and interior surfaces. A minimum of 2 spray coats of final finish colour shall be applied to all surfaces. The final finished thickness of paint film on steel shall not be less than 65-75 micron for sheet thickness of 2 mm and 50 microns for sheet thickness of 1.6

mm. The finish colors for exterior and interior surfaces shall conform to following shades:

- (a.) Exterior:- As per RAL 9002 (End panel sides RAL 5012), to be finalised during detailed engineering.
- (b.) Interior:- Same as above.

Paint films which show sags, checks or other imperfections shall not be acceptable.

As an alternative, single coat of anodic dipcoat primer along with single textured powder coating with epoxy polyester meeting the thickness requirement is also acceptable.

Refer Subsection Basic Design Criteria, Part-B, Section-VI for grounding requirements.

The mimic shall be configured on the OWS/CRTs and it shall be possible to control, monitor and operate the plant from the same.

The technical specification covering panel fabrication details, wiring and termination details etc. shall be as described under Sub-Section INST CABLE of this specification.

CLAUSE NO.		TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	

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

Sl. No	FEATURES	ESSENTIAL/MINIMUM REQUIREMENTS		
		Pr. Gauge/ DP Gauge/ Draught gauges	Temperature Gauge	Level Gauge
1	Sensing Element and material	Bourdon for high pressure, Diaphragm/Bellow for low pr. Of 316 SS	Mercury in steel for below 450°C and inert gas actuated for above 450°C of SS bulb and capillary.	Tempered * toughened Borosilicate gauge glass steel armoured reflex or transparent type.
2	Body material	Die-cast aluminium	Die-cast aluminium	Forged carbon steel/304 SS
3	Dial size	150mm	150 mm	Tubular covering entire range
4	End connection	1/2 inch NPT (M)	3/4" NPT (M)	Process connection as per ASME PTC and drain/vent 15 NB
5	Accuracy	±1% of span	± 1% of span	± 2%
6	Scale	Linear, 270° arc graduated in metric units	Linear, 270° arc graduated in °C	Linear vertical
7	Range selection	Cover 125% of max. of scale	Cover 125% of max. of scale	Cover 125% of max. of scale
8	Over range test	Test pr. for the assembly shall be 1.5 to the max. Design pr. at 38°C.		
9	Housing	Weather and dust proof as per IP-55	Weather and dust proof as per IP-55	CS/304 SS leak proof
10	Zero/span adjustment	Provided	Provided	--
11	Identification	Engraved with service legend or laminated phenolic name plate		

12	Accessories	Blow out disc, SS Thermowell siphon, snubber, pulsation dampener, chemical seal (if required by process) gauge isolation valve	Gasket for all KEL-F shield for transparent type vent and drain valves of Steel/SS as per CS/Alloy process Requirement.
13	Material of Bourdon/ movement	316 SS / 304 SS	316 SS / 304 SS

Notes:-

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

Length of gauge glass shall not be more than 1400 mm. If the vessel is higher, multiple gauge glasses with 50 mm overlapping shall be provided.

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

THIS IS THE PART OF TECHNICAL SPECIFICATION NO. PE-TS-434-154-A101. DATASHEET FOR MASS FLOW CONTROLLER			
		EQUIPMENT	: OXYGEN DOSING SYSTEM
PROJECT			
BHEL DOC NO			
Sl.No	ITEM		
1.0	Item	Mass Flow Controller	
2.0	Type	Thermal Mass Flow controller	
3.0	Tag No	Vendor to provide	
4.0	Quantity	Vendor to provide	
5.0	Make	Vendor to provide	
6.0	Input Signal	4-20 mA	
7.0	Output Signal	4-20 mA along with HART compatible	
8.0	Power supply	24 V DC	
9.0	Fluid Handled	Oxygen gas	
10.0	MOC	SS-316	
11.0	Operating Pressure	Vendor to provide	
12.0	Response Time	Less than 1 Sec	
13.0	Turn Down Ratio	50:1	
14.0	Accuracy	1 %	
15.0	End Connection	1/2" Ferrule	
16.0	Model	Vendor to provide	
17.0	Required Flow rate	50-400 gm/hr	
18.0	Range Flow rate	0.257 – 2574 gm/hr	
19.0	Protection class	Installed in IP55 enclosure.	
SUBMITTED TO			
SUPPLIED BY			
CLIENT		: BHARAT HEAVY ELECTRICALS LIMITED	

CLAUSE NO.	TECHNICAL REQUIREMENTS	
4.00.00	SAMPLE PIPING SYSTEM	
4.01.00	This shall include piping, fittings, valves and accessories from tapping point upto SWAS conditioning panel located in SWAS room on as required basis. All sample piping shall be 3/4" NB seamless type of material ASTM A213 TP 316 H, conforming to ANSI B36.19. The schedule number shall be suitable for the particular application.	
4.02.00	All fittings shall be socket welding type and of material ASTM A182 F316H conforming to ANSI B 16.11.	
4.03.00	Single and multi tubes shall run with the minimum number of changes in direction. Suitable identification tags shall be provided for easy check up and for proper connections.	
4.04.00	The valves to be used in sample piping shall be of stainless steel conforming to ASTM A182. The pressure temperature ratings shall be as per ANSI B16.34. The valve design shall be such that the seats can be reconditioned and stem and disc can be replaced without	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION - IIIC-13 SWAS PAGE 7 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS							
4.05.00	removing valve body from the line. The specification of End size, Pressure class, Type, End preparation, Body, etc. for different type of valves are specified in SWAS table in Clause No. 4.06.00 of Subsection IIIC-09, Section-VI, Part-B.							
	Material Specifications for Sample Pipe Lines							
	The piping to be furnished and installed for water and steam analysis system shall be as indicated below:							
	Piping System		Material					
	1.	Piping from the sample inlet bulk head fittings to the shut off valves	Stainless steel, ASTM A 213, Type 316H, 16 BWG tubing					
	2.	Piping for the high pressure samples and sample blow down piping	Stainless steel, ASTM A 213, Type 316 H. 14 BWG tubing					
	3.	Blow down header	Stainless steel, ASTM A 312, Type 304 Schedule 160					
	4.	Miscellaneous drains receiver holder	Stainless steel, ASTM A 312, Type 304 Schedule 40					
	5.	Piping from the shut-off valves to the terminal points including branch piping and the closed cooling water grab sample piping	Stainless steel, ASTM A 213, Type 316 H, 16 BWG tubing					
	6.	Closed cooling water piping except grab sample and water purge line	Carbon steel, ASTM A 53 Gr. A, Schedule 40.					
4.06.00	SWAS Valve Table:							
	S. No.	Service / Location	End Size	Pr. Class	Type	End Preparation	Body	Make (as specified or equivalent)
	1	Sample Shut off valve	0.38	6000	Globe	SW	316SS	Thiedig
	2	Sample blow down valve	0.38	6000	Ball valve	SW	316SS	Thiedig
	3	Solenoid valve	--	--	2 way	--	316SS	ASCO
	4	Pr. reducing Valve	0.38	--	Needle	Tube	316SS	Thiedig
	5	Safety relief Valve	0.25	3000	Relief	Tube	316SS	Nupro
	6	PI and FI isolation valve	0.25	3000	Needle	Tube	316SS	Whiety
	7	Back pr. regulating valve	0.25	300	C.W.	SCR	316SS	Cono. flow H30XT-
	EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION - IIIC-13 SWAS		PAGE 8 OF 9	

CLAUSE NO.	TECHNICAL REQUIREMENTS							एन टी पी सी NTPC
5.00.00								HAXXXG
	8	Grab	0.25	300	3-way	Tube	316SS	Whiety
	9	Quick	--	--	ball	--	316SS	Hancock Walther
	10	Individual P.C. and S.C. inlet & outlet valve					316SS	Hancock/ ACKER MANN
	11	P.C. I/L & O/L header & chilled water I/L & O/L isolation valve	--	--	Gate	--	316SS	Hancock
	12	Safety relief valve at each PC & SC and cooling water header	--	--	Relief	--	316SS	Baldota
	13	High Pressure reducing valve	--	--	--	--	316SS	--
	14	Isolation valve before primary cooler	--	--	Needle	Tube	316SS	Whiety
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.: CS:9585-001-2			SUB-SECTION - IIIC-13 SWAS		PAGE 9 OF 9



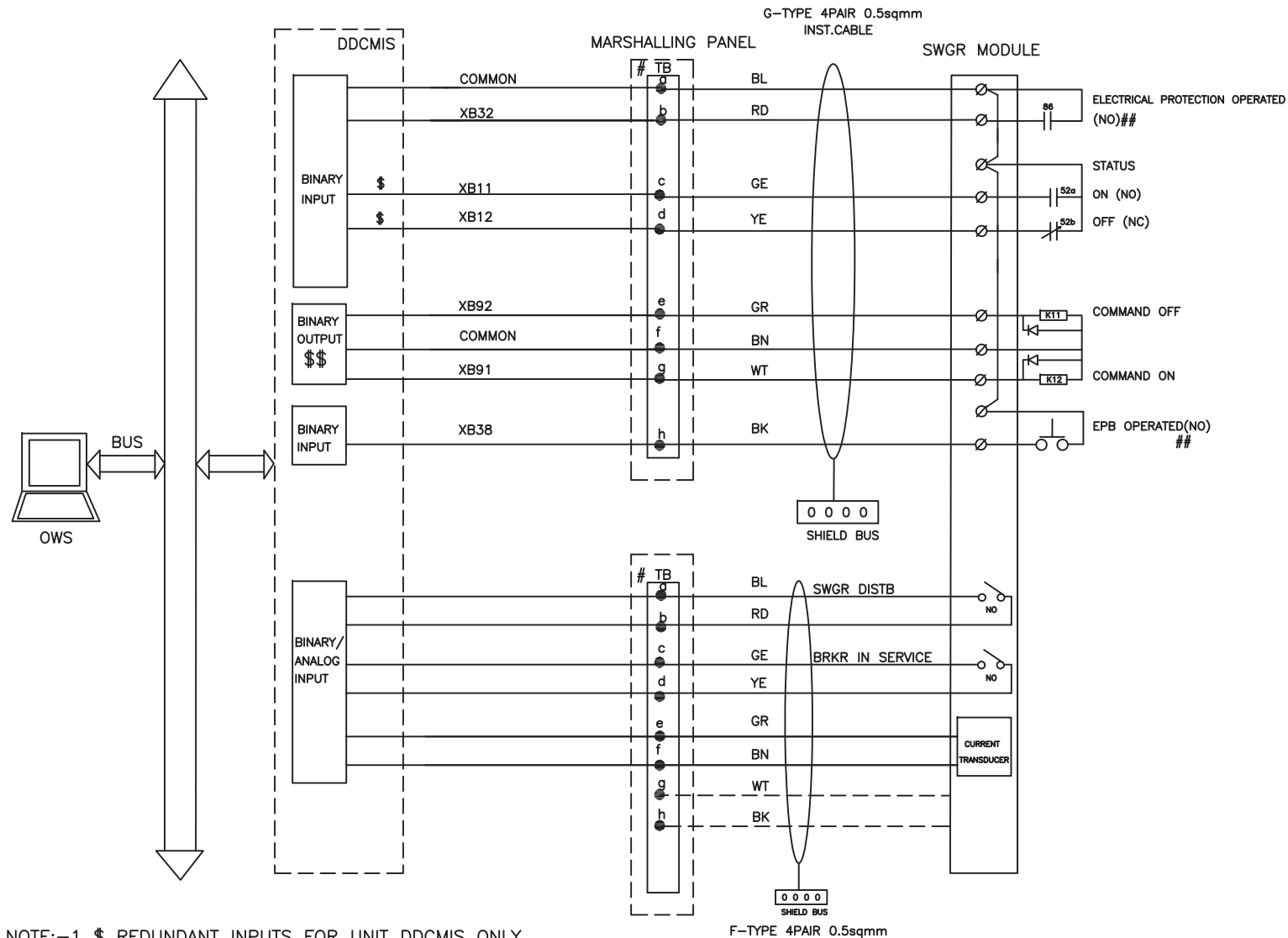
**C&I SPECIFICATION FOR
OXYGEN DOSING**

SECTION: C
SUB SECTION: C&I

**SIGNAL EXCHANGE BETWEEN
DRIVES & DCS**

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DDCMIS INTERFACE WITH HT SWITCH GEAR (HT)



NOTE:-1 \$ REDUNDANT INPUTS FOR UNIT DDCMIS ONLY

NOTE:-2 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

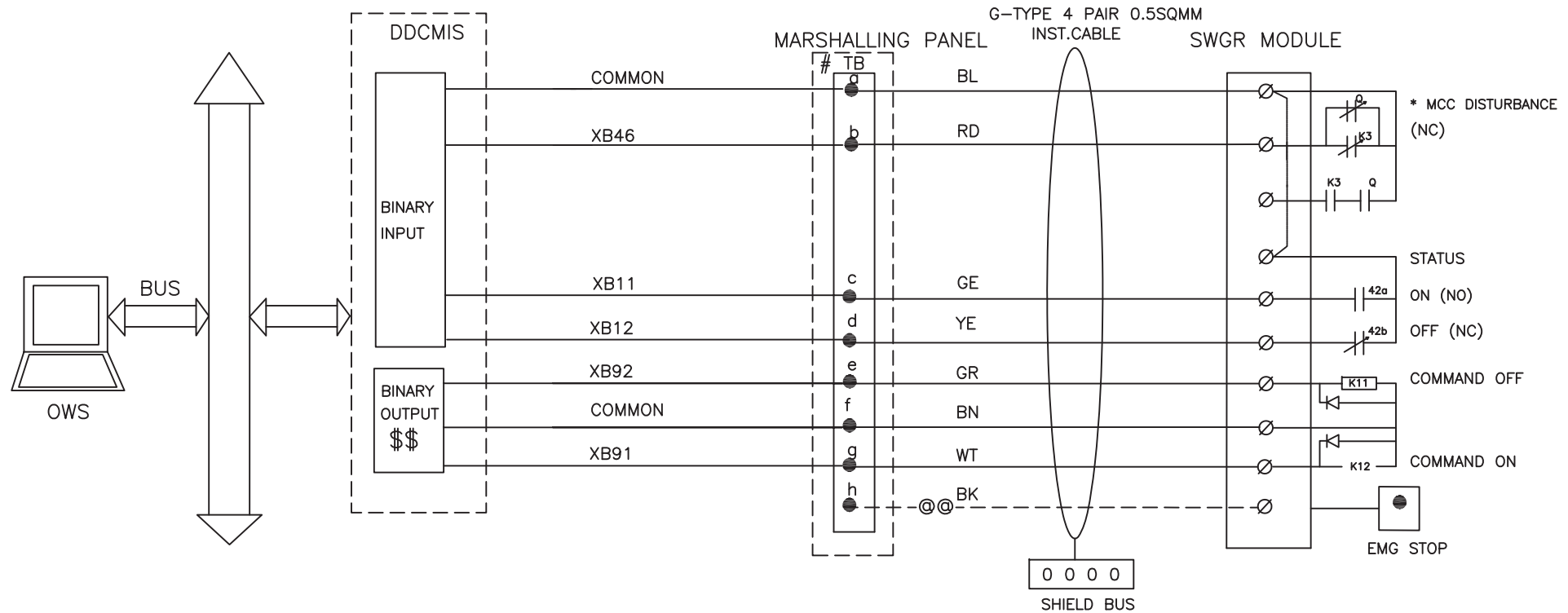
NOTE:-3 # 8 LEVEL TERMINAL BLOCK

NOTE:-4 ## DI-SOE SIGNALS FOR UNIT DDCMIS ONLY

NOTE:-5 CURRENT SIGNAL IS TO BE CONSIDERED IN DDCMIS FROM HT BREAKER FOR FD,ID,PA,MILL MOTORS, CHP HT CONVEYORS

	3X800 MW NTPC PATRATU STPP PHASE-I		DRG.NO.	9585-001-405-PVI-B-152B
	DDCMIS INTERFACE WITH HT SWITCH GEAR(HT)		SH	04 OF 34

DDCMIS INTERFACE WITH LT MCC (LT)



NOTE:-1 \$\$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

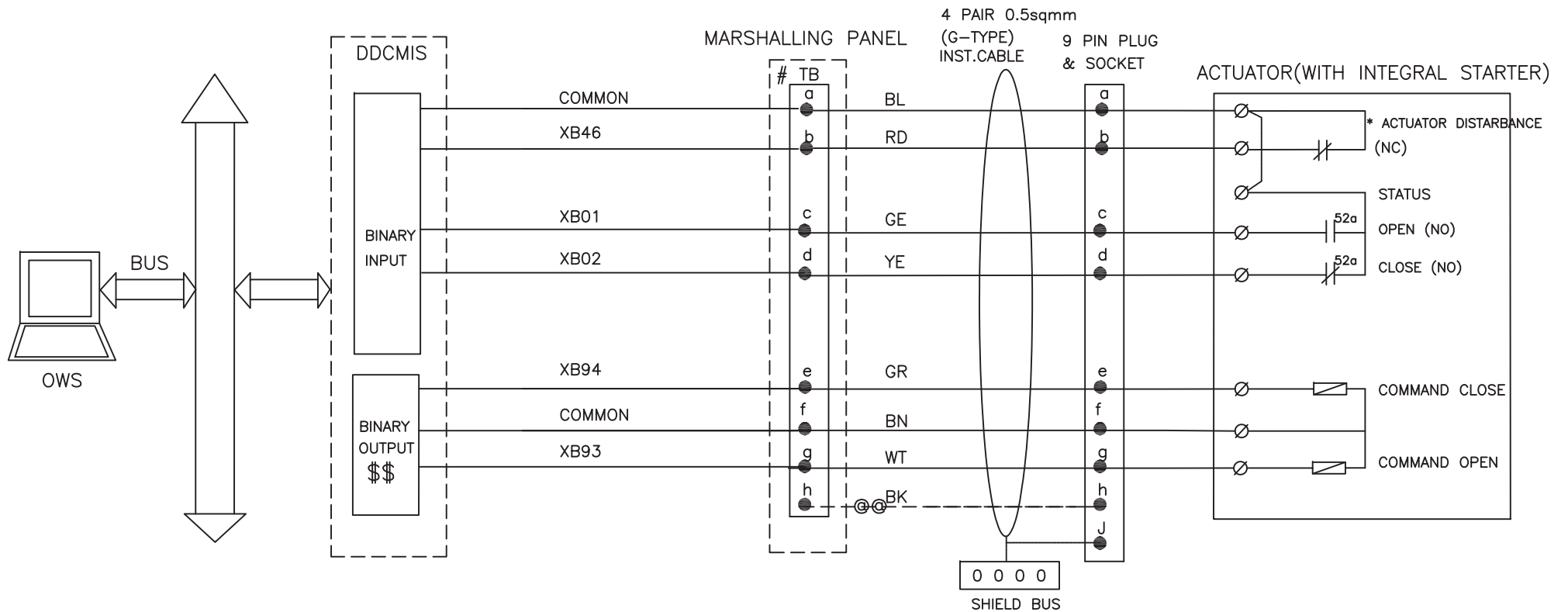
NOTE:-2 # 8 LEVEL TERMINAL BLOCK

NOTE:-3 @@ IN EACH DDCMIS POST, UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION SEQUENTIALLY.

NOTE:-4 * MCC DISTURBED= THERMAL O/L OPT/CONT SUPP FAIL/EPB OPTD /DRIVE POWER SUPPLY OFF

	3X800 MW NTPC PATRATU STPP PHASE-I		DRG.NO.	9585-001-405-PVI-B-152B
	DDCMIS INTERFACE WITH LT MCC (LT)		SHT	05 OF 34

DDCMIS INTERFACE WITH BID/MOV/MOD



04

NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

NOTE:-2 # 8 LEVEL TERMINAL BLOCK

NOTE:-3 @@ IN EACH DDCMIS POST, UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.

NOTE:-4 * DISTURBANCE=LOSS OF POWER SUPPLY(1PHASE/3PHASE)/LOSS OF CONTROL SUPPLY/MOTOR THERMOSTAT TRIP/THERMAL OVER LOAD/TORQUE SWITCH OPERATED, LOCAL/OFF/REMOTE SWITCH IN LOCAL/OFF POSITION



3X800 MW NTPC PATRATU STPP PHASE-I

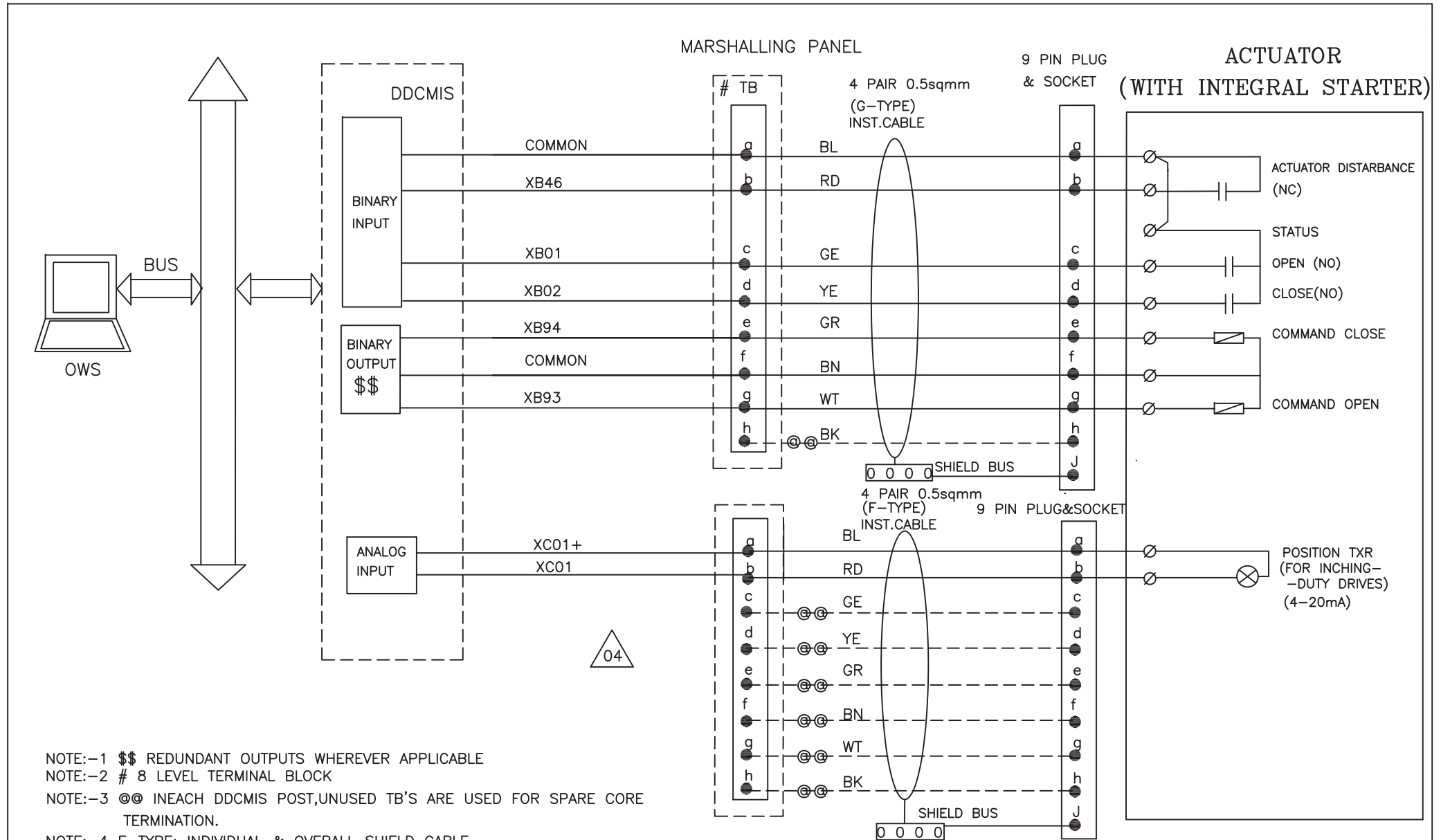
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DDCMIS INTERFACE WITH BID

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06 OF 26

DDCMIS INTERFACE WITH BIDI/MODI/MOVI



NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

NOTE:-2 # 8 LEVEL TERMINAL BLOCK

NOTE:-3 @@ IN EACH DDCMIS POST, UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.

NOTE:-4 F-TYPE: INDIVIDUAL & OVERALL SHIELD CABLE.

NOTE:-5 *DISTURBANCE=LOSS OF POWER SUPPLY/LOSS OF CONTROL SUPPLY/MOTOR THERMOSTAT TRIP/THERMAL OVERLOAD/TORQUE SWITCH OPTD/LOCAL/OFF/REMOTE SWITCH IN LOCAL/OFF POSITION

3X800 MW NTPC PATRATU STPP
PHASE-I

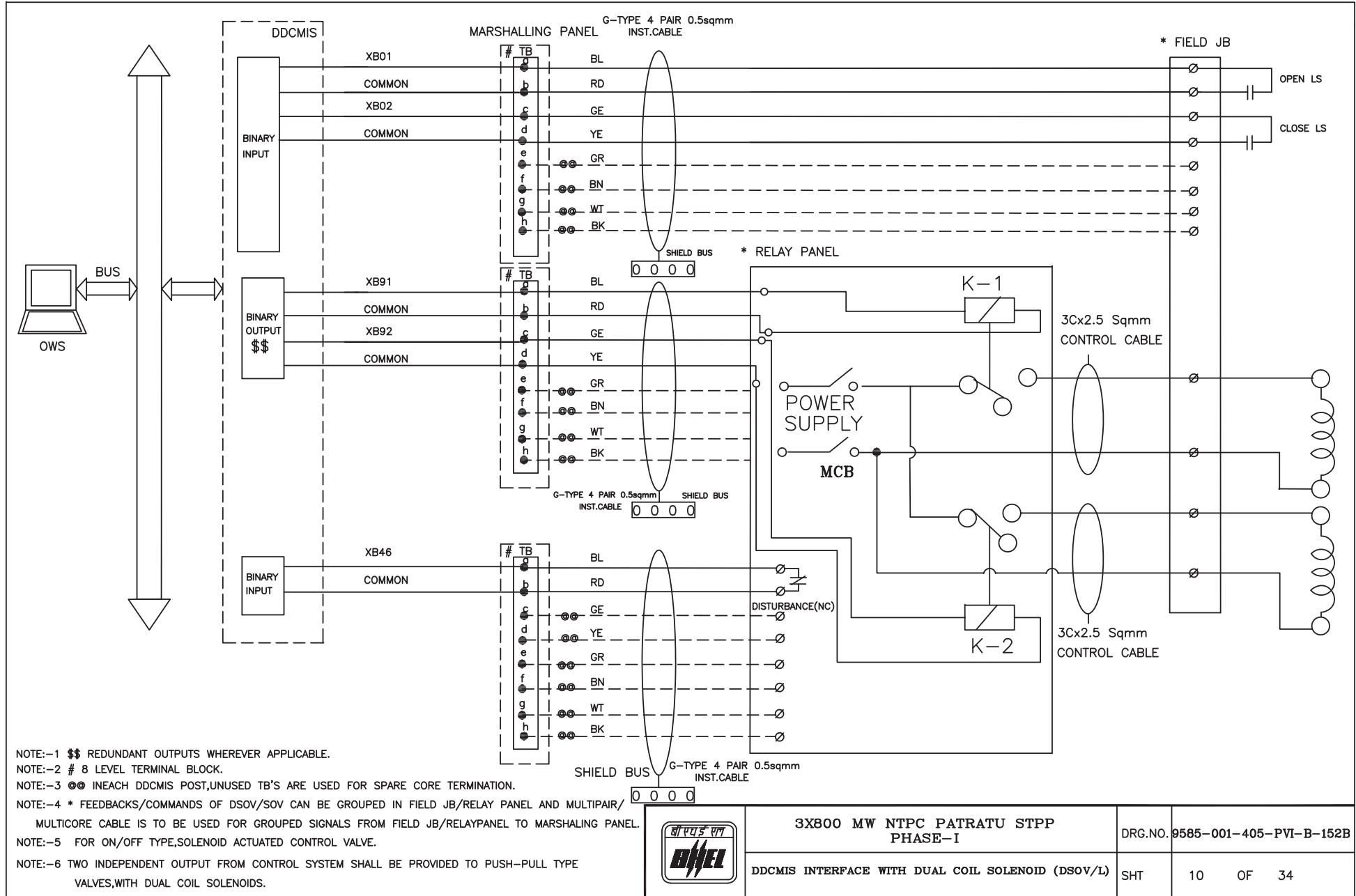
DRG.NO. 9585-001-405-PVI-B-152B

DDCMIS INTERFACE WITH BIDI

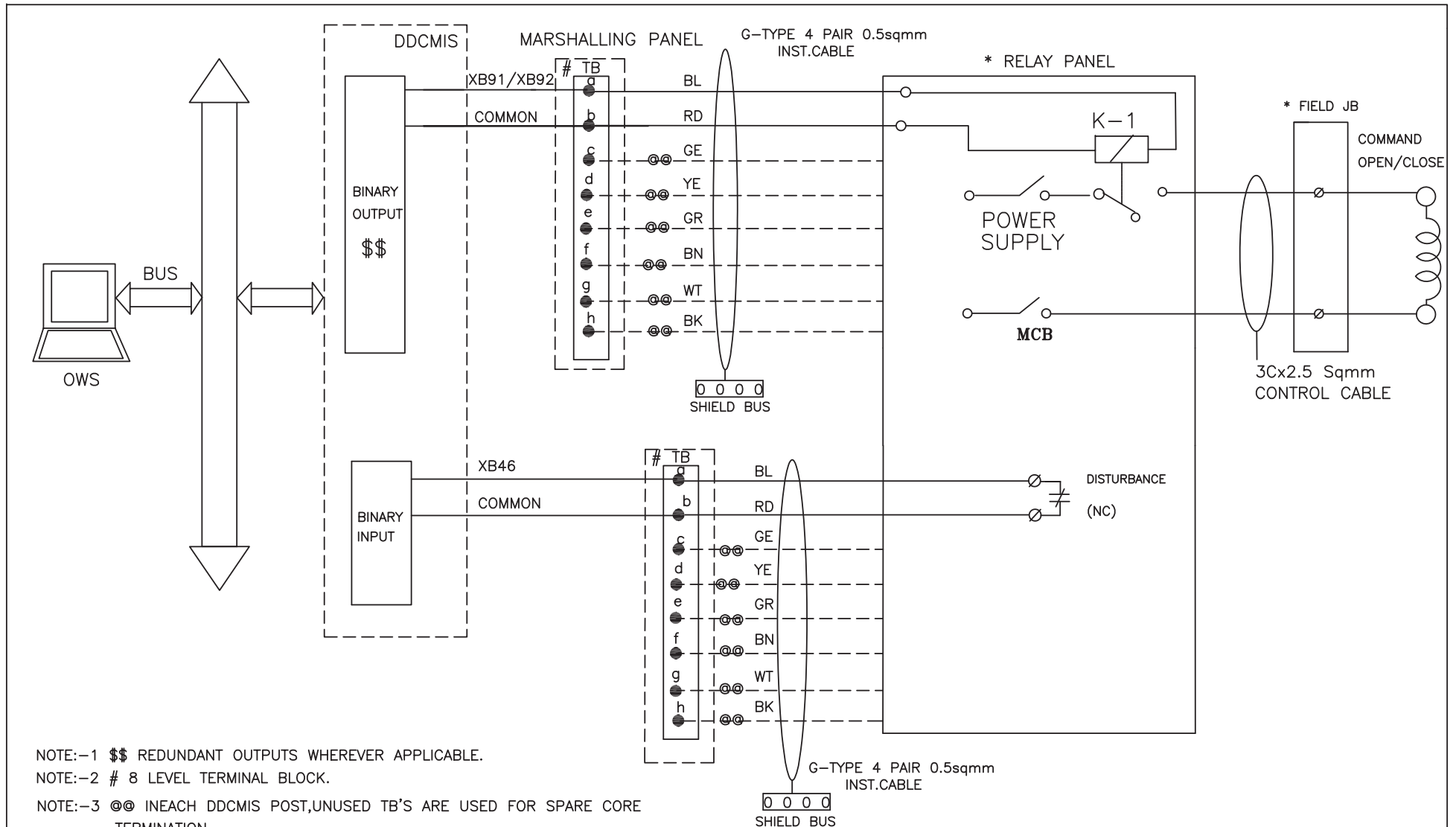
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DDCMIS INTERFACE WITH DUAL COIL SOLENOID (DSOV/L)



DDCMIS INTERFACE WITH SOV/O/SOV/C(WITH OUT FEEDBACKS)



NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE.

NOTE:-2 # 8 LEVEL TERMINAL BLOCK.

NOTE:-3 @@ IN EACH DDCMIS POST, UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.

NOTE:-4 * FEEDBACKS/COMMANDS OF DSOV/SOV CAN BE GROUPED IN FIELD JB/RELAY PANEL AND MULTIPAIR/MULTICORE CABLE IS TO BE USED FOR GROUPED SIGNALS FROM FIELD JB/RELAY PANEL TO MARSHALLING PANEL.

NOTE:-5 FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.

3X800 MW NTPC PATRATU STPP
PHASE-IDDCMIS INTERFACE WITH
SOV/O/SOV/C(WITHOUT FEEDBACKS)

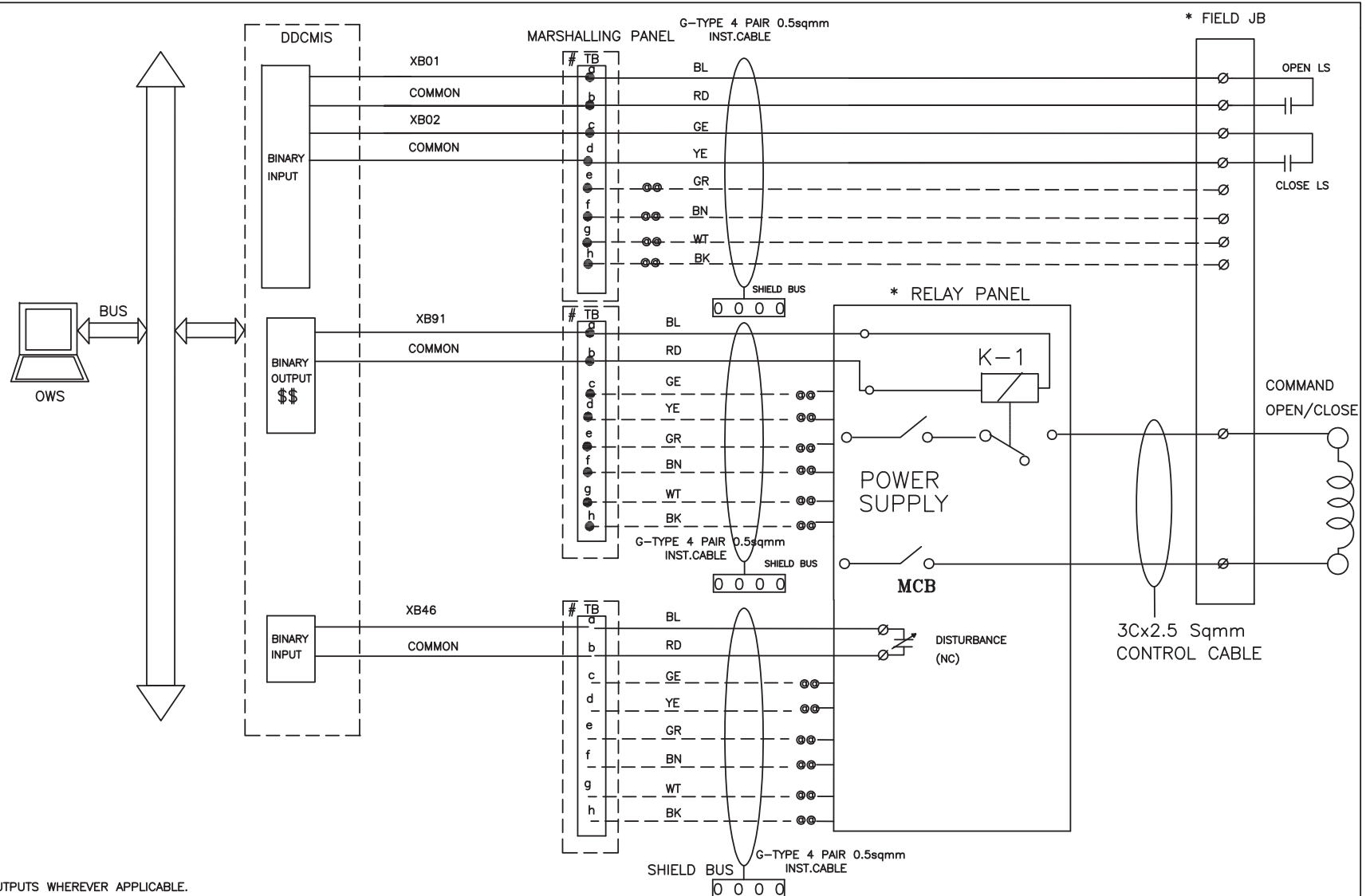
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DDCMIS INTERFACE WITH SOV/O/L(WITH FEED BACKS)



NOTE:-1 \$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE.

NOTE:-2 # 8 LEVEL TERMINAL BLOCK.

NOTE:-3 @ @ IN EACH DDCMIS POST, UNUSED TB'S ARE USED FOR SPARE CORE TERMINATION.

NOTE:-4 * FEEDBACKS/COMMANDS OF DSOV/SOV CAN BE GROUPED IN FIELD JB/RELAY PANEL AND MULTIPAIR/
MULTICORE CABLE IS TO BE USED FOR GROUPED SIGNALS FROM FIELD JB/RELAY PANEL TO MARSHALLING PANEL.

NOTE:-5 FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.

3X800 MW NTPC PATRATU STPP
PHASE-I

DDCMIS INTERFACE WITH SOV/O/L(WITH FEEDBACKS)

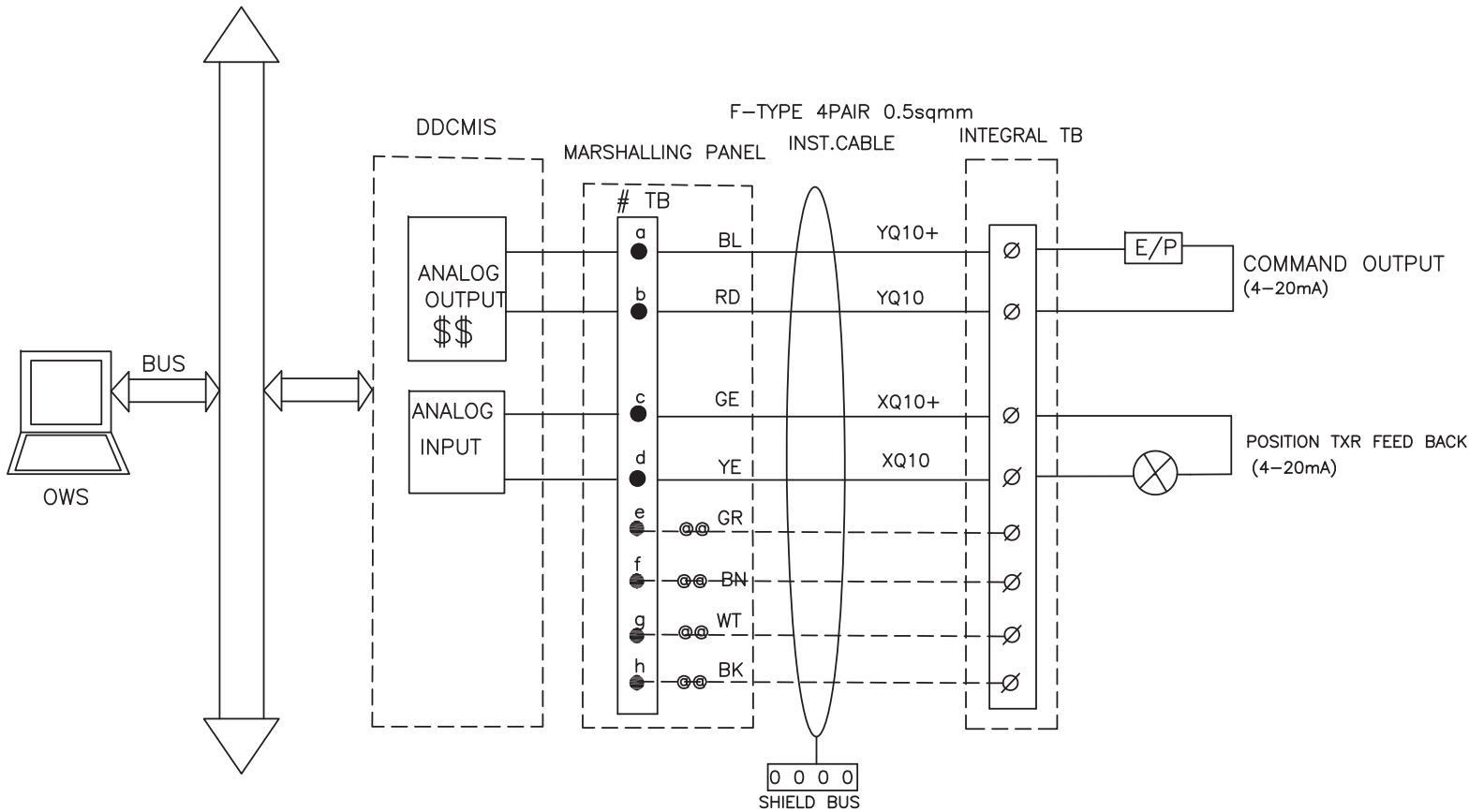
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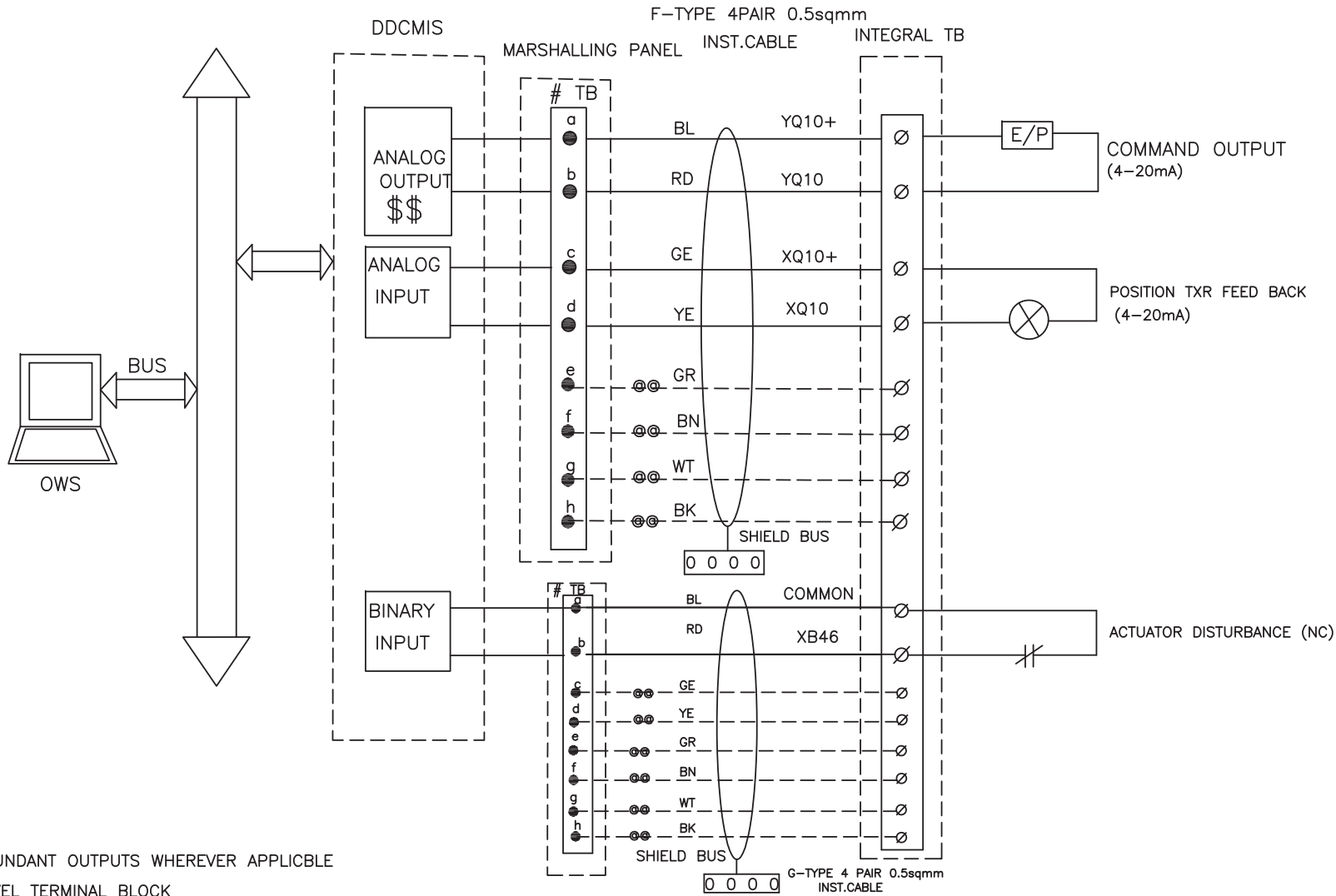
INTERFACE FOR MODULATING DRIVES - CLCS



- NOTE:-1 \$\$\$ REDUNDANT OUTPUTS WHEREVER APPLICBLE
- NOTE:-2 # 8 LEVEL TERMINAL BLOCK
- NOTE:-3 @@ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.
- NOTE:-4 F-TYPE: INDIVIDUAL & OVERALL SHIELD CABLE.

	3X800 MW NTPC PATRATU STPP PHASE-I	DRG.NO.	9585-001-405-PVI-B-152B
	INTERFACE FOR MODULATING DRIVES - CLCS	SHT	14 OF 34

INTERFACE FOR MODULATING DRIVES – CLCS–M



NOTE:-1 \$\$\$ REDUNDANT OUTPUTS WHEREVER APPLICABLE

NOTE:-2 # 8 LEVEL TERMINAL BLOCK

NOTE:-3 @@ IN EACH DDCMIS POST, UNUSED TB's ARE USED FOR SPARE CORE TERMINATION.

NOTE:-4 F-TYPE: INDIVIDUAL & OVERALL SHIELD CABLE.



3X800 MW NTPC PATRATU STPP
PHASE-I

INTERFACE FOR MODULATING DRIVES – CLCS–M

DRG.NO. 9585-001-405-PVI-B-152B

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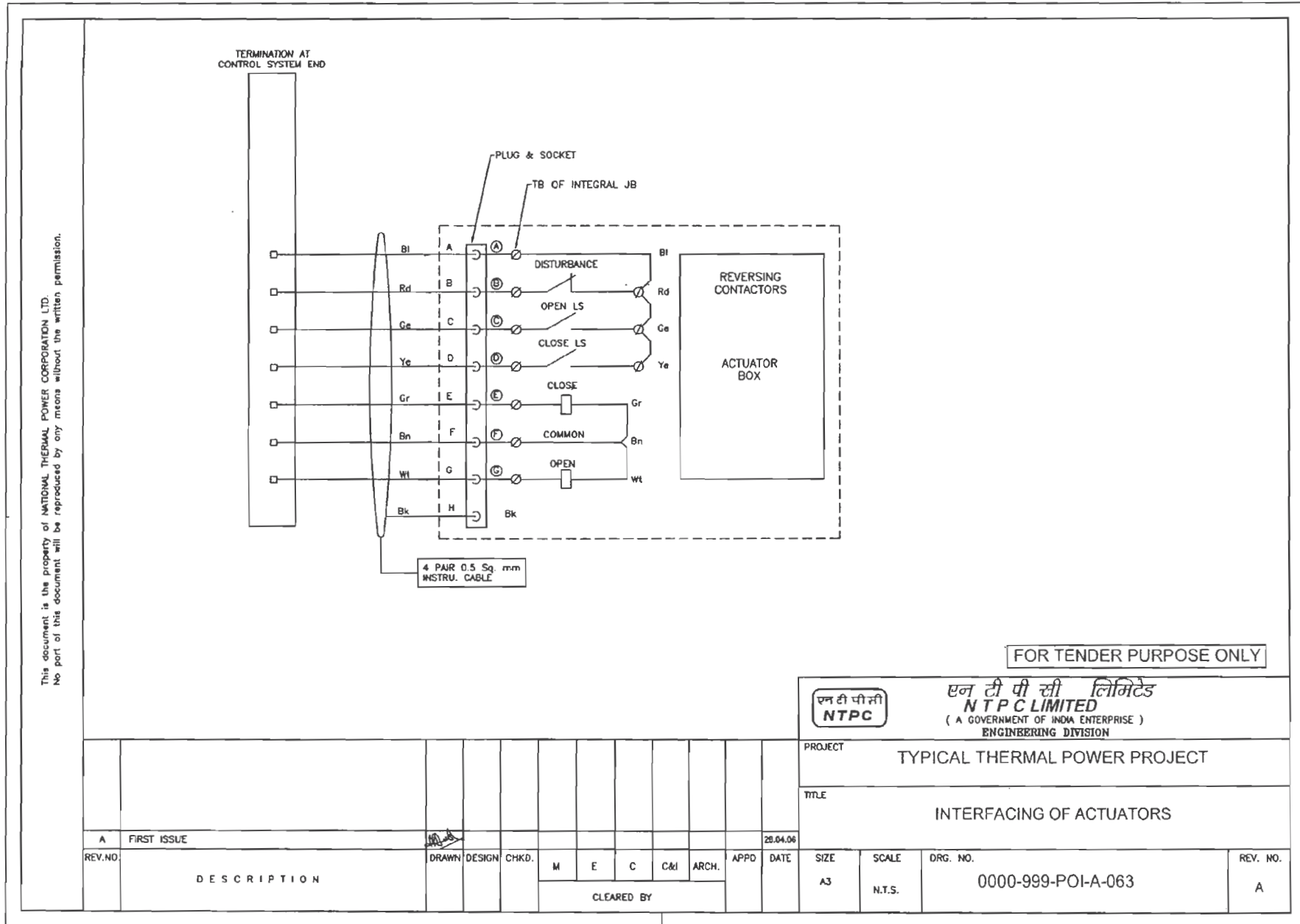


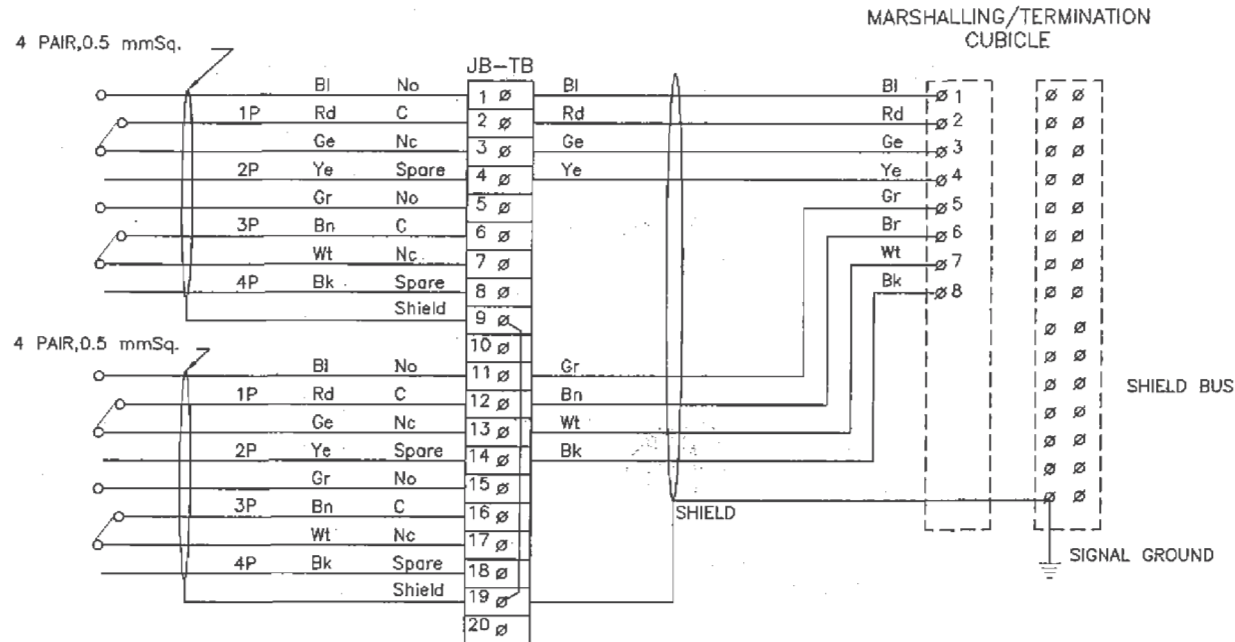
**C&I SPECIFICATION FOR
OXYGEN DOSING**

SECTION: C
SUB SECTION: C&I

**INSTRUMENTATION CABLE
INTERCONNECTION AND TERMINATION
PHILOSOPHY**

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FOR TENDER PURPOSE ONLY

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

PROJECT

TYPICAL THERMAL POWER PROJECT

TITLE

INTERFACING OF FIELD INSTRUMENTS/
SWGR SWITCH (COC) TERMINATION DETAILS

A FIRST ISSUE

29.04.06

REV. NO.

DESCRIPTION

DRAWN DESIGN CHKD.

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ARCH.

APPD

DATE

SIZE

A3

SCALE

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DRG. NO.

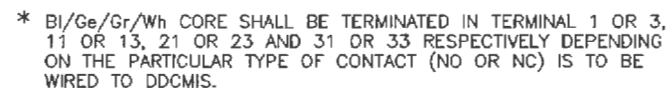
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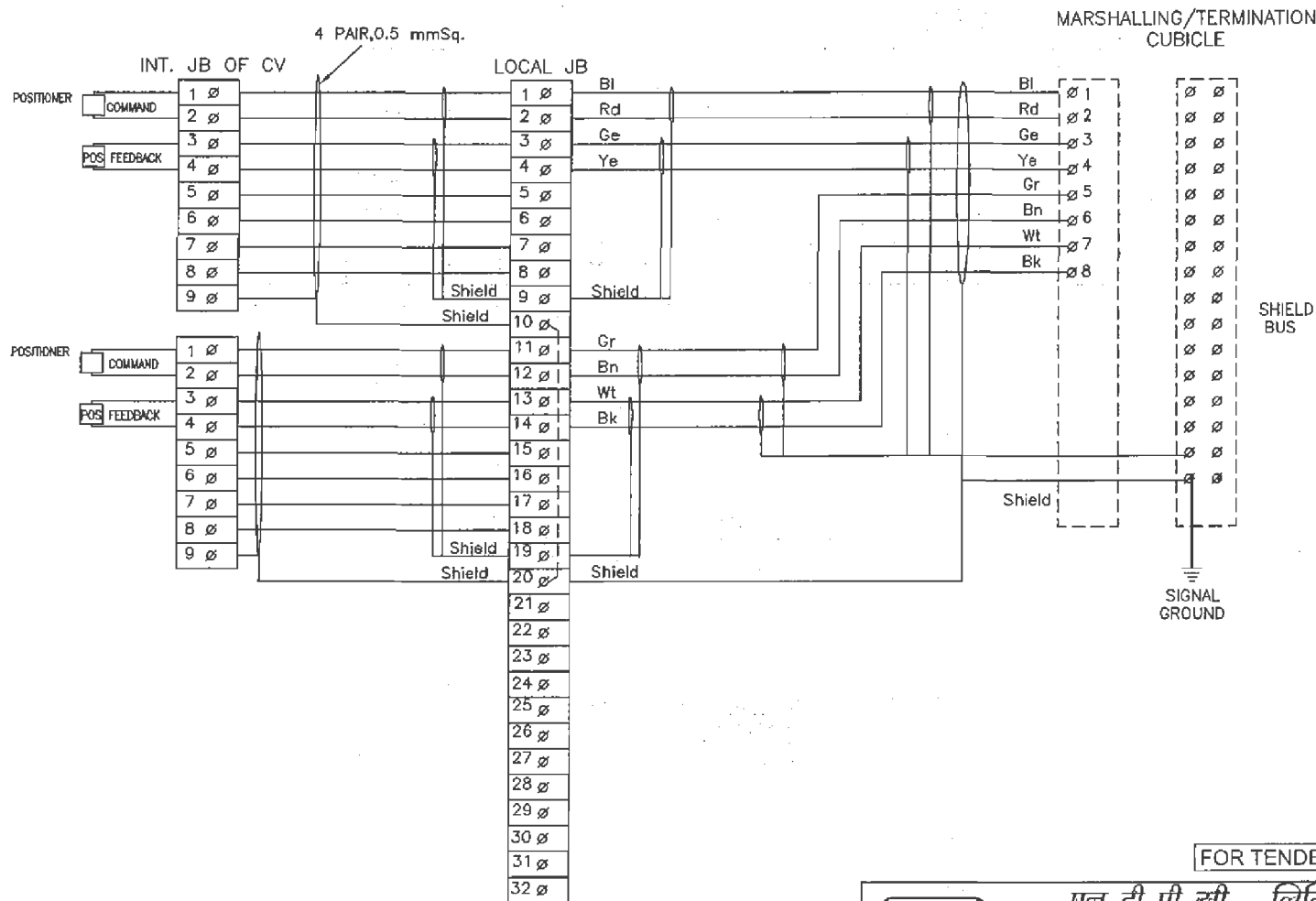
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NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT		TYPICAL THERMAL POWER PROJECT	
TITLE		INTERFACING OF FIELD INSTRUMENTS SWITCH TERMINATION DETAILS NO/NC	
SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065	A
		SH 02 OF 14	



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

PROJECT

TYPICAL THERMAL POWER PROJECT

TITLE

INTERFACING OF FIELD INSTRUMENTS
CONTROL VALVE

A FIRST ISSUE

29.04.06

REV.NO.

DESCRIPTION

DRAWN

DESIGN

CHKD.

M

E

C

C&I

ARCH.

APPD

DATE

SIZE

A3

SCALE

NTS

DRG. NO.

0000-999-POI-A-065

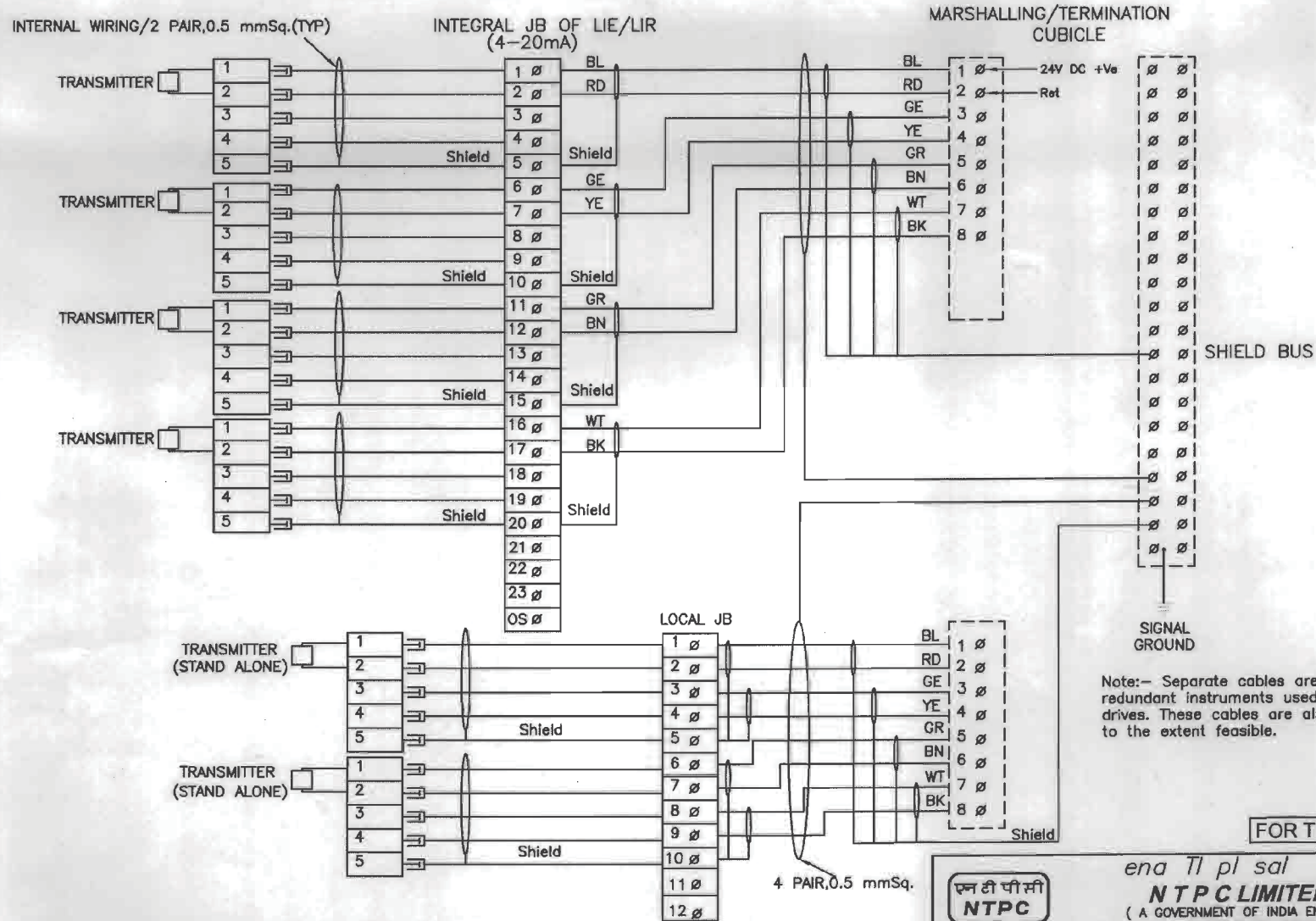
REV. NO.

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SH 03 OF 14

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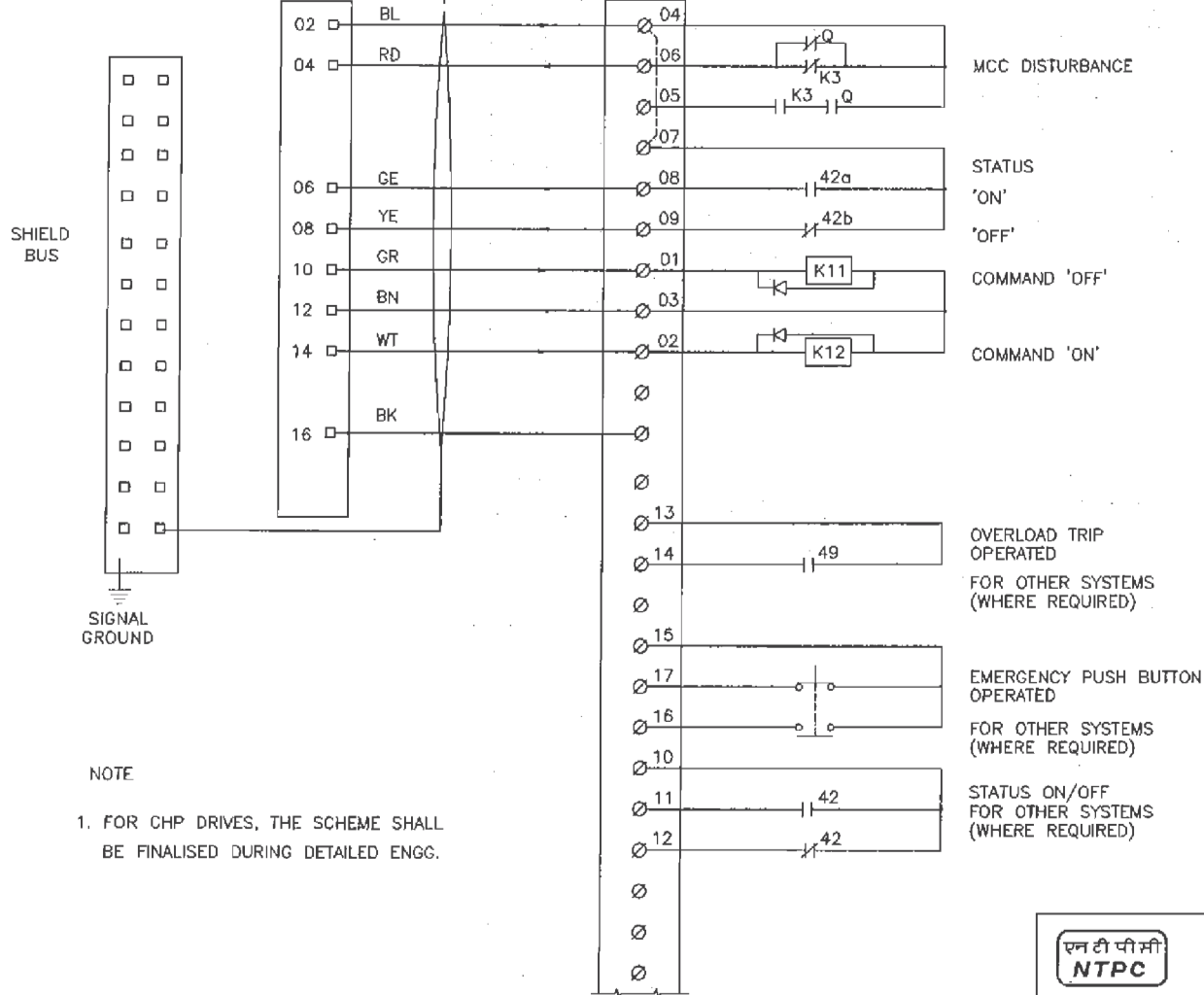


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ENGINEERING DIVISION

C	NOTE REGARDING CABLE IS ADDED.										10.12.13	PROJECT TYPICAL THERMAL POWER PROJECT			
B	INTERNAL WIRING FOR LIE/LIR MOUNTED SHOWN WIRING OF STAND ALONE TXTR SHOWN										10.12.06	TITLE INTERFACING OF FIELD INSTRUMENTS 4-20mA			
A	FIRST ISSUE										12.1.05				
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
					CLEARED BY				A3			NTS	0000-999-POI-A-065	C	
SH 04 OF 14															

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MARSHALLING/ TERMINATION CUBICLES

4 PAIR,
0.5 Sq. mmMCC/SWGR
D

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ENGINEERING DIVISION

PROJECT

TYPICAL THERMAL POWER PROJECT

TITLE

INTERFACING OF FIELD INSTRUMENTS
INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR
(LT MOTORS)

A FIRST ISSUE

29.04.06

REV.NO.

DESCRIPTION

DRAWN

DESIGN

CHKD.

M

E

C

C&D

ARCH.

APPD

DATE

SIZE

A3

SCALE

NTS

DRG. NO.

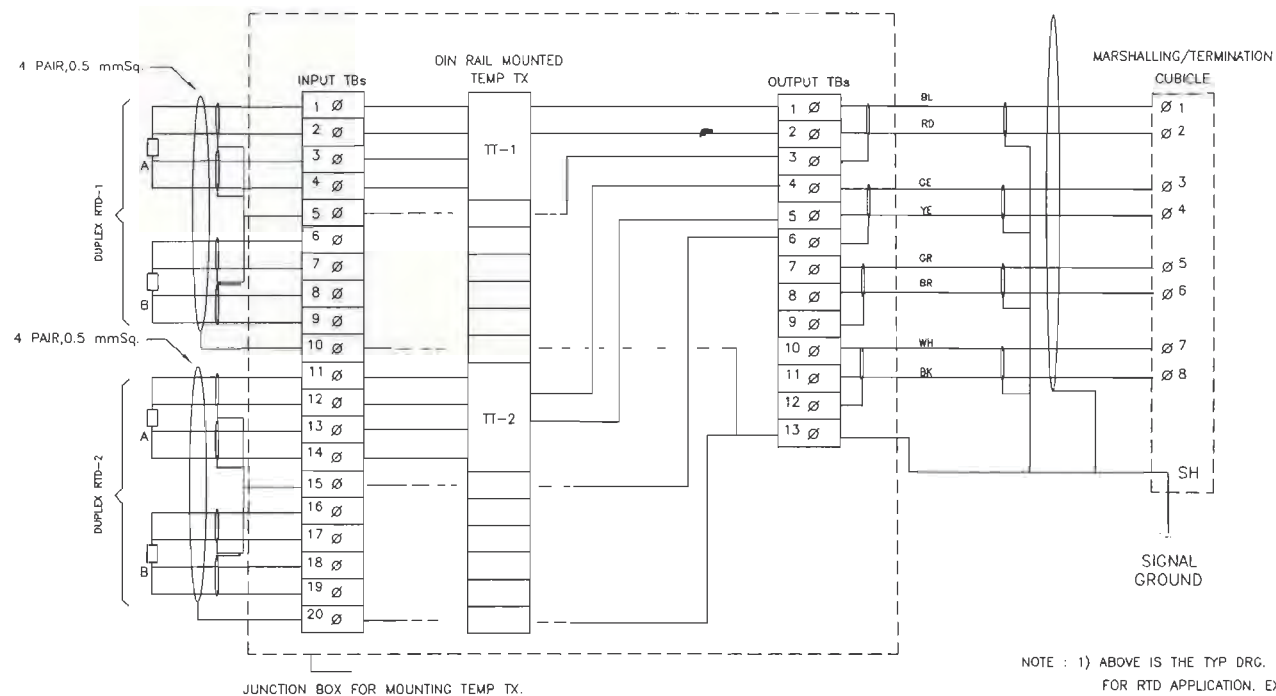
0000-999-POI-A-065

REV. NO.

A

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- NOTE : 1) ABOVE IS THE TYP DRG. FOR DIN RAIL MOUNTED TEMP TRANSMITTERS FOR RTD APPLICATION. EXACT TYPE OF TEMP TRANSMITTER SHALL BE AS PER PART-A OF SPECIFICATION.
- 2) THE EXACT GROUPING OF TEMP TXs SHALL BE FINALISED DURING DETAILED ENGG. STAGE.

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PROJECT TYPICAL THERMAL POWER PROJECT

TITLE INTERFACING OF FIELD INSTRUMENTS
TYPICAL RTD CONNECTION WITH TEMP TRANSMITTERS INJBS

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

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SIZE	SCALE	ORG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065	C

SH 06 OF 14



1. SPARE CORES AT MCC/SWGR END ARE TO BE TERMINATED AT SPARE TERMINALS.
2. OVERLOAD ALARM & RELAY FAULT ALONG WITH OTHER INFORMATION SHALL FLOW THROUGH SOFT LINK.

FOR TENDER PURPOSE ONLY

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**C&I SPECIFICATION FOR
OXYGEN DOSING**

SECTION: C
SUB SECTION: C&I

QUALITY ASSURANCE-INSTRUMENTS

|

CLAUSE NO.

QUALITY ASSURANCE



MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)

ITEMS	TESTS								
	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	Insulation Resistance (R)	IBR Certification (if applicable)(R)	Hydro Test(R)	Material Test certificate ®
1. PR Gauge (IS-3624)	Y	Y	Y	Y	Y				
2. Temp. Gauge (BS-5235)	Y	Y	Y	Y	Y				
3. Pr./D.P.Switch(BS-6134)	Y	Y	Y	Y	Y	Y			
4. Electronic Transmitter(IEC-770)	Y	Y	Y	Y	Y	Y			
5. Temp. Switch	Y	Y	Y	Y	Y	Y			
6. Recorder(IS-9319/ANSI C-39.4)	Y	Y	Y	Y	Y	Y			
7. Vertical indicators	Y	Y	Y	Y		Y			
8. Digital Indicators	Y	Y	Y	Y		Y			
9. Integrators	Y	Y	Y	Y					
10. Electrical Metering Instrument (IS-1248)	Y	Y	Y	Y	Y	Y			
11. Transducer (IEC-688)	Y	Y	Y	Y	Y	Y			
12. Thermocouples (ANSI-MC-96.1)	Y	Y	Y	Y	Y	Y			
13. RTD(IEC-751)	Y	Y	Y	Y	Y	Y			
14. Thermowell	Y		Y				Y	Y	Y
R-Routine Test A- Acceptance Test Y – Test applicable									
:									

CLAUSE NO.

QUALITY ASSURANCE



ITEMS	TESTS											
	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Requirement as per standard (R)	WPS approval (A)	Non-destructive testing (R)	Calculation for accuracy (R)	Insulation Resistance (R)	IBR Certification as applicable (R)	Hydro test (R)	Material test certificate (A)
15. Cold junction compensation box	Y	Y	Y	Y					Y			
16. Orifice plate(BS-1042)	Y	Y	Y	Y *	Y	Y **	Y **			Y	Y **	Y
17. Flow nozzle(BS-1042)	Y	Y	Y	Y *	Y	Y	Y			Y	Y	Y
18. Impact head type element	Y	Y	Y					Y				Y
19. Level transmitter/float type switch	Y	Y	Y	Y					Y	Y	Y	Y
20. Flue Gas analyser	Y	Y	Y	Y								
21. Dust emission monitors	Y	Y	Y	Y								
*Calibration to be carried out on one flow element of each type and size if calibration carried out as type test same shall not be repeated.												
** If applicable												
R-Routine Test A- Acceptance Test Y – Test applicable												
Note: 1) Detailed procedure of Environmental Stress screening test shall be as per Quality Assurance. Programme in General Technical Conditions 2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.												

CLAUSE NO.

QUALITY ASSURANCE



ELECTRICAL ACTUATOR WITH INTEGRAL STARTER

Test/Attributes Characteristics													
ITEM/ COPONENT/ SUB SYSTEM ASSEMBLY/ TESTING	RPM ®	No Load Current ®	IR & HV Test®	Mounting Dimension®	All routine Test as per Standard & Specification®	Correct Phase Sequence®	Operation & Setting of limit Switch/Torque Switch®	Stall Torque/Current (A)	Hand Wheel operation/ Auto de clutch function (A)	Function of Aux. like Potentiometer, space heater, position indicator ®	EPT output ®	Grease leakage ®	Local/ Remote (Open-Stop-Close) Operation® Safety check (Single phasing, Phase correction, Tripping etc.) (A)
ELECTRICAL ACTUATOR WITH INTEGRAL STARTER(IS_9334)													
Motor	Y	Y	Y	Y	Y								
Final Testing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions. Requirement of test and procedure finalized during QP finalization 2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the practices and procedure adopted along with relevant supporting documents.													
® - Routine Test (A) - Acceptance Test Y - Test applicable													

**STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)****CHECK LIST FOR SOLENOID VALVES**

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	TYPE						
	MAKE						
	MODEL No.						
2	MATERIAL (BODY. PLUNGER/TRIM)			P	W	V	
3	PORT SIZE			P	W	V	
4	CABLE CONNECTION SIZE			P	W	V	
5	ENCLOSURE CLASS			P	W	V	TYPE TEST CERTIFICATE TO BE FURNISHED BY VENDOR
6	No. OF COILS & INSULATION CLASS			P	W	V	TEST CERTIFICATE TO BE FURNISHED FOR INSULATION CLASS BY VENDOR
7	POWER SUPPLY CHECK			P	W	V	
8	IR / HV TEST			P	W	V	
9	FUCTIONAL TEST			P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,
P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.

TYPE TEST REQUIREMENTS

EPC PACKAGE FOR
PATRATU SUPER THERMAL POWER STATION EXPANSION
PHASE –I (3X 800MW)

TECHNICAL SPECIFICATION
SECTION-VI
BID DOC. NO.: CS:9585-001-2

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.00.00	TYPE TEST REQUIREMENTS			
1.01.00	General Requirements			
1.01.01	The Contractor shall furnish the type test reports of all type tests as per relevant standards and codes as well as other specific tests indicated in this specification. If the bidder proposes a different standard/code from that indicated at table 3.00.00, same is acceptable provided the equivalence of the proposed standard is established by the bidder. A list of such tests are given for various equipment in table titled 'TYPE TEST REQUIREMENT FOR C&I SYSTEMS' at the end of this chapter and under the item Special Requirement for Solid State Equipments/Systems. For the balance equipment instrument, type tests may be conducted as per manufactures standard or if required by relevant standard. (a) Out of the tests listed, the Bidder/ sub-vendor/ manufacturer is required to conduct certain type tests specifically for this contract (and witnessed by Employer or his authorized representative) even if the same had been conducted earlier, as clearly indicated subsequently against such tests. (b) For the rest, submission of type test results and certificate shall be acceptable provided. i. The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment. ii. There has been no change in the components from the offered equipment & tested equipment. iii. The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening. (c) In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the Bidder/ sub-vendor within the quoted price and no extra cost will be payable by the Employer on this account.			
1.01.02	As mentioned against certain items, the test certificates for some of the items shall be reviewed and approved by the main Bidder or his authorized representative and the balance have to be approved by the Employer.			
1.01.03	The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.			
1.01.04	For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Employer. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording precautions to be taken etc. for the tests to be carried out.			
1.01.05	The Bidder shall indicate in the relevant BPS schedule, the cost of the type test for each item only for which type tests are to be conducted specifically for this project. The cost shall only be payable after conduction of the respective type test in presence of authorize representative of Employer. If a test is waived off, then the cost shall not be payable.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS	PAGE 1 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.00.00	SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS		
2.01.00	The minimum type test reports, over and above the requirements of above clause, which are to be submitted for each of the major C&I systems shall be as indicated below: i) Surge Withstand Capability (SWC) for Solid State Equipments/ Systems All solid state systems/ equipments shall be able to withstand the electrical noise and surges as encountered in actual service conditions and inherent in a power plant. All the solid state systems/ equipments shall be provided with all required protections that needs the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Hence, all front end cards which receive external signals like Analog input & output modules, Binary input & output modules etc. including power supply, data highway, data links shall be provided with protections that meets the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Complete details of the features incorporated in electronics systems to meet this requirement, the relevant tests carried out, the test certificates etc. shall be submitted along with the proposal. As an alternative to above, suitable class of EN 61000-4-12 which is equivalent to ANSI 37.90.1/ IEEE-472 may also be adopted for SWC test. ii) Dry Heat test as per IEC-68-2-2 or equivalent. iii) Damp Heat test as per IEC-68-2-3 or equivalent. iv) Vibration test as per IEC-68-2-6 or equivalent. v) Electrostatic discharge tests as per EN 61000-4-2 or equivalent. vi) Radio frequency immunity test as per EN 61000-4-6 or equivalent. vii) Electromagnetic Field immunity as per EN 61000-4-3 or equivalent. Test listed at item no. v, vi, vii, above are applicable for electronic cards only as defined under item (i) above.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS
			PAGE 2 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS										एनटीपीसी NTPC
3.00.00	TYPE TEST REQUIREMENT FOR C&I SYSTEMS										
	Sl. No	Item	Test Requirement		Standard	Test To Be Specifically Conducted	NTPC's Approval Req. On Test Certificate				
	Col 1	Col 2	Col 3		Col 4	Col 5	Col 6				
	1	Elect. Metering instruments	As per standard (col 4)		IS-1248	No	Yes				
	2	Transducers	As per standard (col 4)		IEC-60688,IS12784	No	Yes				
	3	Thermocouple	Degree of protection test		IS-13947	No	No				
	4	RTD	As per standard (col 4)		IEC-60751	No	No				
	5	Electronic transmitter	As per standard (col 4)		BS-6447 / IEC-60770	No	Yes				
	6	E/P converter	As per standard (col 4)		Mfr. standard	No	No				
	7	Dust emission monitor	Degree of protection test		IS-13947	No	Yes				
	8	Instrumentation Cables Twisted & Shielded*									
		-Conductor	Resistance test		VDE-0815	No	Yes				
			Diameter test		IS-10810	No	Yes				
			Tin Coating test (Persulphate test)		IS-8130	No	Yes				
		-Insulation	Loss of mass		VDE 0472	No	Yes				
			Ageing in air ovens**		VDE 0472	No	Yes				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2			SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS			PAGE 3 OF 9		

CLAUSE NO.	TECHNICAL REQUIREMENTS				
		Tensile strength and elongation test before and after ageing**	VDE 0472	No	Yes
		Heat shock	VDE 0472	No	Yes
		Hot deformation	VDE 0472	No	Yes
		Shrinkage	VDE 0472	No	Yes
		Bleeding & blooming	IS-10810	No	Yes
	-Inner sheath***	Loss of mass	VDE 0472	No	Yes
		Heat shock	VDE 0472	No	Yes
		Cold bend/ cold impact test	VDE 0472	No	Yes
		Hot deformation	VDE 0472	No	Yes
		Shrinkage	VDE 0472	No	Yes
	-Outer sheath	Loss of mass	VDE 0472	No	Yes
		Ageing in air ovens**	VDE 0472	No	Yes
		Tensile strength and elongation test before and after ageing**	VDE 0472	No	Yes
		Heat shock	VDE 0472	No	Yes
		Hot deformation	VDE 0472	No	Yes
		Shrinkage	VDE 0472	No	Yes
		Bleeding & blooming	IS-10810	No	Yes
		Colour fastness to water	IS-5831	No	Yes
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS	
				PAGE 4 OF 9	

CLAUSE NO.	TECHNICAL REQUIREMENTS					
		Cold bend/ cold impact test	VDE-0472	No	Yes	
		Oxygen index test	ASTMD-2863	No	Yes	
		Smoke Density Test	ASTMD-2843	No	Yes	
		Acid gas generation test	IEC-60754-1	No	Yes	
	-fillers	Oxygen index test	ASTMD-2863	No	Yes	
		Acid gas generation test	IEC-60754-1	No	Yes	
	-AL-MYLAR shield	Continuity test		No	Yes	
		Shield thickness		No	Yes	
		Overlap test		No	Yes	
	-Over all cable	Flammability Test	IEEE 383	No	Yes	
		Swedish Chimney Test	SEN 4241475	No	Yes	
		Noise interference	IEEE Trans- actions	No	Yes	
		Dimensional checks	IS 10810	No	Yes	
		Cross talk	VDE-0472	No	Yes	
		Mutual capacitance	VDE-0472	No	Yes	
		HV test	VDE-0815	No	Yes	
		Drain wire continuity		No	Yes	
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS		PAGE 5 OF 9

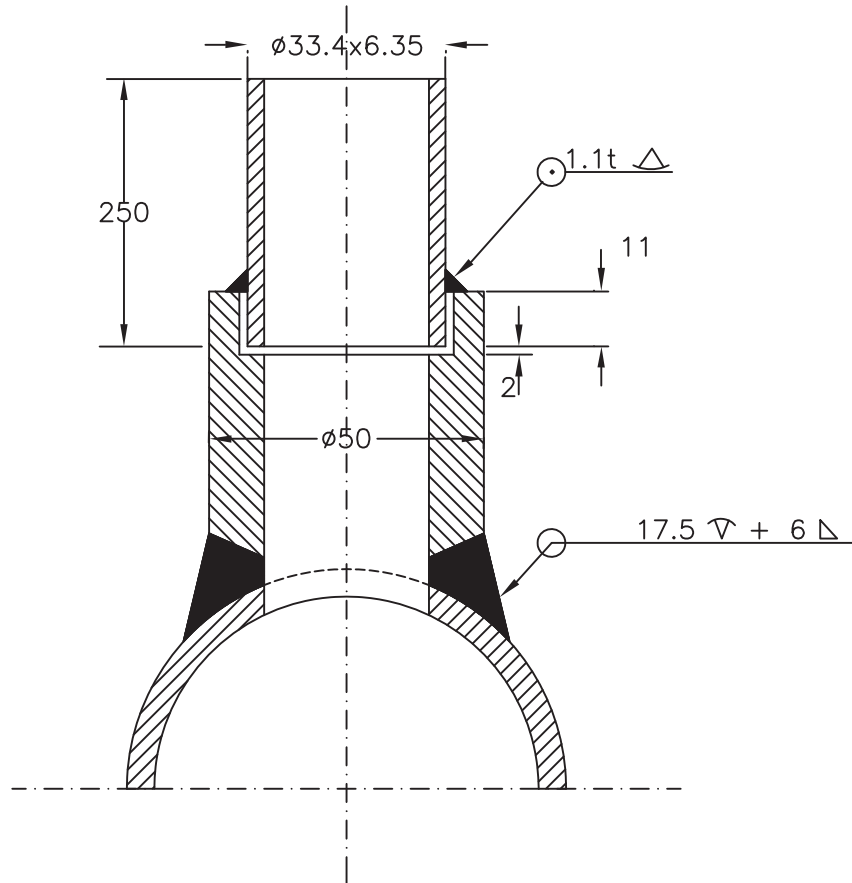
CLAUSE NO.	TECHNICAL REQUIREMENTS				
	* 1.0 All cables to be supplied shall be of type tested quality. The Contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last Ten years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. 2.0 In case the Contractor is not able to submit report of the type test(s) conducted within last Ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests either in an independent laboratory or at manufacturer's works in presence of Owner's representative under this contract free of cost to the Owner and submit the reports for approval. **These tests shall be carried out as per VDE0207 Part 6 & ASTM-D-2116 for TEFLON insulated & outer sheathed cables ***Applicable for armoured cables only				
9	DC Power Supply System (Applicable for each model and rating)				
	1)The Type Test reports for offered rectifier module and the controller module irrespective of the rectifier bank shall be acceptable				
	Surge Withstand Capability(SWC)	ANSI 37.90.1, No IEEE-472,EN 61000-4-12	Yes		
	Dry Heat Test	IEC-68-2-2 or No equivalent	Yes		
	Damp Heat test	IEC-68-2-3 or No equivalent	Yes		
	Vibration test	IEC68-2-6 or No equivalent	Yes		
	Electrostatic discharge test	EN 61000-4-2 No orr equivalent	Yes		
	Radio frequency immunity test	EN-61000-4-3 No orr equivalent	Yes		
	Electromagnetice field immunity	EN 61000-4-3 No orr equivalent	Yes		
	Degree of Protection	IS-13947 or No equivalent	Yes		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS	PAGE 6 OF 9	

CLAUSE NO.	TECHNICAL REQUIREMENTS 				
	10 Battery ## As per standard (col 4) IS-10918 (Ni-Cd Batteries) No Yes IS-1652 (Lead Acid Plante Batteries) No Yes 11 NOT APPLICABLE 12 UPS (Applicable for each model and rating) 1) Type Test reports of same series of UPS with similar PCB's cards and controllers as the target UPS system shall be acceptable. 2) For Dry heat, Damp heat and vibration, the tests conducted on individual PCB's shall be acceptable. Surge Withstand Capability(SWC) ANSI 37.90.1, No IEEE-472,EN 61000-4-12 No Yes Dry Heat Test IEC-68-2-2 or equivalent No Yes Damp Heat test IEC-68-2-3 or equivalent No Yes Vibration test IEC68-2-6 or equivalent No Yes Electrostatic discharge test EN 61000-4-2 or equivalent No Yes Radio frequency immunity test EN-61000-4-3 or equivalent No Yes Electromagnetic field immunity EN 61000-4-3 or equivalent No Yes Degree of protection test IS-13947 No Yes Fuse Clearing Capability Approved procedure No Yes Short Circuit current capability IEC 60146-2 No Yes				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS	PAGE 7 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS						
	13	Voltage Stabilisers	Over Load Test	Approved procedure	No	Yes	
			Temp rise test without redundant fans	Approved procedure	No	Yes	
	14	Public Address System					
		- Amplifiers	As per standard (col 4)	IS 9302, Part-II	No	Yes	
		Microphones	As per standard (col 4)	IS 9302, Part-III IS 15482:2004/ IEC 61842(2002)	No	Yes	
		Loudspeaker	As per standard (col 4)	IS 9302, Part-IV	No	Yes	
	15	LIE / LIR	Degree of protection test	IS-13947	No	Yes	
	16	Flue analyzers	gas Degree of protection test	IS-13947	No	Yes	
	17	Master Clock	Functional test	As per approved procedure	No	Yes	
	18	CJC Box	Degree Of protection test	IS-13947	No	Yes	
19	Junction Box	Degree Of protection Test	IS-13947	No	Yes		
20	OPC Access Data Server, Data Exchange & Server	OPC Compliance Testing		No	Yes (Self certification is also		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)			TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS		PAGE 8 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS																																															
	Historical Data Access Server acceptable) <table><tr><td>21</td><td>Conductivity Type Level Switch</td><td>Degree protection test</td><td>of</td><td>IS-2147</td><td>No</td><td>No</td></tr><tr><td>22</td><td>Local Gauges</td><td>Degree protection test</td><td>of</td><td>IS-2147</td><td>No</td><td>No</td></tr><tr><td>23</td><td>Process actuated Switches</td><td>Degree protection test</td><td>of</td><td>IS-2147</td><td>No</td><td>No</td></tr><tr><td>24</td><td>Control Valves</td><td>CV test</td><td></td><td>ISA 75.02& 75.11</td><td>No</td><td>Yes</td></tr><tr><td>25</td><td>PLCs</td><td>As per standard (Col 4)</td><td></td><td>IEC 1131</td><td>No</td><td>No</td></tr><tr><td>26</td><td>Flow Nozzle Orifice plates</td><td>Calibration</td><td></td><td>ASME PTC BS 1042</td><td>No</td><td>Yes</td></tr></table> ## The contractor shall submit for Employers approval the reports of all the type test as per latest IS-10918 carried out within last ten years from the date of Bid opening and the test(s) should have been either conducted at an independent laboratory or in presence / owners representative. The complete type test reports shall be for any rating of Battery in a particular group based on plate dimensions being manufactured by supplier. Note: Type Tests are to be conducted only for the items, which are being supplied as a part of this Package.						21	Conductivity Type Level Switch	Degree protection test	of	IS-2147	No	No	22	Local Gauges	Degree protection test	of	IS-2147	No	No	23	Process actuated Switches	Degree protection test	of	IS-2147	No	No	24	Control Valves	CV test		ISA 75.02& 75.11	No	Yes	25	PLCs	As per standard (Col 4)		IEC 1131	No	No	26	Flow Nozzle Orifice plates	Calibration		ASME PTC BS 1042	No	Yes
21	Conductivity Type Level Switch	Degree protection test	of	IS-2147	No	No																																										
22	Local Gauges	Degree protection test	of	IS-2147	No	No																																										
23	Process actuated Switches	Degree protection test	of	IS-2147	No	No																																										
24	Control Valves	CV test		ISA 75.02& 75.11	No	Yes																																										
25	PLCs	As per standard (Col 4)		IEC 1131	No	No																																										
26	Flow Nozzle Orifice plates	Calibration		ASME PTC BS 1042	No	Yes																																										
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS		PAGE 9 OF 9																																										

**C&I SPECIFICATION FOR
OXYGEN DOSING**SECTION: C
SUB SECTION: C&I**INSTRUMENT STUB DETAILS**

**NOTE :**

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED
4. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY ($1/64''$ RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES
5. STUB LENGTH SHALL BE 64mm UPTO 250Nb PIPE, 45mm ABOVE 200Nb PIPE SIZE.



TITLE :

**INSTRUMENT STUB DETAILS
FOR PRESSURE MEASUREMENT**

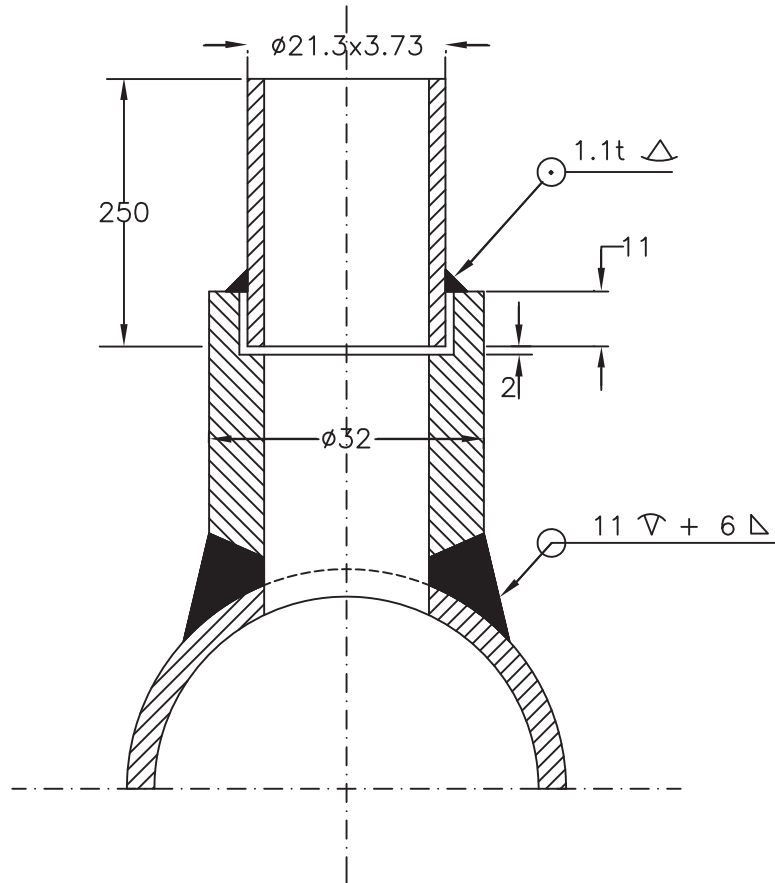
(APPLICABLE FOR TEMP < 500 DegC, CLASS 6000#)

DRG. NO.

PE-DG-434-145-I101

REV. 00

SH. 03 OF 08 SHS.

**NOTE :**

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED
4. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY ($1/64''$ RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES
5. STUB LENGTH SHALL BE 64mm UPTO 250Nb PIPE, 45mm ABOVE 200Nb PIPE SIZE.

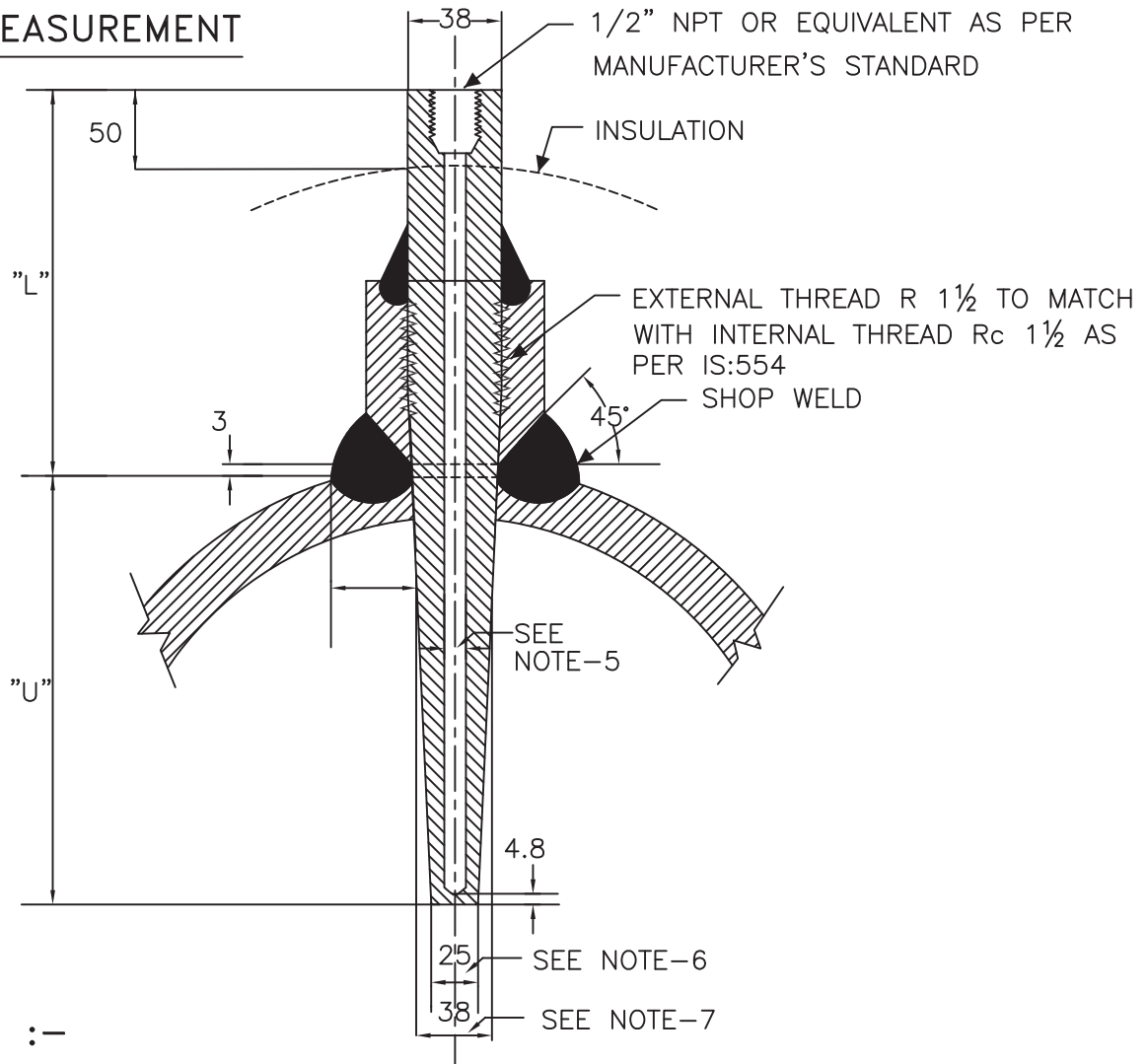


TITLE :
**INSTRUMENT STUB DETAILS
 FOR PRESSURE MEASUREMENT**

DRG. NO.
PE-DG-434-145-I101

REV. 00

(SYSTEM PRESS UPTO 40Kg/Cm², TEMP < 400 Deg C) SH. 04 OF 08 SHS.

TEMP. MEASUREMENT**NOTES :-**

1. THIS TYPE OF TEMPERATURE BOSS SHALL BE USED FOR THE PROCESS PRESS EQUAL/ ABOVE 40 KG/CM²(g) AND FOR PROCESS TEMP.>400 DEG C EVEN IF THE PROCESS PRESSURE IS LESS THAN 40 KG/CM²(g).
2. THE MATERIAL OF THE BOSS SHALL BE SIMILAR TO PIPING MATERIAL.
3. MATERIAL OF THE THERMOWELL SHALL BE OF 316SS.
4. THERMOWELL SHALL BE DRILLED BAR STOCK TYPE.
5. INTERNAL BORE OF THE THERMOWELL SHOULD BE SELECTED BASED ON THE NORMAL SIZE OF THE SENSING ELEMENT AS PER ASME PTC-19.3.
6. THE BOTTOM DIAMETER OF THE THERMOWELL TYPICALLY SHOWN HERE SHALL BE SUBJECT TO VARIATION BASED ON THE INTERNAL BORE OF THERMOWELL AND THICKNESS OF THERMOWELL MATERIAL TO WITHSTAND THE PROCESS PRESS AND TEMP AS PER ASME PTC-19.3.
7. THERMOWELL SHALL BE SUITABLE TO MATCH THE STUB DIMENSIONS AS PER Rc 1½.
8. THE 'U' & 'L' DIMENSIONS SHALL BE SELECTED BASED ON PARTICULAR APPLICATION.
9. ORIENTATION OF STUB ON VERTICAL/ HORIZONTAL PIPES SHALL BE 90° TO THE CENTRE LINE OF THE PIPES, FOR PIPE SIZE LARGER THAN 4". HEIGHT OF STUB SHALL BE 64mm FOR PIPE OD < 200Nb AND 45mm FOR PIPE OD ≤ 200Nb.
10. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED.



TITLE :

DRG. NO.

INSTRUMENT STUB DETAILS (TEMP)
 (APPLICABLE FOR PIPE SIZE ABOVE 4")

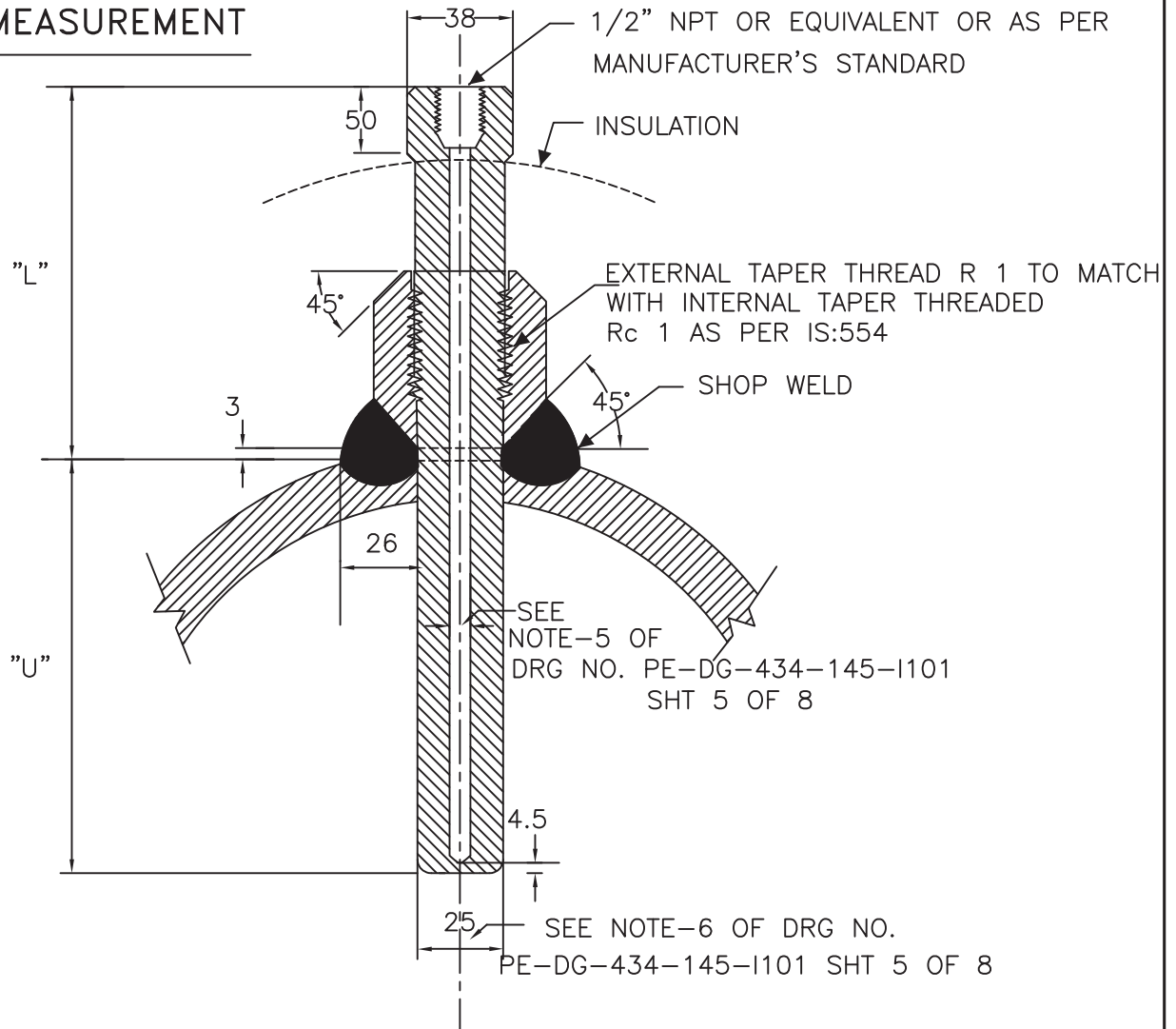
PE-DG-434-145-I101

[PROCESS PRESS EQUAL/> 40 Kg/Cm² (g)

REV. 00

PROCESS PRESS < 40 Kg/Cm² (g), TEMP.EQUAL/>400 DEG C]

SH. 05 OF 08 SHS.

TEMP. MEASUREMENT**NOTES :-**

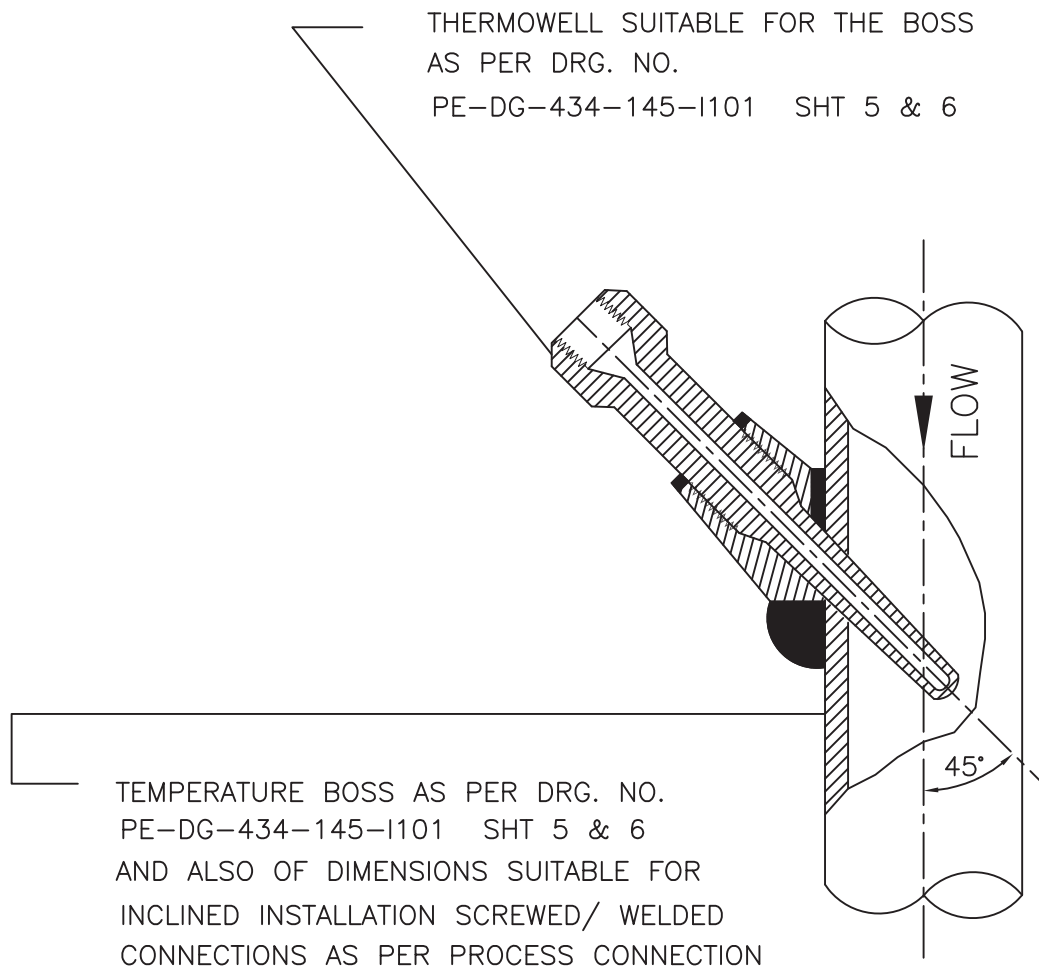
1. THIS TYPE OF TEMPERATURE BOSS IS APPLICABLE FOR THE PROCESS PRESS/ TEMP. BELOW 40 KG/CM²(g)/400°C.
2. SEE NOTES-2 TO 9 IN SHT. 5 OF 8 OF THIS DRG.
3. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE INDICATED.



TITLE :
INST. STUB DETAILS (TEMP)
 (APPLICABLE FOR PIPE SIZE ABOVE 4")

DRG. NO.
PE-DG-434-145-I101
 REV. 00
 SH. 06 OF 08 SHS.

[PROCESS PRESS < 40 Kg/Cm² (g), TEMP < 400 °C]



NOTES :-

1. INCLINED INSTALLATION OF THERMOWELL SHALL BE APPLICABLE FOR 4" AND SMALLER LINE SIZE BUT LIMITED TO MIN. 3" LINE SIZE.
2. FOR 2" AND SMALLER LINE SIZE NECESSARY EXPANDER OF 3" SIZE OF MAIN PIPING SPECIFICATION SHALL BE USED.
3. THIS TYPE OF INSTALLATION IS APPLICABLE FOR HORIZONTAL AND VERTICAL PIPE SECTION.
4. FOR STEAM SERVICES EXPANDER SECTION MAY BE USED ONLY IN VERTICAL RUN.
5. THE EXPANDER SECTION SHALL BE OF ADEQUATE LENGTH (ATLEAST 3-4 TIMES DIA OF THE MAIN PROCESS PIPE AT BOTH SIDE OF INSTALLED THERMOWELL).



TITLE :

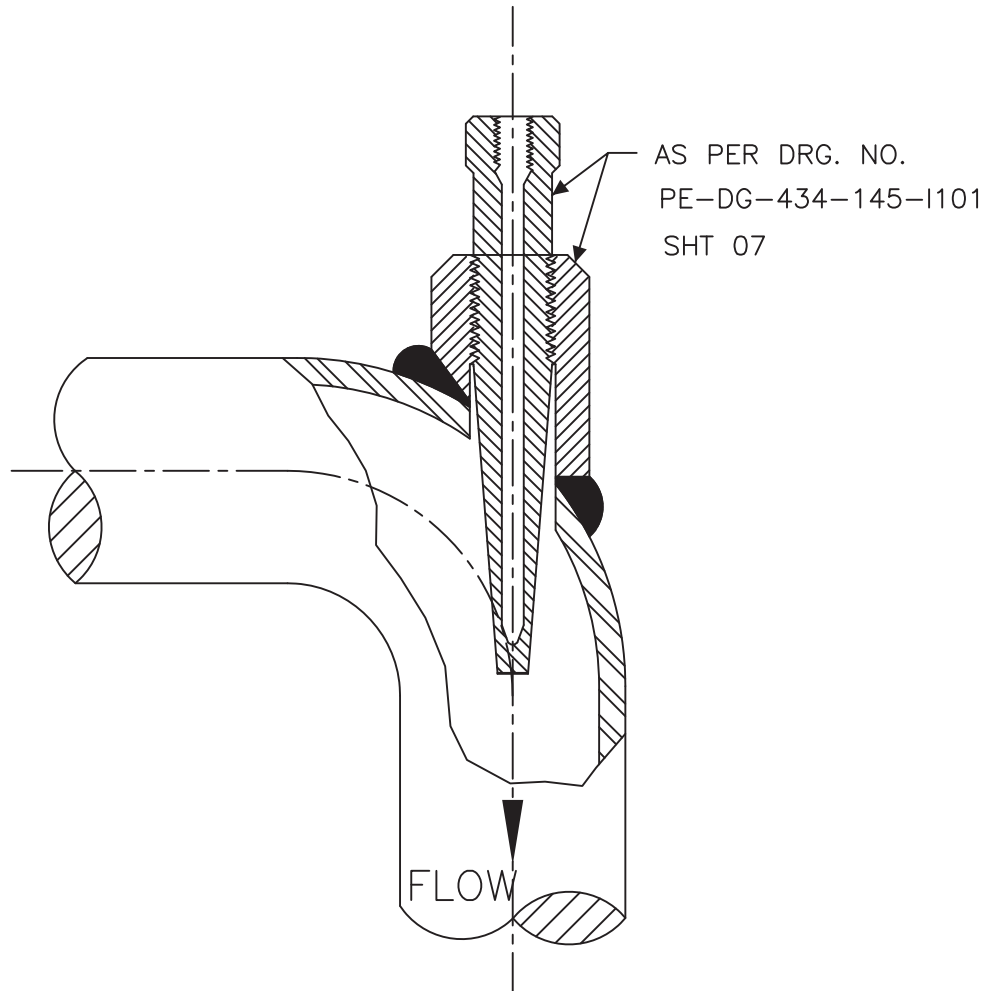
THERMOWELL INSTALLATION

DRG. NO.

PE-DG-434-145-I101

REV. 00

SH. 07 OF 08 SHS.



NOTES :-

1. FLOW INSTALLATION OF THERMOWELL SHALL BE APPLICABLE FOR 4" AND SMALLER LINE SIZE BUT LIMITED TO MINIMUM 3" LINE SIZE. THIS DETAIL IS APPLICABLE FOR THERMOWELL INSTALLATION IN BEND PIPES.
2. FOR 2" AND SMALLER LINE SIZE NECESSARY EXPANDER OF ELBOW FORM (AS SHOWN) OF 3" SIZE SHALL BE USED.
3. ELBOW EXPANDER SECTION IN HORIZONTAL PLANE TO BE USED FOR LIQUID SERVICE. FOR STEAM SERVICES EXPANDER SECTION TO BE USED IN VERTICAL PLANE.



TITLE :

THERMOWELL INSTALLATION
(IN BEND PIPES)

DRG. NO.

PE-DG-434-145-I101

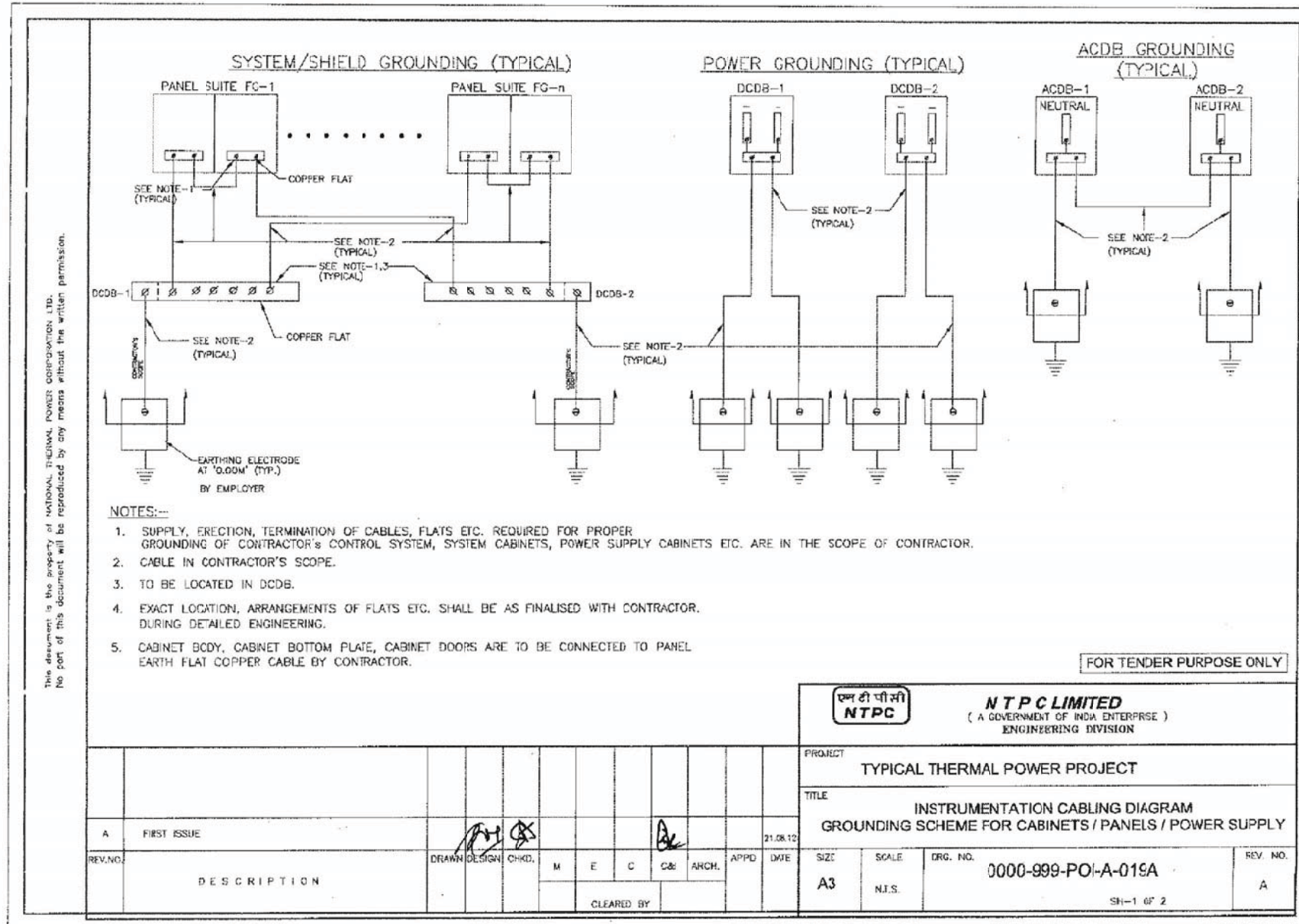
REV. 00

SH. 08 OF 08 SHS.



SECTION: C
SUB SECTION: C&I

INSTRUMENT INSTALLATION DRAWING



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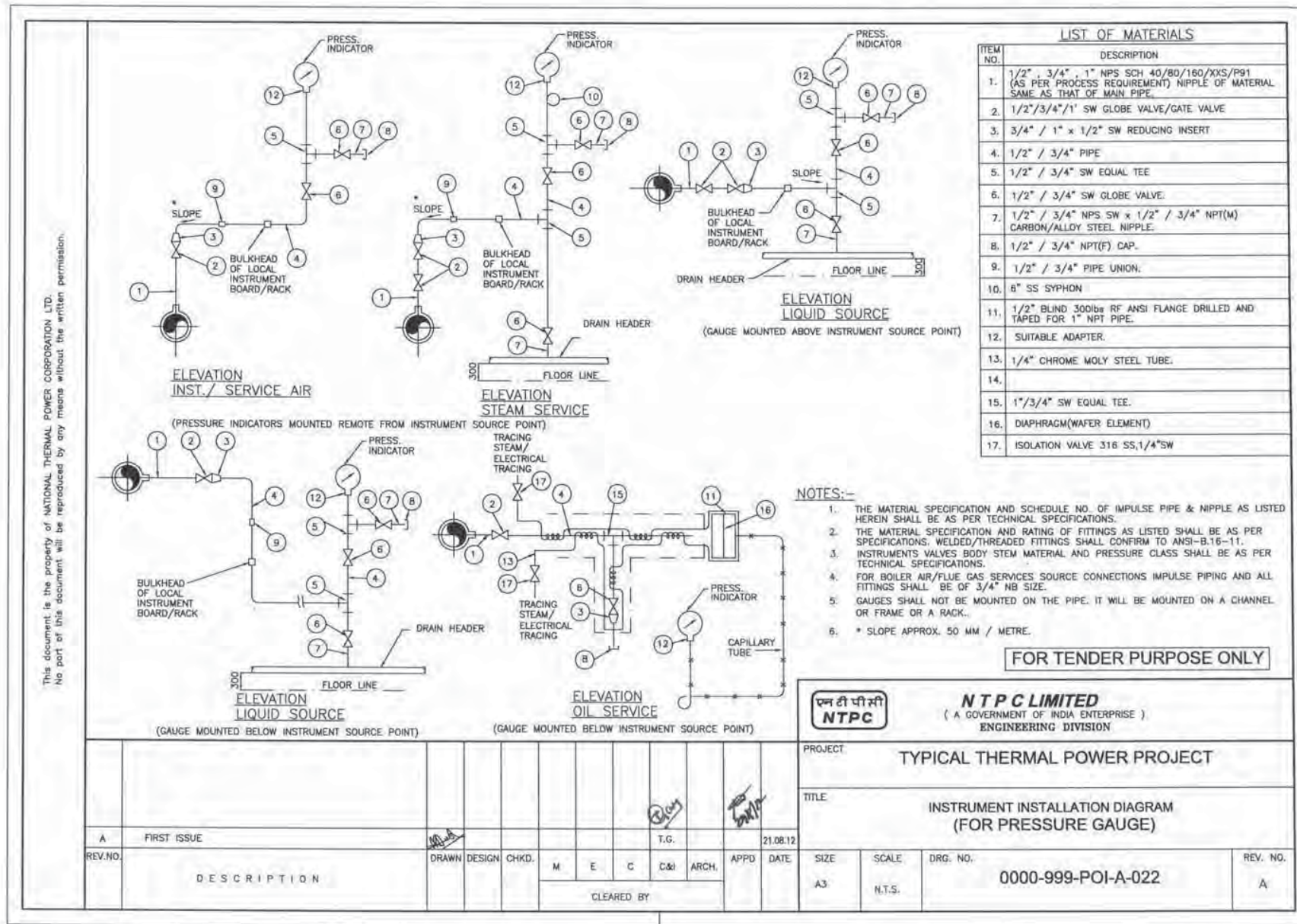
GROUNDING FOR EACH ROW OF PANELS (TYPICAL)

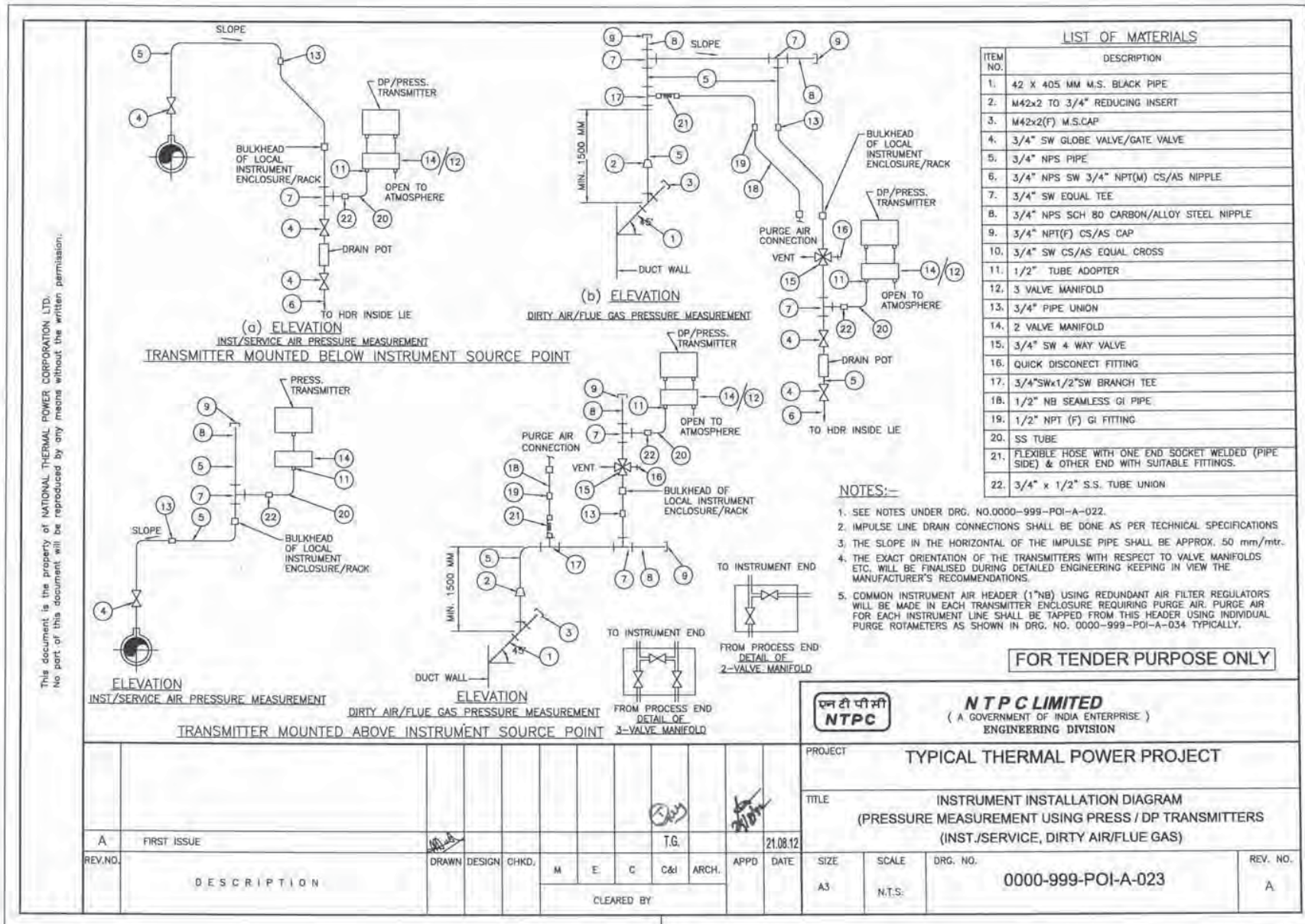
NOTES:-

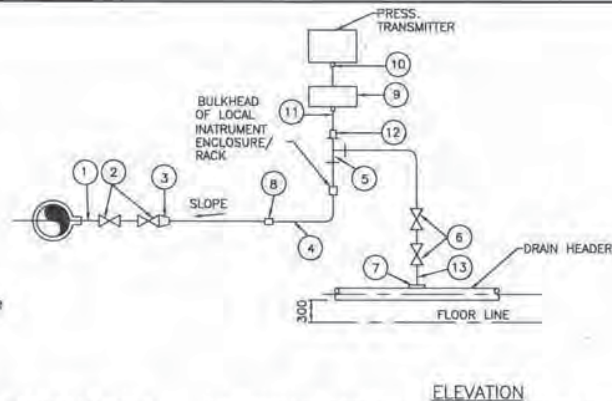
- SUPPLY, ERECTION, TERMINATION OF CABLES, FLATS ETC. REQUIRED FOR PROPER GROUNDING OF CONTRACTOR'S CONTROL SYSTEM, SYSTEM CABINETS, POWER SUPPLY CABINETS ETC. ARE IN THE SCOPE OF CONTRACTOR.
- CABLE IN CONTRACTOR'S SCOPE.
- TO BE LOCATED IN DCDB.
- EXACT LOCATION, ARRANGEMENTS OF FLATS ETC. SHALL BE AS FINALISED WITH CONTRACTOR DURING DETAILED ENGINEERING.
- CABINET BODY, CABINET BOTTOM PLATE, CABINET DOORS ARE TO BE CONNECTED TO PANEL EARTH FLAT COPPER CABLE BY CONTRACTOR.

FOR TENDER PURPOSE ONLY

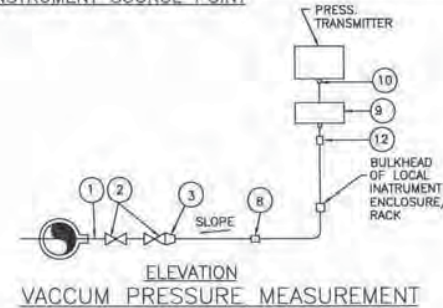
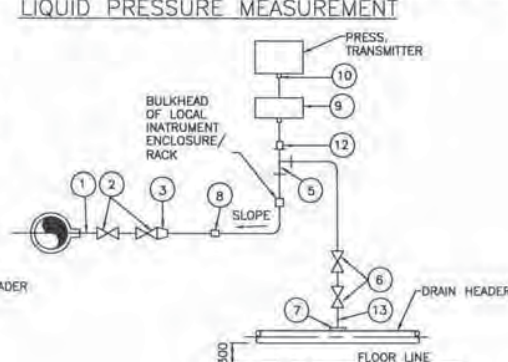
एन टी पी सी NTPC NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION															
PROJECT TYPICAL THERMAL POWER PROJECT															
TITLE INSTRUMENTATION CABLING DIAGRAM GROUNDING SCHEME FOR CABINETS / PANELS / POWER SUPPLY															
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	CM	ARCH.	APPD	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
A	FIRST ISSUE										21.08.12	A3	N.T.S.	0000-999-POI-A-019A	A
Cleared by										SH-2 OF 2					







LIST OF MATERIALS	
ITEM NO.	DESCRIPTION
1.	1/2" x 3/4" 1" NPS SCH. 80/160/XXS/P91 NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	3/4" 1" SW GLOBE VALVE.
3.	3/4" 1" TO 1/2" REDUCING INSERT
4.	1/2" NPS PIPE
5.	1/2" SW EQUAL TEE
6.	1/2" SW GLOBE VALVE.
7.	1/2" NPS SCH. 80/160 SWx1/2"CS/AS COUPLER
8.	1/2" PIPE UNION
9.	2/3 VALVE MANIFOLD (FOR DETAIL SEE DRAWING NO.0090-102-POI-A-023.
10.	SUITABLE ADAPTER
11.	SS TUBE
12.	1/2" PIPE x 1/2" TUBE UNION
13.	1/2" NPS SCH. 80/160 SWx1/2" NPT(M) CS/AS NIPPLE



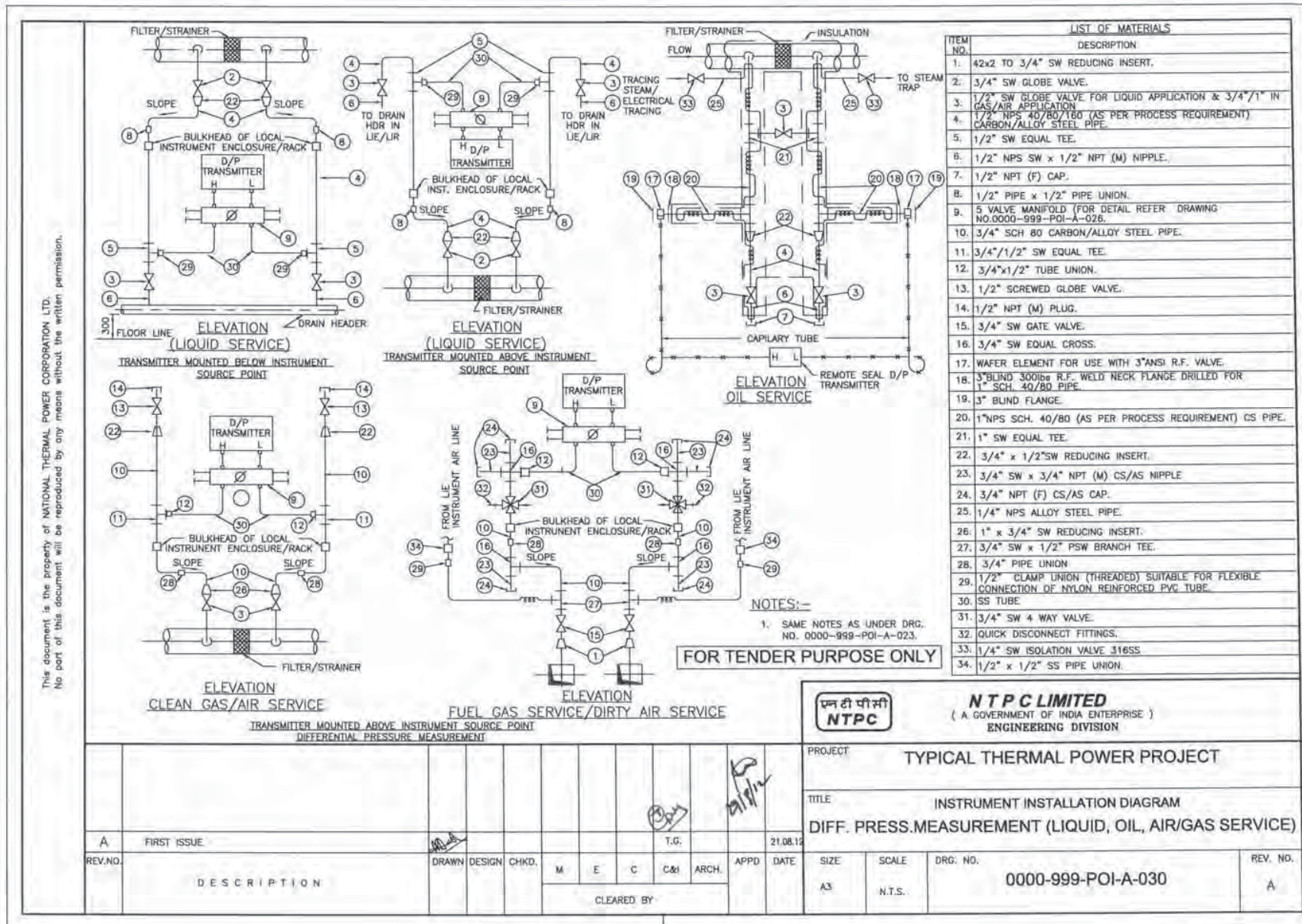
1. SAME NOTES UNDER DRG. NO. 0000-999-POI-A-023.
2. FOR VACUUM APPLICATION OTHER PORT OF TRANSMITTER SHALL BE KEPT OPEN TO ATMOSPHERE.

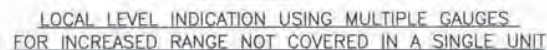
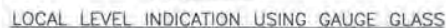
FOR TENDER PURPOSE ONLY

ELEVATION
TRANSMITTER MOUNTED ABOVE
INSTRUMENT SOURCE POINT

STEAM PRESSURE MEASUREMENT

												PROJECT TYPICAL THERMAL POWER PROJECT					
												TITLE INSTRUMENT INSTALLATION DIAGRAM (PRESSURE MEASUREMENT USING PRESS /DP TRANSMITTERS STEAM/LIQUID VACUUM)					
A	FIRST ISSUE								T.G.		21.08.12						
REV.NO.																	
	DESCRIPTION																
	</																





NOTES:-

1. FOR LEVEL GAUGE 3/4" AND FOR LEVEL SWITCH 1" PROCESS CONNECTION SHALL BE PROVIDED.
2. NOTES UNDER DRG. NO. 0000-999-POI-A-023 (WHICHEVER ARE RELEVANT).



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NTPC

NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT	TYPICAL THERMAL POWER PROJECT
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TITLE	INSTRUMENT INSTALLATION DIAGRAM (LEVEL GAUGE & SWITCHES)
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A	FIRST ISSUE							T.G.			21.08.12
REV.NO.		DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
	DESCRIPTION				CLEARED BY						

SIZE A3	SCALE N.T.S.	DRG. NO. 0000-999-POI-A-031	REV. NO. A
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CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC								
	PROCESS CONNECTION AND PIPING										
1.00.00	PROCESS CONNECTION PIPING										
1.01.00	The Contractor shall provide, install and test all required material for completeness of Impulse Piping System and Air Piping System as per the requirements of this Sub-Section on as required basis for the connection of all instruments and control equipments of entire plant.										
1.01.01	IMPULSE PIPING, TUBING, FITTINGS, VALVES AND VALVE MANIFOLDS										
1.01.02	All impulse pipes shall be of seamless type conforming to ANSI B36.10 for schedule numbers. The size of impulse pipe shall be ½" for Steam & Water Application and ¾" for Air & Flue Gas applications. The rating of material of impulse pipes, tubes, fittings, valves and their installation thereof shall conform to the latest edition of standards as per following table: <table><tr><td>Impulse Pipes, Tubes (Material, Rating)</td><td>ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70</td></tr><tr><td>Valves (Material, Pr. Class, Size)</td><td>ASTM A182/ASTM A105 as per ASME 16.34</td></tr><tr><td>Fittings (Size, Rating, Material)</td><td>ANSI B31.1, ANSI B31.1a, ASME B16.11-2009</td></tr><tr><td>Installation Schemes</td><td>BS 6739-2009, ANSI/ISA 77.70</td></tr></table> Stainless steel tube shall be provided inside enclosures & racks from tee connection to valve manifold and then to instrument. The source shut-off (primary process root valve) and blow down valve shall be of 1/2 inch size globe valve type for all applications except for air and flue gas service wherein no source shut-off valves are to be provided. Two root valves are to be used wherever pressure is more than 40 Kg/cm² or Temp>280 °C. The end connections of valves shall be of socket welded type. Typical installation scheme of DP Transmitter (inside LIE/LIR) mounted below instrument source point is indicated in Drg. No. 0000-999-POI-A-036. Same scheme with necessary changes shall be applied for other instruments.			Impulse Pipes, Tubes (Material, Rating)	ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70	Valves (Material, Pr. Class, Size)	ASTM A182/ASTM A105 as per ASME 16.34	Fittings (Size, Rating, Material)	ANSI B31.1, ANSI B31.1a, ASME B16.11-2009	Installation Schemes	BS 6739-2009, ANSI/ISA 77.70
Impulse Pipes, Tubes (Material, Rating)	ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70										
Valves (Material, Pr. Class, Size)	ASTM A182/ASTM A105 as per ASME 16.34										
Fittings (Size, Rating, Material)	ANSI B31.1, ANSI B31.1a, ASME B16.11-2009										
Installation Schemes	BS 6739-2009, ANSI/ISA 77.70										
1.01.03	The valve manifolds of 316 SS with pressure rating suitable for intended application shall be provided as given below: <table><tr><th>Manifold</th><th>Application/M Measurement</th></tr><tr><td>2 Valve</td><td>Pressure measurements using pressure transmitters/pressure switches</td></tr><tr><td>3 Valve</td><td>Pressure measurements using differential pressure transmitter/ switches</td></tr><tr><td>5 Valve</td><td>Differential Pressure, Flow and Level Measurements</td></tr></table> For Pr./D.P gauges, two-way globe/gate valve shall be provided on each impulse line to the instrument in Fluid/Air & Flue Gas applications respectively .			Manifold	Application/M Measurement	2 Valve	Pressure measurements using pressure transmitters/pressure switches	3 Valve	Pressure measurements using differential pressure transmitter/ switches	5 Valve	Differential Pressure, Flow and Level Measurements
Manifold	Application/M Measurement										
2 Valve	Pressure measurements using pressure transmitters/pressure switches										
3 Valve	Pressure measurements using differential pressure transmitter/ switches										
5 Valve	Differential Pressure, Flow and Level Measurements										
2.00.00	AIR SUPPLY PIPING										
2.01.01	All pneumatic piping, fittings, valves, air filter cum regulator, purge rotameter and other accessories required for instrument air for the various pneumatic devices/ instruments shall be provided. This will include as a minimum air supply to pneumatically operated control valves, actuators, instruments, continuous and intermittent purging requirements etc.										
2.02.00	Instrument air and Service air supply shall be provided for continuous and intermittent purging respectively for all transmitters of mill, dirty air and flue gas applications. Purging Scheme shall be as per Drg. No. 0000-999-POI-A-036.										
2.03.00	The Contractor shall also provide SS Tubing and associated fittings (screwed type) of suitable sizes for all pneumatic equipments/actuators (including supply air, signal air and output to actuators) conforming to ANSI 31.1 and 31.3 standard. All other air supply lines shall be of mild steel hot dipped galvanized inside and outside as per IS-1239, heavy duty										
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-06 PROCESS CONNECTION AND PIPING PAGE 1 OF 3								

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
	with threaded ends. Fittings for air supply line shall be of forged carbon steel A234 Gr. WPB galvanized inside and outside, screwed as per ASA B2.1. Dimensions of fittings shall be as per ASA B16.11 of rating 3000 lbs. Air supply piping shall be adequately sloped to prevent accumulation of condensed water within the pipe. The air supply headers, sub-headers and branch pipes shall be supported properly by clamps or supports.			
2.04.00	The instrument/service air supply to each equipment/devices requiring air supply shall be provided by a well designed air distribution scheme comprising of 2" GI Pipe Header feeding 1" GI Pipe sub-header feeding ½" pipe at each equipment/device. Instrument air filters cum regulator set with mounting accessories shall be provided for each pneumatic device requiring air supply except for Ash Handling System wherein it shall be provided on instrument air header at each location.			
2.05.00	All the isolation valves in the air supply line shall be gate valves as per ASTM B62 inside screw rising stem, screwed female ends as per ASA B2.1. Valve bonnet shall be union type & trim material shall be stainless steel, body rating 150 pounds ASA. The valve sizes shall be ½ inch to 2 inch.			
2.06.00	Instrument air filters cum regulator set with mounting accessories shall be provided for pneumatic device requiring air supply. The filter regulators shall be suitable for 10-kg/ sq.cm max. Inlet pressure. The filter shall be of size 5 microns and of material sintered bronze. The air set shall have 2-inch size pressure gauge and built in filter housing blowdown valve. The end connection shall be as per the requirement to be finalized during detailed engineering.			
3.00.00	INSTALLATION AND ROUTING			
3.01.01	All instrument piping, tubing and its accessories shall be supported in a safe manner to prevent excessive vibrations and anchored sufficiently to prevent undue strain on connected equipment. Impulse piping shall be supported at an interval not exceeding 1.5 meters. The slope of the impulse pipe from the process connection to the instrument shall be as per ANSI/ISA 77.70 latest edition and BS 6739-2009. All impulse piping shall be installed to permit free movement due to thermal expansion. Wherever required expansion loops shall be provided. Condensate pots shall be provided for all level measurements in steam and water services, all flow measurement in steam services and for flow measurements in water services above 120 Deg. C. Colour coding of all impulse pipes shall be done by the Contractor in line with the colour coding being followed for the parent pipes.			
4.00.00	SHOP AND SITE TESTS			
4.01.01	The equipment and work performed as per this Sub-section shall be subject to shop and site test as per requirements of Sub-section-IIIE-04 (Quality Assurance & Inspection) other applicable clauses of this Sub-section and Employer approved quality assurance plan.			
4.01.02	Hydrostatic and Pneumatic leakage tests shall be performed on all pipes, tubing and systems and shall conform to ANSI B31.1.			
5.00.00	LOCAL INSTRUMENT ENCLOSURE AND RACKS All transmitters, switches etc. in Boiler Turbine Generator measurements (except for all fuel oil applications) shall be suitably grouped together and mounted inside (i) local instruments enclosures in case of open areas of the plant like boiler area, etc. and (ii) In local instrument racks in case of covered areas like Turbine/Generator area. The GA of LIE with purging indicated in the Drg. No. 0000-999-POI-A-036 is to be followed by contractor. The GA of LIR shall be similar to LIE except for front/rear doors and side panels.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-06 PROCESS CONNECTION AND PIPING	PAGE 2 OF 3

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC		
5.01.00	The internal layout shall be such that the impulse piping/ blow down lines are accessible from back side of the enclosure / rack and the transmitters etc. are accessible from front side for easy maintenance. Bulkheads, especially designed to provide isolation from process line vibration shall be installed on instrument enclosures/racks to meet the process sensing line connection requirement. Vibration dampeners shall be installed for each enclosure / rack. The Degree of Protection of LIE and JB of LIE/LIR shall be IP-55. The instrument racks shall be free standing type constructed of suitable 3 mm thick channel frame of steel and shall be provided with a canopy to protect the equipment mounted in racks from falling objects, water etc. The canopy shall not be less than 3 mm thick steel, and extended beyond the ends of the rack. Enclosures/Racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein. Centre posts or any member which would reduce access shall not be provided. Contractor shall provide not more than three variants for LIE/LIR with respect to max. no. transmitters mounted in each LIE/LIR. ENCLOSURE / RACKS FOR DUAL I/P TEMPERATURE TRANSMITTERS All Dual Input temperature transmitters in Boiler Turbine Generator measurements shall be suitably grouped together and mounted inside (i) Enclosures in case of open areas of the plant like boiler area, etc. and (ii) Racks in case of covered areas like Turbine/Generator area. Integral JB shall be provided with each Enclosure and Rack. The internal layout shall be such that the transmitters are accessible from both front and back side of the enclosure / rack for easy maintenance. Enclosure/ Racks shall be of robust and rugged design. Vibration dampeners shall be installed for each enclosure / rack. The Degree of Protection of Enclosure and JB shall be IP-55. Enclosure and Racks shall be free standing type. Enclosures/Racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein. Contractor shall provide not more than five variants for Enclosure/ Rack with respect to max. no. transmitters mounted in each Enclosure/ Rack. However, the maximum number of Transmitters that can be grouped in one Enclosure/ Rack shall be decided during detail Engineering.			
	6.00.00	INSTALLATION OF OTHER INSTRUMENTS: For installation and routing of other field mounted instruments which are not covered in Cl. No. 5.00.00, please refer Cl. No 52.04.00(f) of Section-VI, Part-D, Erection Conditions of Contract (ECC) of Technical Specifications.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-06 PROCESS CONNECTION AND PIPING	PAGE 3 OF 3



**C&I SPECIFICATION FOR
ACWT SYSTEM**

SECTION: C
SUB SECTION: C&I

CABLE TERMINATION PHILOSOPHY

|

CLAUSE NO.	TECHNICAL REQUIREMENTS																																																				
3.07.00																																																					
4.00.00																																																					
5.00.00																																																					
INSTRUMENTATION CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY																																																					
The cable interconnection philosophy to be adopted shall be such that extensive grouping of signals by large scale use of field mounted Group Junction Boxes (JBs) at strategic locations (where large concentration of signals are available, e.g. valves limit & torque switches, switchgear) is done and consequently cable with higher number of pairs are extensively used. The details of termination to be followed are mentioned in the given Table A.																																																					
TABLE A: CABLE TERMINATION TO BE FOLLOWED																																																					
<table><tr><th colspan="2">Application</th><th colspan="2">Type Of Termination</th><th rowspan="2">Type Of Cable</th></tr><tr><th>FROM (A)</th><th>TO (B)</th><th>END A</th><th>END B</th></tr><tr><td>Valves/dampers drives (Integral Junction box)</td><td>Marshalling / Marshalling – cum Termination Cubicle / local group JB</td><td>Plug in connector</td><td>Post mount cage clamp type.</td><td>G</td></tr><tr><td>Transmitters, Process Actuated switches mounted in LIE/LIR</td><td>Integral Junction box of LIE/LIR</td><td>Plug in connector</td><td>Cage clamp (Rail mount) type.</td><td>F,G</td></tr><tr><td>RTD heads</td><td>Local junction box</td><td>Plug in connector</td><td>Cage clamp (Rail mount) type.</td><td>F</td></tr><tr><td>Thermocouple</td><td>Local junction box / CJC box (if applicable)</td><td>Plug in connector</td><td>Cage clamp (Rail mount) type.</td><td>A, B, C*</td></tr><tr><td>Other Field mounted Instrument</td><td>Local JB / Group JB</td><td>Plug in connector</td><td>Cage clamp (Rail mount) type.</td><td>F,G</td></tr><tr><td>RTD</td><td>Temperature transmitter</td><td>Plug in connector</td><td>Screwed, Cage clamp type</td><td>F</td></tr><tr><td>Thermocouple</td><td>Temperature transmitter</td><td>Plug in connector</td><td>Screwed, Cage clamp type</td><td>A, B, C*</td></tr><tr><td>Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/ MCC/SWGR</td><td>Group JB</td><td>Cage clamp (Rail mount) type.</td><td>Cage clamp (Rail mount) type.</td><td>F,G</td></tr></table>					Application		Type Of Termination		Type Of Cable	FROM (A)	TO (B)	END A	END B	Valves/dampers drives (Integral Junction box)	Marshalling / Marshalling – cum Termination Cubicle / local group JB	Plug in connector	Post mount cage clamp type.	G	Transmitters, Process Actuated switches mounted in LIE/LIR	Integral Junction box of LIE/LIR	Plug in connector	Cage clamp (Rail mount) type.	F,G	RTD heads	Local junction box	Plug in connector	Cage clamp (Rail mount) type.	F	Thermocouple	Local junction box / CJC box (if applicable)	Plug in connector	Cage clamp (Rail mount) type.	A, B, C*	Other Field mounted Instrument	Local JB / Group JB	Plug in connector	Cage clamp (Rail mount) type.	F,G	RTD	Temperature transmitter	Plug in connector	Screwed, Cage clamp type	F	Thermocouple	Temperature transmitter	Plug in connector	Screwed, Cage clamp type	A, B, C*	Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/ MCC/SWGR	Group JB	Cage clamp (Rail mount) type.	Cage clamp (Rail mount) type.	F,G
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EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION-IIIC-07 INSTRUMENTATION CABLES																																																	
PAGE 7 OF 13																																																					

CLAUSE NO.	TECHNICAL REQUIREMENTS 				
	Application		Type Of Termination		Type Of Cable
	FROM (A)	TO (B)	END A	END B	
	Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/ Group JB / MCC/SWGR	Marshalling / Marshalling – cum Termination Cubicle	Cage clamp (Rail mount) type.	Cage clamp (Post mounted) type.	F,G
	Marshalling cubicle/ Termination Cabinet	Electronic system cabinet	Cage clamp (Post mounted) type.	Plug-in connector / other system as per Mfr.'s Standard	Internal wiring
	Marshalling/ Termination System Cabinets	UCD mounted equipments	Cage clamp (Post mounted) type.	Plug in connector / Cage clamp type (rail mounted).	F,G (with plug-in connect or at one end)
	DDCMIS/PLC cabinets	PC, Printers etc.	Plug in connector	Plug in connector	Mfr.'s Standard
	Notes 1 Normally 10% spare cores shall be provided when the numbers of pairs of cables are more than four pairs, except for pre-fabricated cables which shall be as per manufacturer's standard. 2 For analog signals, individual pair shielding & overall shielding & for Binary signals, only overall shielding of instrumentation cables shall be provided. 3 * For high temperature applications only. 4 . For connection between field/JB and DDCMIS marshalling cabinet minimum 4 pair instrumentation cable shall be used. 5 All the spare cores of instrumentation cable have to be terminated in Marshalling cabinets/ DCS panel end. 6 For Cable type and cable termination scheme for the instruments/ equipment that are connected to Steam Turbine and Generator (STG) control system defined at Part A, sub section IIC, clause no. 2.03.01 (a) (ii) above and hydrogen generation plant auxiliaries system, Contractor's standard and proven practice is also acceptable. However, for termination of instrumentation cable at marshalling cabinets/DCS panel end, cage-clamp termination shall be offered. For power and control cable termination, Contractor's standard and proven practice would be acceptable				
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION-IIIC-07 INSTRUMENTATION CABLES	PAGE 8 OF 13

CLAUSE NO.	TECHNICAL REQUIREMENTS		
6.00.00	TERMINAL BLOCKS		
6.01.00	All terminal blocks shall be rail mounted/post mounted, cage clamp type with high quality non-flammable insulating material of melamine suitable for working temperature of 105 deg. C. The terminal blocks in field mounted junction boxes, temperature transmitters, instrument enclosures/racks, etc., shall be suitable for cage clamp connections. The terminal blocks in Control Equipment Room logic/termination/marshalling cubicles shall be suitable for post mounted cage clamp connection at the field input end. The exact type of terminal blocks to be provided by the Bidder and the technical details of the same including width etc. shall be subject to Employer's approval.		
6.02.00	All the terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, partitions, small partitions, transparent covers, support brackets, distance sleeves, warning label, marking, etc.		
6.03.00	The marking on terminal strips shall correspond to the terminal numbering on wiring diagrams. At least 20% spare unused terminals shall be provided everywhere including local junction boxes, instrument racks/enclosures, termination/marshalling cabinets, etc. All terminal blocks shall be numbered for identification and grouped according to the function. Engraved labels shall be provided on the terminal blocks.		
6.04.00	For terminating each process actuated switches, drive actuators, control valves, Thermocouple, RTD, etc. in Local Junction Boxes, etc, refer Drg no. 0000-999-POI-A-065.		
6.05.00	The terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks and between terminal blocks and junction box walls.		
7.00.00	INTERNAL PANELS/ SYSTEM CABINETS WIRING		
7.01.00	Internal panel/cabinet wiring shall be of multi-stranded copper conductor with FRLS PVC insulation without shield and outer sheath meeting the requirements of VDE 0815.		
7.02.00	All internal wires shall be provided with tag and identification nos. etched on tightly fitted ferules at both ends. All wires directly connected to trip devices shall be distinguished by one additional red colour ferrule.		
7.03.00	All external connection shall be made with one wire per termination point. Wires shall not be tapped or spliced between terminal points.		
7.04.00	All floor slots of desk/panels/cabinets used for cable entrance shall be provided with removable gasketed gland plates and sealing material. Split type grommets shall be used for prefabricated cables.		
7.05.00	All the special tools as may be required for solder less connections shall be provided by Bidder.		
7.06.00	Wire sizes to be utilised for internal wiring.		
	(i)	Current (4-20 mA), low voltage signals (48V); Ammeter/Voltmeter circuit, control switches etc. for electrical system.	0.5 Sq.mm.
	(ii)	Power supply and internal illumination.	2.5Sq.mm. minimum (shall be as per load requirement.)
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-07 INSTRUMENTATION CABLES
			PAGE 9 OF 13

CLAUSE NO.	TECHNICAL REQUIREMENTS												
8.00.00	INSTRUMENTATION CABLE INSTALLATION AND ROUTING												
8.01.00	All cables assigned to a particular duct/conduit shall be grouped and pulled in simultaneously using cable grips and suitable lubricants. Cables removed from one duct/conduit shall not be reused without approval of Employer.												
8.02.00	Cables shall be segregated as per IEEE Std.-422. In vertically stacked trays, the higher voltage cable shall be in higher position and instrumentation cable shall be in bottom tier of the tray stack. The distance between instrumentation cables and those of other system shall be as follows: <table><tr><td>From 11 kV/6.6 kV/3.3 kV tray system</td><td>-</td><td>914 mm</td></tr><tr><td>From 415V tray system</td><td>-</td><td>610 mm</td></tr><tr><td>From control cable tray system</td><td>-</td><td>305 mm</td></tr></table>				From 11 kV/6.6 kV/3.3 kV tray system	-	914 mm	From 415V tray system	-	610 mm	From control cable tray system	-	305 mm
From 11 kV/6.6 kV/3.3 kV tray system	-	914 mm											
From 415V tray system	-	610 mm											
From control cable tray system	-	305 mm											
8.03.00	Cables shall terminate in the enclosure through cable glands. All cable glands shall be properly gasketed. Sealing (to prevent ingress of dust entry and propagation of fire) shall be provided for all floor slots used for cable entrance. Compression cable glands (double for armoured and single for other cables) shall be provided.												
8.04.00	Not in use												
8.05.00	The cables emanating from redundant equipment/devices shall be routed through different paths. The above segregation of cables & wiring for redundant equipments/devices shall be in accordance with IEEE-Std-422.												
9.00.00	CABLE LAYING AND ACCESSORIES												
9.01.00	CABLE LAYING												
	1	Cables shall be laid strictly in line with cable schedule.											
	2	Identification tags for cables.											
		Indelible tags to be provided at all terminations, on both sides of wall or floor crossing, on each conduit/duct/pipe entry/exit, and at every 20 m in cable trench/tray.											
	3	Cable tray numbering and marking.											
		To be provided at every 10m and at each end of cable way & branch connection.											
	4	No jointing is permissible for Instrumentation cables. For other cables Jointing for more than 250 Meters run of cable shall be permitted.											
	5	Buried cable protection											
		With concrete slabs; Route markers at every 20 Meters along the route & at every bend.											
	6	Road Crossings											
		Cables to pass through buried high density PE pipes encased in PCC. At least 300											
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2		SUB-SECTION-IIIC-07 INSTRUMENTATION CABLES									
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC	
	mm clearance shall be provided between - HT power & LT power cables, - LT power & LT control/instrumentation cables, Spacing between cables of same voltage grade shall be in accordance with the derating criteria adopted for cable sizing. 7 Segregation (physical isolation to prevent fire jumping) - a All cable associated with the unit shall be segregated from cables of other Units. - b Interplant cables of station auxiliaries and unit critical drives shall be segregated in such a way that not more than half of the drives are lost in case of single incident of fire. 8 Cable clamping All cables laid on trays shall be neatly dressed up & suitably clamped/tied to the tray. For cables in trefoil formation, trefoil clamps shall be provided. 9 Optical fiber cables (OFCs) : Outside Building Area - to be laid necessarily inside GI conduit with support from cable tray/Trestle structure Inside Building Area – to be laid on separate cable sub-trays While buried- in separate buried trench approx.1.0 meter depth, to be laid in 2" rodent proof HDPE conduits covered with sand, brick, laid breadth-wise and soil along the pipe line route by contractor; While crossing roads - to be laid in GI/ rodent proof HDPE conduits with sand filling at bottom and sand, soil filling at top with cement concrete; While crossing canals/river- to be laid in rodent proof HDPE conduits within hume pipe. 10 Laying of Network Cable (UTP/STP) : Out side Building Area- to be laid necessarily inside GI conduits with support from cable tray / Trestle structure. Inside Building Area- to be laid necessarily inside GI conduits on separate cable sub-trays.		
9.02.00	Bidder shall supply and install all cable accessories and fittings like Light Interface Units, Surge suppressors, Opto isolators, Interface Converters, Fibre Optic Card Cage, Fibre Optic Line Driver, Repeater / Modem (for Optical Fibre Cables), cable glands, grommets, lugs, termination kits etc. on as required basis.		
9.03.00	Cables, which terminate in cabinets of draw out sections shall have sufficient cable coiled in the bottom of the cabinet to permit full withdrawal of draw out sections without disconnecting the cables. When prefabricated cables with factory connectors on both ends are longer than required, the excess cable shall be coiled in the bottom of one or both termination cabinets.		
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-07 INSTRUMENTATION CABLES
			PAGE 11 OF 13

CLAUSE NO.	TECHNICAL REQUIREMENTS			
9.04.00	The Bidder shall be responsible for proper grounding of all equipment under this package. Further, proper termination of cable shields shall be verified and the grounding of the same shall be coordinated so as to achieve grounding of all instrumentation cable shields at same potential. This shall be completed prior to system tests.			
9.05.00	The Contractor shall take full care while laying / installing cables as recommended by cable manufacturers regarding pulling tensions and cable bends. Cables damaged in any way during installation shall be replaced at the expense of the Contractor.			
10.00.00	FIELD MOUNTED LOCAL JUNCTION BOXES			
	(i)	No. of ways	12/24/36/48/64/72/96/128 with 20% spares terminals.	
	(ii)	Material and Thickness	4mm thick Fiberglass Reinforced Polyester (FRP).	
	(iii)	Type	Screwed at all four corners for door. Door gasket shall be of synthetic rubber.	
	(iv)	Mounting clamps and accessories	Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands required for erection shall be of SS, included in Bidders scope of supply.	
	(v)	Type of terminal blocks	Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm ² . A M6 earthing stud shall be provided.	
	(vi)	Protection Class	IP: 55 minimum for indoor & IP-65 minimum for outdoor applications.	
	(vii)	Grounding	To be provided.	
	(viii)	Color	RAL 7035	
11.00.00	CONDUITS			
11.01.00	Conduits shall be generally used for interconnecting cables from field instruments to Local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanised rigid mild steel in accordance with IS: 9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate. Flexible conduit shall be heat resistant lead coated galvanized steel with , water leak, fire and rust proof protected <i>for the areas of Mills,Drum, Main Steam, RH steam Air Heaters and Furnace, BFPDT's</i> . <i>And for remaining applications, water leak, fire and rust proof flexible GI conduits shall be provided.</i> The temperature rating of flexible conduit shall be suitable for actual application.			
11.02.00	All rigid conduit fittings shall conform to the requirements of IS: 2667, 1976. Galvanized steel fitting shall be used with steel conduit. All flexible conduit fittings shall be liquid tight, galvanized steel. The end fittings shall be compatible with the flexible conduit supplied.			
11.03.00	Conduit sealing, explosion proof, dust proof and other types of special fittings shall be provided as required by these specifications and shall be consistent with the area and equipment with which they are installed. Fittings installed outdoors and in damp locations shall be sealed and gasketed. Hazardous area fittings and conduits sealing shall conform			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-07 INSTRUMENTATION CABLES	PAGE 12 OF 13

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	with NEC requirements for the area classification.			
11.04.00	Contractor shall provide double locknuts on all conduit terminations not provided with threaded hubs and couplings. Water tight conduit unions and rain tight conduit hubs shall be utilised for all the application which shall be exposed to weather. Moisture pockets shall be eliminated from conduits.			
11.05.00	Conduits shall be securely fastened to all boxes and cabinets.			
12.00.00	CABLE SUB-TRAY & SUPPORT			
12.01.00	The cable sub-trays and the supporting system, to be generally used between Local/Group JB's and the main cable trays and the same shall be furnished and installed by the Contractor. It is the assembly of sections and associated fittings forming a rigid structural system used to support the cable from the equipment or instrument enclosure upto the main cable trays (trunk route).			
12.02.00	The covers on the cable sub-trays shall be used for protection of cables in areas where damage may occur from falling objects, welding spark, corrosive environment, etc. & shall be electrically continuous and solidly grounded.			
EPC PACKAGE FOR PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE-I (3X 800MW)		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS:9585-001-2	SUB-SECTION-IIIC-07 INSTRUMENTATION CABLES	PAGE 13 OF 13

KKS PHILOSOPHY

	DOCUMENT TITLE KKS NUMBERING PHILOSOPHY
	3 x 800 MW PVUNL PATRATU TPP PHASE-I

KKS NUMBERING PHILOSOPHY

For identifying (tagging) an instrument / equipment in Power plant KKS numbering scheme is used. The purpose is to assign a unique number to every equipment in the power plant. For C&I equipment unique number are to be provided up to the signal level so that a unique number Input / Output exist in DCS for every signal.

Normally KKS number is a 10 digit alpha-numeric code and is typically split into the following:

X	X	X	A	A	Y	Y	B	B	B
---	---	---	---	---	---	---	---	---	---

First three digits indicate the Sub-System. The Code for the major system are given as per **Annexure-1**.

Fourth and Fifth digits are the **Numerical Keys at System Code Level** and used to distinguish between main systems having same Alpha Codes.

Sixth and Seventh digits are the **Equipment / Apparatus / Measuring Circuit Code**. The code of various Equipment / Apparatus / Measuring Circuit is shown in **Annexure-2**

Eight, Nine and tenth digits are the **Numerical Keys at Equipment / Apparatus / Measuring Circuit Code** and used to distinguish between various instruments in the same sub-group. Numerical keys at System / Equipment / Apparatus / Measuring Circuit is shown in **Annexure-3**.

	DOCUMENT TITLE KKS NUMBERING PHILOSOPHY
	3 x 800 MW PVUNL PATRATU TPP PHASE-I

ANNEXURE-1**List of System / Sub-System Codes used in Power Plant:****ANNEXURE-2****Standard Equipment Codes:**

AA	Valves including drives, also hand operated
AB	Seclusions, Lock, Gates, Doors
AC	Heat Exchanger
AE	Turning, Driving, Lifting equipment
AF	Continuous conveyors, Feeders
AG	Generator Units
AH	Heating and Cooling Units
AK	Pressing and Packaging equipment
AM	Mixer, Stirrer
AN	Blower, Air Pumps / Fans, Compressor Units
AP	Pump Units
AT	Purification, Drying, Filter
AV	Combustion Equipment e.g. grates

Standard Apparatus Codes:

BB	Vessels and Tank
BF	Foundation
BG	Boiler Heating Surfaces
BN	Injector, Ejector
BP	Flow and throughput limitation equipment (Orifice)
BQ	Holders, Carrying Equipment, Support
BR	Piping, Ducts, Chutes, Compensator
BS	Sound Absorber
BU	Insulations, Sheatings

Standard Measuring Circuits Codes:

CD	Density
CE	Electrical Quantities
CF	Flow, throughput
CG	Distance, Length, Position
CK	Time
CL	Level

	DOCUMENT TITLE	
	KKS NUMBERING PHILOSOPHY 3 x 800 MW PVUNL PATRATU TPP PHASE-I	

CM	Humidity
CQ	Analysis (SWAS)
CS	Speed, Velocity, Frequency
CT	Temperature
CY	Vibration, Expansion

ANNEXURE-3

Numerical Keys

A) Numerical Keys at System Code Level

- i) Use 10, 20, 30... To distinguish between main systems having same Alpha Codes. Examples:
 - a) Main Steam (Left) and Main Steam (Right)
 - b) BFP – A/B/C
 - c) ID Fan – A/B, FD Fan A/B, AH – A/B
- ii) For branch off from main system path having code say 10, keep the same alpha code and use 11, 12, 13 etc. Similarly for other branch off from main system path having code say 20, keep the same alpha code and use 21, 22, 23 etc and shall carry on further in the same way.
- iii) If the branch off from main system / sub system path is used for some other system, where different alpha codes can be applied, then in that case the said branch line will be designated by the alpha codes of the system to which it is providing the input.

B) Numerical keys at Equipment Code level:

There are three numerical keys available for each type of equipment code. Following has been agreed upon considering present practice, better flexibility and ease in sorting.

- i) **Valves and Dampers --- Equipment Code – AA**

		<u>N1</u>	<u>N2 N3</u>
Motorised (<i>on/off duty</i>)	-	0	01 to 50
Motorised (<i>inching duty</i>)	-	0	51 to 99
Pneumatic (Control)	-	1	01 to 50
Motorised (<i>thyristor Control</i>)	-	1	51 to 99
Sol. Operated	-	2	01 to 99
(Open / Close duty (Valves, NRVs, Gate)			
Hydraulic	-	3	01 to 99

	DOCUMENT TITLE		
	KKS NUMBERING PHILOSOPHY		
	3 x 800 MW PVUNL PATRATU TPP PHASE-I		
	-	4	01 to 99
Manual	-	5	01 to 99
Manual	-	6	01 to 99
Relief & Safety Valves	-	7	01 to 99
Reserve	-	8	01 to 99
Reserve	-	9	01 to 99
ii) Field Instruments			
Field Transmitters & Analog Signals	-	0	01 to 99
Field Switches & Binary Signals	-	1	00 to 99
PG Test Point	-	4	00 to 99
Gauges	-	5	00 to 99
Automatic Turbine Tester (ATT)-HWR	-	2	00 to 99
(Reserved for protection Signals used by Hardwar)			
Example of Numerical Key Usage:			
In line with the philosophy adopted for Valves / Dampers /instruments etc. pumps and fans in the main systems (having different system code) can be numbered as AP/N100 and as AP/N101, 102, Where system code is same.			

Annexure - 4**FORMAT FOR PROVENNESS CERTIFICATE**

Sl.No.	Item Description	Plant No.1
5.00.00	INSTRUMENTS (PRIMARY & SECONDARY)	
(i)	Type of Instrument	
(ii)	Make / Model	
(iii)	Name of Power Station (Location & Address)	
(iv)	Unit Size (MW)	
(v)	Commissioning date	
	Whether above instruments have atleast one (1) year satisfactory operation in one (1) power station having unit rating of 200 MW or above.	Yes/No
(vi)	Client's certificate attached	Yes/No

Signature of authorized signatory.....



TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO.: PE-TS-434-154-A101

SUB-SECTION: III

REV. NO.: 00

DATE: 12.04.2019

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER



TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
DOSING SYSTEM

SPECIFICATION NO.: PE-TS-434-154-A101

SUB-SECTION: III

REV. NO.: 00

DATE: 12.04.2019

SCHEDULE OF PRE-BID CLARIFICATION

All clarification from the Technical Specification shall be filled in by the BIDDER clause by clause in this format only.

VOLUME	SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION REQUIREMENT	CLARIFICATION	REASONS FOR CLARIFICATION

Note: Bidder to furnish all the pre bid in the above indicated pre bid clarification format only. General Pre bid clarification will not be considered.

THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-434-154-A101

		SCHEDULE OF DEVIATIONS WITH COST OF WITHDRAWAL							
		PROJECT:- PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE- I (3 X 800 MW)							
		PACKAGE:- OXYGEN DOSING SYSTEM							
		TENDER ENQUIRY REFERENCE:-							
NAME OF VENDOR:-									
SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWAL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWAL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWAL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									
PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE									
NAME		DESIGNATIONS				SIGN & DATE			
NOTES:									
1. For self manufactured items of bidder, cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.									
2. For directly dispatchable items, cost of withdrawal of deviation will be applicable on the basic price including taxes, duties & freight.									
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.									
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.									
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.									
6. Bidder shall furnish price copy of above format along with price bid.									
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.									
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.									
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.									
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.									
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.									
12. Cost of withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.									
13. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.									
14. In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.									



TITLE: PATRATU SUPER THERMAL POWER STATION EXPANSION PHASE- I (3 X 800 MW) TECHNICAL SPECIFICATION FOR OXYGEN DOSING SYSTEM	SPECIFICATION NO.: PE-TS-434-154-A101	
	SUB-SECTION: III	
	REV. NO.: 00	DATE: 12.04.2019

COMPLIANCE CUM CONFIRMATION SCHEDULE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnishing same with the offer:

- a.) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.
- b.) QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder.
- c.) All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.
- d.) There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'.
- e.) The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.
- f.) The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).
- g.) All sub vendors shall be subject to BHEL/CUSTOMER approval.
- h.) Any special tools & tackles, if required, shall be in bidder's scope.
- i.) Demonstration parameters shall stand valid till the satisfactory completion of demonstration test and its acceptance by BHEL/Customer.



TITLE:
PATRATU SUPER THERMAL POWER
STATION EXPANSION PHASE- I (3 X 800 MW)
TECHNICAL SPECIFICATION FOR OXYGEN
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SUB-SECTION: III

REV. NO.: 00

DATE: 12.04.2019

DECLARATIONS

I.....certify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated and there is no deviation to the specification.

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Bidders company name

Authorized representative's signature

Name

Bidder's name

The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated.