

**PROJECT:
2X250 MW BHILAI TPP (NSPCL).
(FGD SYSTEM PACKAGE).**

CUSTOMER: NTPC LIMITED.

**TECHNICAL SPECIFICATION
FOR
CHEMICAL DOSING SYSTEM (NaOH DOSING)**

SPECIFICATION NO: PE-TS-468-154-A001



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

8/2/2020/PS-PEM-MAX



TITLE: TECHNICAL SPECIFICATION
FOR CHEMICAL DOSING SYSTEM (NaOH DOSING).
PROJECT: 2X250 MW BHILAI TPP (NSPCL)
(FGD SYSTEM PACKAGE).

BHEL DOCUMENTS NO.: PE-TS-468-154-A001

REV NO: 00

DATE:

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SECTION –A

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SECTION - A
INTENT OF SPECIFICATION

	TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM (NaOH DOSING). PROJECT: 2X250 MW BHILAI TPP (NSPCL). (FGD SYSTEM PACKAGE).	BHEL DOCUMENTS NO.: PE-TS-468-154-A001	
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1.0 SCOPE OF INQUIRY/ INTENT OF SPECIFICATION:

This specification is intended to cover design, engineering, manufacturing, fabrication, assembly, painting, packing, inspection & testing at manufacturer's works, **mandatory spares, start up and commissioning spares**, special tools & tackles, supply and dispatch to power station site of skid mounted **CHEMICAL DOSING SYSTEM (NaOH DOSING SYSTEM)** including supervision of commissioning by experience/capable engineer, as specified in different sections / volumes of this specification hereinafter for the **2X250 MW BHILAI TPP (NSPCL) (FGD SYSTEM PACKAGE)** for following systems:-

- **NaOH Dosing system (1 number for entire units).**

- 1.1 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve them of the responsibility of providing such facilities to complete the supply of **CHEMICAL DOSING SYSTEM**.
- 1.2 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgment is not in full accordance herewith.
- 1.3 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- 1.4 **Bidder shall be required to depute his qualified/capable personnel at any stage for one (1) visit of two (2) days to supervise in Commissioning.** This visit will include supervision of commissioning of LP Dosing system in totality including pump, stroke controllers commissioning and auto operation from remote. Bidder to indicate the prices (in price format) for the same. The prices for Visit shall be inclusive of charges of Air-Fair/Rail-Fair, Boarding/Lodging, local conveyance etc.
- 1.5 Items though not specifically mentioned but needed to make the system complete as stipulated under these specifications are also to be furnished unless otherwise specifically excluded.
- 1.6 The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification are subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- 1.7 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of BHEL/Customer shall prevail and shall be complied by the bidder without any commercial and delivery implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by BHEL/ Customer as and when brought to their notice either by the bidder or by BHEL/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

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- 1.8 Deviations, if any, should be very clearly brought out clause by clause along with cost of withdrawal in the enclosed schedule (in Vol – III); otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/its customer.
- 1.9 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 1.10 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and Customer/Purchaser/Employer will mean BHEL and/or Customer (NTPC: National Thermal Power Corporation Limited) as interpreted by BHEL in the relevant context. Please refer GCC/SCC for better clarity.
- 1.11 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.
- 1.12 BHEL's/Customer's representative shall be given full access to the shop in which the equipment are being manufactured or tested and all test records shall be made available to him.
- 1.13 Pre-bid meeting shall be held before bid submission. Bidder to ask all their queries in Prebid clarifications format only.

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SECTION – B
PROJECT INFORMATION

CLAUSE NO.	PROJECT INFORMATION
1.00.00 1.01.0 1.02.00 1.03.00 1.04.00 1.05.00 1.06.00 2.00.00 3.00.00 4.00.00	 BACKGROUND NSPCL has setup coal based thermal power plant of 2X250 MW capacity at BHILAI in Chhattisgarh primarily to meet captive power requirement of SAIL, NSPCL is supplying balance power to the beneficiaries in the western region. Both the units have been commissioned during 2008-09 and commercialized during 2009-10. LOCATION AND APPROACH The NSPCL site is located at District Durg, Bhilai (East) having latitude and longitude of 21° 11' 25" N and 81°26'05" E, respectively. The nearest railhead on the Raipur- Nagpur section of South Eastern Central Railway is Bhilai which is approx. 4 km from site. The site is approachable from National Highway -6 which connects the site with both Durg and Raipur. The nearest- airport is at Raipur, about 35kms away from the site. The nearest town is Bhilai, approx. 10 km from the project site. Vicinity plan of the proposed project is placed at Annexure-I. LAND Total land area for plant & dyke is 659 acres. Ash Dyke is constructed in 221 Acre land. WATER The make- up water requirement for the plant has been met from the existing system of Bhilai CPP-1, CPP-2 and BSP i: e Maroda Tank-II, which is fed by Tandula Main Canal. Coal Quality Parameters / Fuel Oil Characteristics & Plant Water details: (i) The coal quality parameters and Fuel oil Characteristics are indicated in Table-1 & Table-2 respectively below. (ii) Process water: Process water quality based on COC given in Table-4. (iii) Clarified water: Clarified water quality is indicated in Table-4. (iv) DM water for Equipment cooling water system. DM water quality is indicated in Table-5. STEAM GENERATOR AND ESP DATA: Refer Table-6 Drawings are enclosed as per Table-7 for initial overview to the Bidder. NOT USED Capacity Present proposal : 2 X 250 MW Metrological Data The metrological data from nearest observatory is placed at Annexure-II.
LOT-2 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(2)-9 SUB-SECTION-II-A5 PROJECT INFORMATION (BHILAI 2X250 MW) PAGE 1 OF 30

CLAUSE NO.	PROJECT INFORMATION 		
5.00.00	CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES AND a) Steel structures : 2% b) Reinforced Concrete structures : 5% c) Reinforced Concrete Stacks : 3% d) Steel stacks : 2% EQUIPMENT All structures and equipment shall be designed for seismic forces adopting the site specific seismic information provided in this document and using the other provisions in accordance with IS:1893 (Part 1 to Part 4). Pending finalization of Part 5 of IS:1893, provisions of part 1 shall be read along with the relevant clauses of IS:1893:1984, for embankments. A site specific seismic study has been conducted for the project site. The peak ground horizontal acceleration for the project site, the site specific acceleration spectral coefficients (in units of gravity acceleration 'g') in the horizontal direction for the various damping values and the multiplying factor (to be used over the spectral coefficients) for evaluating the design acceleration spectra are as given at Appendix-I. Vertical acceleration spectral values shall be taken as 2/3rd of the corresponding horizontal values. The site specific design acceleration spectra shall be used in place of the response acceleration spectra, given at figure-2 in IS:1893 (Part 1) and Annex B of IS:1893 (Part 4). The site specific acceleration spectra along with multiplying factors specified in Appendix-I includes the effect of the seismic environment of the site, the importance factor related to the structures and the response reduction factor. Hence, the design spectra do not require any further consideration of the zone factor (Z), the importance factor (I) and response reduction factor (R) as used in the IS:1893 (Part 1 to Part 4). Damping in Structures The damping factor (as a percentage of critical damping) to be adopted shall not be more than as indicated below for:		
LOT-2 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(2)-9	SUB-SECTION-II-A5 PROJECT INFORMATION (BHILAI 2X250 MW)	PAGE 2 OF 30

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SECTION – C1 SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

	TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM (NaOH DOSING). PROJECT: 2X250 MW BHILAI TPP (NSPCL). (FGD SYSTEM PACKAGE).	BHEL DOCUMENTS NO.: PE-TS-468-154-A001	
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1.0 **BRIEF DESCRIPTION OF THE SYSTEMS:**

The Chemical Dosing System shall consist of NaOH dosing system to dose dilute NaOH in ECW tank and ECW line.

2.0 **NaOH DOSING SYSTEM for ECW SYSTEM**

Sodium Hydroxide (NaOH) dosing system is provided to dose NaOH solution in Equipment cooling water lines to increase pH upto 9.5. The sodium hydroxide dosing is done in the ECW cycle during the initial fill and for the compensation of cooling water for any leakage during normal run. The 1% solution of NaOH is prepared manually by opening the inlet valve of DM water and adding NaOH lye in basket. The NaOH is being dissolved by locally starting the motorized stirrer. The dosing is done manually as per requirements of desired pH in ECW line judged by trial basis. Normally the leakage is occasionally and of small quantity. At the low level of solution in tank the solution is to be prepared again.

The dosing system consists of following (Refer Data Sheet-A and P&ID).

3.0 **SCOPE OF SUPPLY:**

The bidder's scope of supply includes the following under this specification:

- One number NaOH Dosing tank.
- Two (2X100%) NaOH Dosing Pumps.
- Associated Piping, valves, fitting as indicated in the P&ID of NaOH dosing system and data sheet-A enclosed and as required to make the system complete.
- Foundation nuts & bolts to fix each skid on the floor, as required.
- Control & instrumentation as per P&ID of NaOH dosing system, Data sheet-A and as indicated in different section in this specification.
- Commissioning spares as indicated in specification.
- Mandatory spares as indicated in specification.

4.0 **SCOPE OF SERVICE:**

The bidder's scope service includes the following under this specification:

- Design and engineering.
- Fabrication of the skid mounted chemical dosing system.
- Inspection and testing of the skid as per the approved quality assurance plan.
- Supply of the skid mounted chemical dosing system up to the power plant site along with all accessories as defined in the technical specification.
- Supervision of Commissioning by experienced/capable engineer **for one (1) visit of two (2) days to supervise in Commissioning.**
- Painting as per technical specification.
- Packing of skid (**Refer Note Below**)

Note: To prevent damage to the equipment of the skid during loading/unloading, transit and in view of the site storage suitable wooden packing with steel angel/frame shall be provided. Auto Stroke controller shall be packed separately in weather proof packing box.

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SUB VENDOR LIST (TABLE-1)

SL NO.	ITEM	APPROVED SUPPLIERS	PLACE	REMARKS
	MECHANICAL:			
1	TANK/DISSOLVING BASKET/WATER SEAL POT/ CO ₂ ABSORBER/BREATHING	SELF-MAKE OF MAIN VENDOR	AS APPLICABLE	
2	AGITATOR/STIRRER	REMI (REFER NOTE 1)	MUMBAI	
		CEECON	CHENNAI	
		FIBRE & FIBRE		
3	GATE/GLOBE/NON-RETURN (CHECK) VALVES	PRECISION ENGG.	MUMBAI	
		CRESENT VALVE	MUMBAI	
		BDK	HUBLI	
		LEADER	JALANDHAR	
		CHEMTECH	MUMBAI	
		TECHNO VALVE	MUMBAI	
		FOURESS	MUMBAI	
		FLUIDLINE	MUMBAI	
		STEELSTRONG	MUMBAI	
		L&T AUDCO		
		GM ENGINEERING		
		A.V. VALVES		
		ATAM VALVES	JALANDHAR	
4	2/3 WAY VALVE MANIFOLDS	TECHNO VALVE	MUMBAI	
		HI TECH	AHMEDABAD	
		CHEMTROL		
		BLISS ANAND	GURGAON	
		APPROVED ORIGINAL SUPPLIER FOR THE RESPECTIVE INSTRUMENT	AS APPLICABLE	
5	METERING PUMP WITH PRV			
		MILTON ROY		
		VK PUMP		
		SWELORE		
		METACHEM		
		DENCIL		
		POSITIVE METERING		
		EXCEL HYDRO		
6	PIPES	CHOKSHI TUBES	AHMEDABAD	
		REMI	MUMBAI	
		RATNAMANI	AHMEDABAD	
		PRAKASH STEELAGE	SILVASA	
		KALYANI		
		PRAKASH		
		SAW		
7	FITTINGS	BHARAT FORGE	PUNE	
		RELIANCE FORGE	MUMBAI	
		EBY	MUMBAI	
		SIDDARTH & GAUTAM	FARIDABAD	
		MS FITTINGS	KOLKATA	
		PRADEEP METALS LTD	MUMBAI	

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		TUBE PRODUCT INCORPORATION	BARODA	
		CSA FITTINGS		
8	FLANGES	PRADEEP METALS LTD	MUMBAI	
		TUBE PRODUCT INCORPORATION	BARODA	
		RELIANCE FORGE	MUMBAI	
		CD INDUSTRIES		
9	PAINT	BERGER PAINTS	KOLKATA	
		ASIAN PAINTS	MUMBAI	
		SHALIMAR PAINTS	KOLKATA	
		JENSON & NICOLSON	KOLKATA	
		GUNJAN PAINT	MUMBAI	
	ELECTRICAL:			
10	LT MOTORS	KEC	BANGALORE	
		SIEMENS	MUMBAI	
		ABB	FARIDABAD	
		CROMPTON GREAVES LTD	MUMBAI	
		BHARAT BIJLEE	MUMBAI	
		NGEF	BANGALORE	
		MARATHON	KOLKATA	
		JYOTI	VADODARA	
		LHP	SOLAPUR	
	C&I:			
11	LOCAL CONTROL PANEL	INDSUSTRIAL SWITCHGEAR & APPS	MUMBAI	BOM OF THE LCP SHALL BE SUBJECT TO BHEL/ CUSTOMER APPROVAL DURING DETAILED ENGINEERING.
		PROCON	CHENNAI	
		CONTROL & SWITCHGEAR		
		PYROTECH	UDAIPUR	
		DELTA CONTROL	MUMBAI	
		RITTAL		
		SUCHITRA		
		INDUSTRIAL CONTROLS & APPLIANCES LTD.		
12	INST CABLES (SCREENED)	RELIANCE	BANGLORE	
		DELTON	FARIDABAD / NEW DELHI	
		NICCO	KOLKATA	
		CHORDS CABLE	BHIWADI	
		UNIVERSAL	SATNA	
		INCAB	PUNE	
		POLYCAB	DAMAN	
13	LT CONTORL CABLES	DELTON	FARIDABAD/N EW DELHI	
		FINOLEX	PUNE	
		NICCO	KOLKATA	
		PARAMOUNT CABLES	ALWAR	
		FGI	KOLKATA	
		POLYCAB WIRES	DAMAN	
		TORRENT CABLES	NADIAD	
		FINOLEX	PUNE	
		INDUSTRIAL CABLE	RAJPURA	

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		THERMOCABLES	HYDERABAD	
		ADVANCE CABLE TECHNOLOGIES	BANGALORE	
		APAR INDUSTRIES	MUMBAI	
		CMI LTD.	FARIDABAD	
		CRYSTAL CABLE INDUSTRIES	KOLKATA	
		DIAMOND POWER	VADODARA	
		ELKEY TELELINKS	NEW DELHI	
		GOVIND CABLES	KOLKATA	
		HAVELLS INDIA	NOIDA	
		KEI INDUSTRIES	DELHI	

14	LEVEL GAUGE	BLISS ANAND PVT. LTD.	
		TOSHNIWAL BROTHERS PVT.LTD.	MAKE:NIVO CONTROLS
		SIGMA INSTRUMENTS CO.	
15	TRANSMITTERS	ABB LIMITED	PRESSURE TRANSMITTER, DP TRANSMITTER and TEMP TRANSMITTER
		Pune Techtrol Pvt. Ltd.	Only for capacitance Type Level Transmitter
		V. AUTOMAT & INSTRUMENTS (P) LTD.	a)DISPLACEMENT TYPE TRANSMITTERS. b)PRESSURE AND DP TRANSMITTERS
		Moore Industries International Inc.	
		PANAM ENGINEERS	For Pressure and Diff. Pressure transmitter
		TOSHNIWAL INDUSTRIES PVT. LTD.,	
		Endress + Hauser (India) Pvt. Ltd.,	
		YOKOGAWA INDIA LIMITED,	
		SBEM PVT. LTD.	FOR CAPACITANCE TYPE.
		SIEMENS LIMITED	
		EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	
		SMART INSTRUMENTS LTD, BRAZIL	LD-301 & T-301 TRANSMITTER FROM M/S SMART EQUIPMENTS BRAZIL.
		NIVO CONTROLS PVT. LTD.	For Capacitance type only
		Honeywell Automation India Limited	
16	JUNCTION BOX	Shrenik & Company,	
	JUNCTION BOX	SUCHITRA INDUSTRIES	
	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Metal type junction box only
	JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	
	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	
17	INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	

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	INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	
	INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	
	INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	
17	INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	
	INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	
	INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	
	INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	
	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	
	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	
	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	
	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	
	INSTRUMENT FITTINGS	AURA INCORPORATED	
	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	
	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	
	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	
	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	
	INSTRUMENT FITTINGS	PANAM ENGINEERS	
19	Pressure gauge and differential Pressure gauge	SWITZER, CHENNAI. AN INSTRUMENTS, KOLKATA, H GURU, NEW DELHI. MANOMETER INDIA, MUMBAI. GIC, MUMBAI/GOA. GLUCK INDIA, MUMBAI. BUDENBERG GAUGE. DRESSER IND. FORBES MARSHALL. WAREE.	

Notes:-

1. Bidder to note that geared motor of REMI make for stirrers (for stirrers of REMI make ONLY) is acceptable to BHEL.
 2. All the finally selected sub vendors shall be subject to customer approval during detailed engineering without any delivery/ commercial implications to BHEL/ Customer.
 3. Calibration column may be purchased from sources as per pump manufacturer's recommendation.
 4. The sub vendor list 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 certificate as applicable) etc. The same shall subject to BHEL and Customer approval during detailed engineering stage without any technical, commercial & delivery implication to BHEL or customer.

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DRAWING DOCUMENTS DISTRIBUTION SCHEDULE

TABLE-2

SL NO	DESCRIPTION	NTPC ENGG	NTPC SITE	BHEL SITE	BHEL PEM
1	Drawing/Document for approval				
	Vendor to BHEL/NTPC	--	--	--	SC
2	Inspection/Test report				
	Vendor to BHEL/NTPC	--	--	--	2+SC
3	O&M Manual for approval				
	Vendor to BHEL/NTPC	--	--	--	SC
4	Final approved drawing/document (as built/O&M Manual)	--	2+2CD	2+2CD	--

Note-1: SC: Soft copy, CD-Compact Disc.

Note-2: All soft copy (Autocad/EXCEL/Microsoft Word/Stad/etc) document shall be submitted by bidder whenever required by BHEL/Customer/Consultant.

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TABLE -3

LIST OF COMMISSIONING SPARES

Sl.No.	Description	Quantity
1.1	Oil Seals for drive end for motor	4 Nos.
1.2	Gaskets for drive end for motor	4 Nos.
1.3	Guide ring for plunger.	4 Nos.
1.4	Teflon rings for valve/s.	4 Nos.
1.5	Level gauge glass	4 Nos.
1.6	Back up fuse	4 Nos.
1.7	Pilot lamp	4 Nos.
1.8	Push Button	4 Nos.
1.9	Control fuse	4 Nos.
1.10	Bulb for Annunciation	4 Nos.

TABLE -4

LIST OF MANDATORY SPARES

Sl.No.	Description	Quantity
A	All types of local indicators	
1.1	Level Gauge/Indicator	1 No
1.2	Pressure gauge/indicator	1 No
1.3	Differential Pressure gauge/indicator	1 No
B	All type of Electronic Transmitters and Ultrasonic Transmitters including sensors.	
1.1	Level Transmitter	1 No
1.2	Pressure Transmitter	1 No
1.3	Differential Pressure Transmitter	1 No
C	Agitator	
1.1	Impeller assembly	1 No
1.2	Bearing assembly	1 No
1.3	Motor	1 No
1.4	Belt and pully	1 No
1.5	Gear box assembly	1 No
1.6	Agitator shaft assembly	1 No
1.7	Complete agitator assembly	1 No

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PAINTING SPECIFICATION (ANNEXURE-I)

CLAUSE NO.	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..
1.05.0	SURFACE PREPARATION
1.05.01	All surfaces to be painted shall be thoroughly cleaned of oil. Grease and other foreign material. Surfaces shall be free of moisture and contamination from chemicals and solvents.
1.05.02	The following surface preparation schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer. SP1 Solvent cleaning SP2 Application of rust converter (Ruskil or equivalent grade) SP3 Power tool cleaning SP4 Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer) SP4* Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns SP5 Shot blasting/ abrasive blasting. SP6 Emery sheet cleaning/Manual wire brush cleaning.
1.06.00	APPLICATION OF PRIMER/PAINT
1.06.01	The paint/primer manufacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification. The Dry film thickness (DFT) of primer/paint shall be as specified herein.
1.06.02	Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.
1.06.03	Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.
1.06.04	Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected. Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.



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CLAUSE NO.	TECHNICAL REQUIREMENTS
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-06 (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
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.

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CLAUSE NO.	TECHNICAL REQUIREMENTS
	(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.

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1.06.10 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.	SP3/SP4	PS 5	2	25	-	-	-	PS 4	3	35	155	
3	Constant Load Hanger (CLH) and Variable Load Hanger (VLH)	SP4*	PS19	1	35	-	-	-	PS17	1	30	70	
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	
5.	Valves												
	a.) Cast / Forged Design Temo < 60 °C Design Temo > 60 °C	SP1/SP2 /SP3	PS9	1	20				PS 9	1	20	40	
			#PS9*	1	20	-	-	-	#PS9*	1	20	40	



6.	All auxiliary Structural Steel components for pipe supports	Outside TG building and in SG envelope	SP4*	Inorganic Ethyl Zinc Silicate	1	75	PS18	1	75	a)Epoxy coat b)Final coat of paint PS17	2 1	35 30	250
		Within TG building	SP4*	-do-	1	35	PS18	1	35	a)Epoxy coat b)Final coat of paint PS17	2 1	25 30	150
7.	Weld Edges	SP6 (Hand cleaning by wire burshing)	PS13 (Weldable primer)	1	25	-	-	-	-	-	-	-	
B) Steam Generator & Auxiliaries:													
1	All surfaces with temperature 95°C or less and which are insulated	SP3/SP4	PS 5	2	30	-	-	-	PS 4	2 \$	20 \$	100 \$	
2	All surfaces with temperature above 95°C and which are insulated	SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	
Note: 1) SG membrane walls and other Flue gas swept pressure part surfaces shall be applied with appropriate primer for protection of surfaces during transit, storage and erection. 2) Painting specification for all other exposed steel surfaces not covered above shall be same as that given in Civil Sub-section, Part-B, Section VI for corrosion protection of steel structures.													
C) LOW PRESSURE PIPING													
1	All 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

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2	Condensate storage tank, (External painting)	SP3/SP5	Epoxy paint minimum DFT 150 micron (finish paint to be preceded by suitable primer paint)	shade/ coding scheme
3	Condensate storage tank (Inside protection)	SP3/SP5	Solvent free epoxy coating (minimum two coats) of total DFT 200 microns.	As per NTPC Colour shade/ coding scheme
4	Drinking water tank (Protection of Internal surface)(if applicable)		Two coats of food grade epoxy paint.	
5	Stainless steel surface, Galvanized steel surface and gun metal surface.		No Painting	
6	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.	

PAINTING FOR ELECTRICAL EQUIPMENT

Unless explicitly stated in relevant chapters of the specification, the painting of all electrical equipment shall be as follows:

Epoxy based with suitable additives. The thickness of finish coat shall be minimum 50 microns (minimum total DFT shall be 100 microns). Paint shade shall be as per technical specification.

Note:

- (i) Painting requirement as indicated above are bare minimum. However any variation in the painting schedule as finally approved by BHEL / Customer shall be taken care by the bidder without any commercial and delivery implication to BHEL / Customer. Colour coding scheme shall be intimated to vendor during detail engineering.

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QUALITY PLAN

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SL NO.	COMPONENT & OPERATIONS	CHARACTERISTIC S	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	* D	**			
					M	C/ N					M	C	N	
1.0	WELDER'S QUALIFICATION													
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	ASME IX		ASME IX	ASME IX	QW 483 & QW 484	√	P	V	V	
2.0	TANKS													
2.1	RAW MATERIAL													
2.1.1	PLATE	CHEM & PHY PROP.	MA	CHEM & PHY TEST	1/PLATE/ HT BATCH		ASTM A 240 GR. TP 304/316		MFG. TC/LAB REPORT	√	P	V	V	IDENTIFICATION BY BHEL
		IGC TEST	MI	IGC TEST			ASTM A 262 PR 'E'			√	P	V	V	
2.1.2	PIPE FOR NOZZLE	CHEM & PHY PROP.	MA	CHEM & PHY TEST	1/HT BATCH/SIZE		ASTM A 240 GR. TP 304/316		MFG. TC/LAB REPORT	√	P	V	V	
		MICRO STRUCTURE	MI	GRAIN STRUCTURE			FOR HEAT TREATMENT			√	P	V	V	
		IGC TEST	MI	IGC TEST			ASTM A 262 PR 'E'			√	P	V	V	
2.2	IN PROCESS													
2.2.1	DISHED ENDS	DIMENSION	MA	MEASUREMENT	100%		APPROVED DRAWING/DOCUMENT.		MFG. TC/LAB REPORT	√	P	V	V	
		SURFACE DEFECTS ON WELDING	MA	DP TEST	100%		ASTM E 165	NO SURFACE DEFFECTS		√	P	V	V	
3.0	STIRRER													
3.1	RAW MATERIAL FOR SHAFT	CHEM & PHY PROP.	MA	CHEM & PHY TEST	1/BAR				MFG. TC/LAB REPORT	√	P	V	V	
		IGC TEST	MI	IGC TEST	1/HT BATCH		ASTM A 262 PR 'E'			√	P	V	V	
3.2	IMPELLER	CHEM PROP.	MA	CHEM TEST	1/PLATE		ASTM A 479 GR TP 304/316			√	P	V	V	
3.3	COMPLETE STRIRRER WITH MOTOR	PERFORMANCE IN WATER FILED TANK												
		VIBRATION	MA	MEASUREMENT	100%		APPROVED DRAWING/DOCUMENT.		MFG. TC	√	P	V	V	
		WOBBLING	MA	VISULA	100%		NO WOBBLING		MFG. TC	√	P	V	V	

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Reviewed by:			Reviewed by:		

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Sign & Date	
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1	2	3	4	5	6		7	8	9	* D	**			
					M	C/ N					M	C	N	
4.0	MOTORS	ROUTINE TEST	MA	MFG. TC	100%		APPROVED DRAWING/DOCUMENT.		MFG. TC	√	P	V	V	
		TYPE TES	MA	MFG. TC	1/SIMILAR FRAME SIZE		APPROVED DRAWING/DOCUMENT.		MFG. TC	√	P	V	V	
		DEGREE OF PROTECTION	MA	MFG. TC			APPROVED DRAWING/DOCUMENT.		MFG. TC	√	P	V	V	
5.0	METERING PUMP													
5.1	RAW MATERIAL													
5.1.1	WETTED PARTS	CHEM & PHY PROP.	MA	CHEM & PHY TEST	1/BAR		APPROVED DRAWING/DOCUMENT.		MFG. TC/LAB REPORT	√	P	V	V	
		SURFACE TEST	MI	UT ON BAR>25 MM DIA	100%		ASTM A 388	REFER NOTE-1		√	P	V	V	
				DP ON M/C SURFACE	100%		ASME-E-165	NO SURFACE DEFECT		√	P	V	V	
5.2	FINAL INSPECTION													
	PUMP WITH MOTOR	CAP/STROKE	MA	PERFORMANCE	100%		API 675	API 675	INSPECTIO N REPORT	√	P	V	V	SHALL BE TESTED WITH EITHER JOB MOTOR OR SHOP MOTOR OF SIMILAR FRAME SIZE
		ACCURACY	MA	SHOP TEST	100%		API 675	API 675		√	P	V	V	
		REPEATABILITY	MA	SHOP TEST	100%		API 675	API 675		√	P	V	V	
		POWER DRAWN @ 100% STROKE	MA	MEASURED AT WORK	100%		APPROVED DRAWING/DOCUMENT			√	P	V	V	
		LEAKAGE	MA	HYDRO TEST	100%		@1.5X DESIGN PRESSURE	NO LEKEAGE		√	P	V	V	
		DIMENSIONS	MA	MEASUREMENT	100%		APPROVED DRAWING/DOCUMENT			√	P	V	V	
		NOISE	MA	MEASUREMENT	100%		--	< 85 dbA AT 1 M RADIUS		√	P	V	V	
		VIBRATION	MA	MEASUREMENT	100%		--	≤45 MICRONS (PEAK TO PEAK)		√	P	V	V	
6.0	PRESSURE RELIEF VALVE	SET & RESET PRESSURE.	MA	PERFORMANCE	100%		API RP 520	API RP 520	MFG. TC	√	P	V	V	
		DIMENSIONS	MA	MEASUREMENT	100%		APPROVED DRAWING/DOCUMENT		MFG. TC	√	P	V	V	
		LEAKAGE DURING PERFORMANCE TEST	MA	VISUAL	100%		NO LEAKGE.	NO LEAKGE.	MFG. TC	√	P	V	V	

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1	2	3	4	5	6		7	8	9	* D	**			
					M	C/ N					M	C	N	
7.0	VALVES (GATE/GLOBE/NRV/BALL)													
7.1	RAW MATERIAL													
	BODY,BONNET COVER	CHEM & PHY PROP.	MA	CHEM.& PHY TEST	1/HT BATCH		APPROVED DRAWING/DOCUMENT		MFG. TC/LAB REPORT	√	P	V	V	
		HEAT TREAT.	MA	HEAT TREATMENT	1/HT BATCH		APPROVED DRAWING/DOCUMENT			√	P	V	V	
	TRIM MATERIAL	CHEM & PHY PROP	MA	CHEM.& PHY TEST	1/BAR/SIZE		APPROVED DRAWING/DOCUMENT			√	P	V	V	
7.2	ASSEMBLY													
		LEAKAGE (BODY & SEAT)	MA	HYDRO TEST	100%		APPROVED DRAWING/DOCUMENT	NO LEAKAGE	MFG. TC/LAB REPORT	√	P	V	V	
		LEAKAGE (SEAT)	MA	PNEUMATIC TEST	100%			NO LEAKAGE		√	P	V	V	
		DIMENSIONS	MA	MEASUREMENT	100%		APPROVED DRAWING/DOCUMENT			√	P	V	V	
8.0	FITTINGS/FLANGES													
	RAW MATERIAL	CHEM & PHY PROP.	MA	CHEM.& PHY TEST	1/HT BATCH		ASTM A 182 GR TP 304/316		MFG. TC/LAB REPORT	√	P	V	V	
		HEAT TREAT.	MA	HEAT TREATMENT	100%		ASTM A 182 GR TP 304/316			√	P	V	V	
		IGC TEST	MI	IGC TEST	1/HT BATCH		ASTM A 262 PR ‘E’			√	P	V	V	
9.0	STRAINERS													
9.1	RAW MATERIAL FOR BODY	PHY.& CHEM. PROPERTIES	MA	PHY. & CHEM.TEST	1/BAR/SIZE		APPROVED DRAWING/DOCUMENT		MFG. TC/LAB REPORT	√	P	V	V	
9.2	SCREEN	CHEMICAL	MA	CHEMICAL	1/SIZE		APPROVED DRAWING/DOCUMENT			√	P	V	V	
		MESH SIZE	MA	MEASUREMENT	1/SIZE		APPROVED DRAWING/DOCUMENT			√	P	V	V	
9.3	FINAL INSPECTION	DIMENSIONS	MA	MEASUREMENT	100%		APPROVED DRAWING/DOCUMENT		MFG. TC	√	P	V	V	
		LEAKAGE	MA	HYDRO TEST	100%		APPROVED DRAWING/DOCUMENT	NO LEAKAGE	MFG. TC	√	P	V	V	
10.0	PIPES													

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1	2	3	4	5	6		7	8	9	* D	**			
					M	C/ N					M	C	N	
10.1	MATERIAL	CHEMICAL	MA	CHEMICAL	1/HT BATCH/SIZE		ASTM A 312 GR.TP 304/316	MFG. TC/LAB REPORT	√	P	V	V	IDENTIFICATION BY BHEL. REFER NOTE-2 AND NOTE-3.	
		MECHANICAL TEST	MA	MECHANICAL TEST	1/HT BATCH/SIZE		ASTM A 312 GR.TP 304/316		√	P	V	V		
		MICRO STRUCTURE	MI	GRAINS STRUCTURE	1/HT BATCH/SIZE		FOR HEAT TREATMENT		√	P	V	V		
		IGC TEST	MI	IGC TEST	1/HT BATCH/SIZE		ASTM A 262 PR 'E'		√	P	V	V		
		HYDRO TEST	MA	LEAKAGE	100%		NO LEAKAGE	NO LEAKAGE	MFG. TC/IR	√	P	V	V	
11.0	INSTRUMENT (LG/PG/LT/PT/DPG/DPT)													
	RAW MATERIAL FOR WETTED PARTS	CHEM. PROP.	MA	CHEM. TEST.	1/HT BATCH		APPROVED DRAWING/DOCUMENT	MFG. TC/LAB REPORT	√	P	V	V		
	FINAL INSPECTION	DIMENSION	MI	MEASUREMENT.	100%		APPROVED DRAWING/DOCUMENT		√	P	V	V		
		ACCURACY	MA	CALIBRATION	100%		APPROVED DRAWING/DOCUMENT		√	P	V	V		
		DEGREE OF PROTECTION	MA	TYPE TEST	100%		APPROVED DRAWING/DOCUMENT		√	P	V	V		
12.0	CONTROL PANEL													
		DIMENSIONS	MA	MEASUREMENT	100%		APPROVED DRAWING/DOCUMENT	INSPECTIO N REPORT	√	P	V	V		
		CONTINUITY, IR-HV-IR	MA	ELECTRICAL	100%		APPROVED DRAWING/DOCUMENT		√	P	V	V		
		VERIFICATION OF MAKE	MA		100%		APPROVED DRAWING/DOCUMENT		√	P	V	V		
		RATING OF COMPONENTS	MA		100%		APPROVED DRAWING/DOCUMENT		√	P	V	V		
		PAINT SHADES, THICKNESS	MA		100%		APPROVED DRAWING/DOCUMENT		√	P	V	V		
		ADHESION	MA		100%		APPROVED DRAWING/DOCUMENT		√	P	V	V		
		DEGREE OF PROTECTION	MI		100%		APPROVED DRAWING/DOCUMENT	MGF. TC/ LAB REPORT	√	P	V	V		

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:			Checked by:		
Reviewed by:			Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			Page 24 of 112
Approved by:			

872/2020/PS-PEM-MAX 	MANUFACTURER/ SUPPLIER NAME & ADDRESS	BIDDER/	QUALITY PLAN FOR CHEMICAL DOSING SYSTEM				SPEC. NO : PE-TS-468-154-A001			DATE:	
			PROJECT: 2X250 MW BHILAI TPP (NSPCL). (FGD SYSTEM PACKAGE).				QP NO.: PE-QP-468-154-A001			SHEET 5 OF 5	

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTIC S	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	* D	**			
					M	C/ N					M	C	N	
13.0	COMPLETE SKID ASSEMBLY													
		DIMENSIONS & ORIENTATION	CR	MEASUREMENT	100%		APPROVED DRAWING/DOCUMENT		INSPECTIO N REPORT	√	P	W	V	
		LEAKAGE, CHECK ON WELDMENTS		VISUAL & HYD TEST	100%		DISCH.PIPING - 1.5 x DISCH PR. OF PUMP, SUCTION PIPING -10 KG/CM2	NO LEAKAGE		√	P	W	V	
		FUNCTIONAL TEST FOR INTERLOCKS	MA	VISUAL	100%		APPROVED DRAWING/DOCUMENT			√	P	W	V	
		LEAKAGE IN TANK		VISUAL & HYD TEST	100%		WATER FILL TEST FOR 2 HR.		NO LEAKAGE	√	P	W	V	
	PMI TEST FOR SS	GRADE CONFIRMATION	MA	CHEM. TEST	100%		APPROVED DRAWING/DOCUMENT		LAB REPORT	√	P	W	V	
		PAINTING	MA	VISUAL AND MEASUREMENT.	100%		APPROVED DRAWING/DOCUMENT		INSPECTIO N REPORT	√	P	V	V	
		PACKING	MA	VISUAL AND MEASUREMENT.	100%		APPROVED DRAWING/DOCUMENT		INSPECTIO N REPORT	√	P	W	V	

LEGENDS:

*RECORDS, IDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,

** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, C: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, N: CUSTOMER, P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE. MA: MAJOR, MI: MINOR, CR: CRITICAL.

NOTE-1: WHEN BACK WALL ECHO IS SET TO 100% OF FSH IN SOUND AREA, DEFECT ECHO SHALL NOT EXCEED 20% OF FSH. MAX BACH WALL ECHO IS 20% OF FSH. TOTAL NO OF DEFECTS SHALL BE MAX. 5 NO IN ONE METER LENGTH. MIN DISTANCE BETWEEN TWO DEFECTS SHALL BE 3 TIMES THE DIA OF BAR.

NOTE-2: FOR PIPES PURCHASED DIRECTLY FROM MANUFACTURER'S OR AUTHORIZED DEALERS, APART FROM TC REVIEW, CHECK WILL BE AS PER CLAUSE 2.1.2 AND 10.0; HOWEVER, FOR HYDRAULIC TEST, MANUFACTURER TC SHALL BE REVIEWED. IN CASE ON IMPORTED PIPES PURCHASED FROM OPEN MARKET, TEST SHALL BE PERFORMED AS PER CLAUSE 2.1.2 AND 10.0 (INCLUDING HYDRAULIC TEST).

NOTE-3: NDT REQUIREMENT ON WELDING (TANK, PIPE, BREATHER/WATER SEAL/CO2 ABSORBER) SHALL BE AS -- A) ON BUTT WELD-- 25% DP & 25% RT FOR PUMP SUCTION SIDE & 100% DP & 100% RT FOR PUMP DISCHARGE SIDE. B) ON FILLET WELD--100% DP TEST

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:			Checked by:					Reviewed by:			Page 25 of 112
Reviewed by:			Reviewed by:					Approved by:			

8/2/2020/PS-PEM-MAX



TITLE: TECHNICAL SPECIFICATION
FOR CHEMICAL DOSING SYSTEM (NaOH DOSING).
PROJECT: 2X250 MW BHILAI TPP (NSPCL).
(FGD SYSTEM PACKAGE).

BHEL DOCUMENTS NO.: PE-TS-468-154-A001

VOLUME II-B

SECTION -C1

REV. NO. 00

DATE:

DATA SHEET-A

SL.No.	Description	NaOH
1.0	No. of skid	One (1) for entire Plant.
2.0	Mixing cum storage tank	
2.1	No. of tanks per Skid	One
2.2	Capacity in litres	500
2.3	Type	
2.4	Material of the tank	SS-316
2.5	Thickness	6 mm
2.6	Motorised Stirrer	Provided with reduction gear for 200 RPM.
2.7	Dissolving basket	Provided (30 mesh B.S.) of SS 316.
2.8	Type of agitator	Motor operated
2.9	Instrument	Refer P&ID.
3.0	METERING PUMP	
3.1	Quantity	2 Nos (1W+1S)
3.2	Type	Positive displacement (Plunger type) metering pump.
3.3	Capacity and Head	10 LPH and 10 kg/cm ²
3.4	MOC	All wetted part SS 316.
3.5	NRV and PRV	1 No per pump shall be provided.
4.0	Piping:	
4.1	Material & rating	SS-316 (Sch 40 min)
3.2	Diameter	25 NB
5.0	Valves:	
5.1	Body Material	SS-316
5.2	Weld ends	Socket weld ends
6.0	Fittings & Flanges	SS 316, CL 300
7.0	Structural steel	MOC: IS 2062
8.0	Ladder and platform (with Chequered Plate)	Shall be provided to reach top of tank and chemical filling
9.0	Nuts/Bolts/Fastners	MOC: Stainless Steel.

8/2/2020/PS-PEM-MAX



TITLE: TECHNICAL SPECIFICATION
 FOR CHEMICAL DOSING SYSTEM (NaOH DOSING).
 PROJECT: 2X250 MW BHILAI TPP (NSPCL).
 (FGD SYSTEM PACKAGE).

BHEL DOCUMENTS NO.: PE-TS-468-154-A001

VOLUME II-B

SECTION -C1

REV. NO. 00

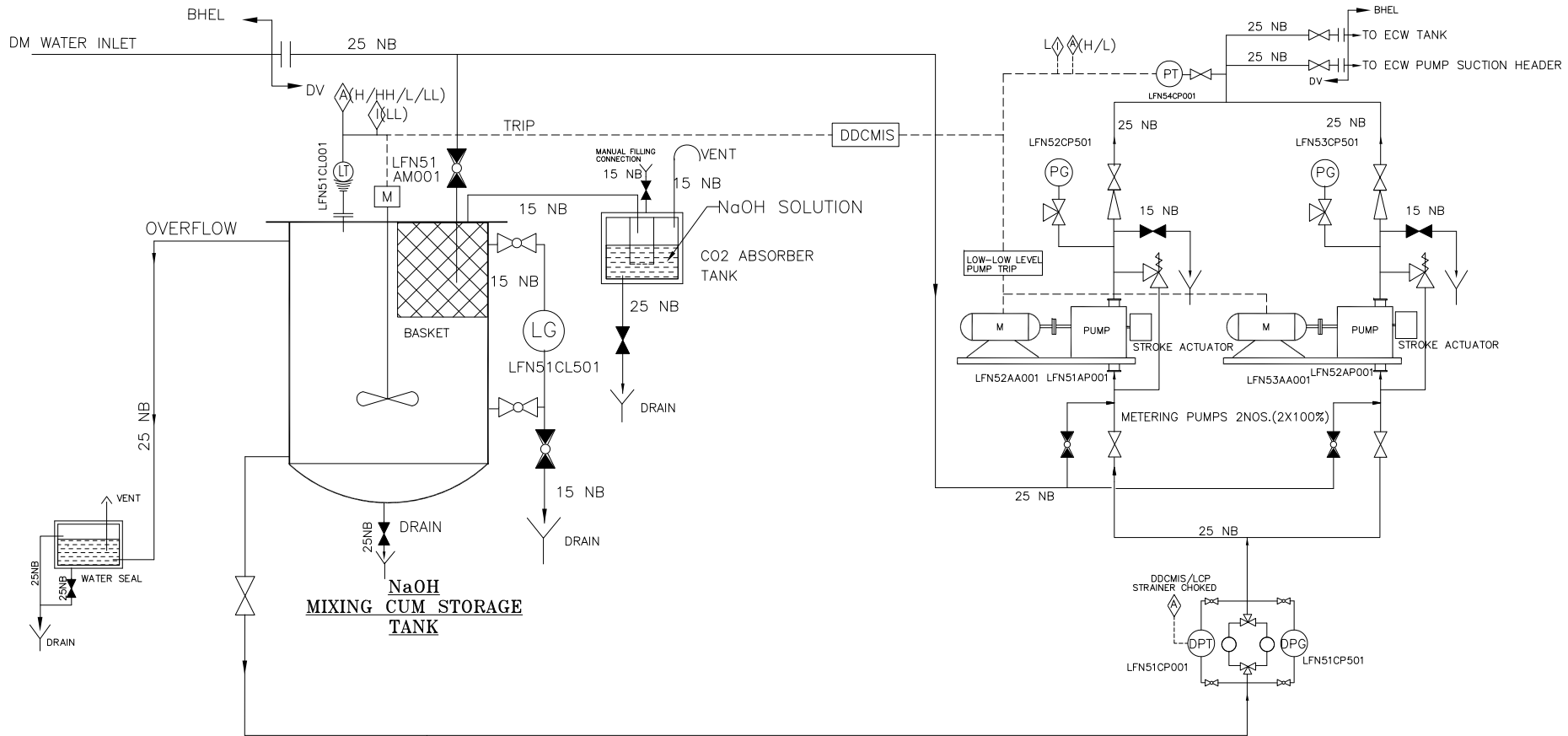
DATE:

DRAWING

(P&ID FOR NaOH DOSING SYSTEM)

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It must not be used directly or indirectly in any way detrimental to the interest of the Company

COMPUTER FILE NAME : C:\ZZZ.dwg



LEGEND	
	GATE VALVE NORMALLY OPEN
	GATE VALVE NORMALLY CLOSED
	GLOBE VALVE NORMALLY CLOSED
	GLOBE VALVE NORMALLY OPEN
	LEVEL TRANSMITTER (ULTRA SONIC TYPE)
	LEVEL GAUGE
	MOTOR OPERATED (AC)
	FUNNEL
	COUNTER FLANGE
	DUPLEX FILTER
	PRESSURE TRANSMITTER
	DIFFERENTIAL PRESSURE TRANSMITTER
	DIFFERENTIAL PRESSURE GAUGE

DV: DOSING VENDOR

OWNER NTPC Limited (A GOVERNMENT OF INDIA ENTERPRISE)	
PROJECT 2X250 MW BHILAI TPP (NSPCL) (FGD SYSTEM PACKAGE)	
DESIGN Bharat Heavy Electricals Ltd PROJECT ENGINEERING MANAGEMENT NOIDA	DATE 01/01/01
TITLE P&ID DIAGRAM FOR NaOH DOSING SYSTEM	
DRAWING No. Page 28 of 112-DG-468-154-A001	
SHEET 01 OF 01 REV 00	

8/2/2020/PS-PEM-MAX



TITLE: TECHNICAL SPECIFICATION
 FOR CHEMICAL DOSING SYSTEM (NaOH DOSING).
 PROJECT: 2X250 MW BHILAI TPP (NSPCL).
 (FGD SYSTEM PACKAGE).

BHEL DOCUMENTS NO.: PE-TS-468-154-A001

VOLUME II-B

SECTION –C2

REV. NO. 00

DATE:

SECTION – C2

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

	TITLE : ELECTRICAL EQUIPMENT SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION : I
		REV NO. : 00 DATE :
		SHEET : 1 OF 3

TECHNICAL SPECIFICATION
FOR
CHEMICAL DOSING SYSTEM
(ELECTRICAL PORTION)

	TITLE : ELECTRICAL EQUIPMENT SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION : I
		REV NO. : 00 DATE : SHEET : 2 OF 3

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

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for CHEMICAL DOSING SYSTEM (all AC & DC loads at different voltage levels like 415V AC, 240 V AC, 220 V DC etc).
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
- i) ~~Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.~~
- j) ~~Cable BOQ worked out based on routing of cable listing provided by the vendor for “both end equipment in vendor’s scope” shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.~~

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

Refer “Electrical Scope between BHEL and Vendor”.

3.0 **DOCUMENTS TO BE SUBMITTED ALONG WITH BID**

3.1 ~~The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.~~

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

	TITLE : ELECTRICAL EQUIPMENT SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION : I
		REV NO. : 00 DATE :
		SHEET : 3 OF 3

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) Technical specification for motors.
- c) Datasheets & ~~quality plan~~ for motors.
- d) Electrical Load data format (Annexure –II)
- e) ~~BHEL cable listing format (Annexure –III)~~

ANNEXURE - I

REV : 0

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR FOR SKID MOUNTED SYSTEM (FOR EPC PROJECTS)

PACKAGE : CHEMICAL DOSING SYSTEM

SCOPE OF VENDOR: SUPPLY

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V, 3 phase, 4 wire AC supply shall be provided by BHEL. based on the load data provided by the vendor at contract stage for all equipment supplied by the vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local control panel	Vendor	Vendor*	Refer C & I specification for details
3	Local push buttons	Vendor	Vendor*	
4	Power cables, ordinary control cables and screened control cables	Vendor	Vendor*	Within the skid. If starters are in MCC, then outside skid, cables scope shall be as per note no. 1.
5	Junction box for control & instrumentation cable (if applicable)	Vendor	Vendor*	
6	Cable trays, accessories & cable trays supporting system. 100/50 mm cable trays/Conduits/Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs as per approved layout drawing during contract stage.
7	Any special type of cable like compensating, co-axial, prefab, MICC & fibre optical	Vendor	Vendor*	Within the skid
8	Equipment grounding	Vendor	Vendor*	Within the skid. All equipment metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL.
9	Motors with base frame and fixing hardware for motors.	Vendor	Vendor*	Makes shall be subject to customer/ BHEL approval at contract stage.

Page 1 of 2

ANNEXURE - I

REV : 0

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR FOR SKID MOUNTED SYSTEM (FOR EPC PROJECTS)

PACKAGE : CHEMICAL DOSING SYSTEM

SCOPE OF VENDOR: SUPPLY

10	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor*	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
11	Conduit and conduit accessories for cabling between equipments supplied by vendor.	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
12	Below grade grounding	BHEL	BHEL	
13	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
14	Electrical Equipment GA drawing & skid GA drawing	Vendor	-	For necessary interface review.

NOTES :- 1. If motor starters are provided in main MCC then BHEL will provide power & control cable including supply, laying & termination.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.

*E & C by vendor during factory assembling of the skid.

ANNEXURE - II

[illegible]

8/2/2020/PS-PEM-MAX



TITLE: TECHNICAL SPECIFICATION
 FOR CHEMICAL DOSING SYSTEM (NaOH DOSING).
 PROJECT: 2X250 MW BHILAI TPP (NSPCL).
 (FGD SYSTEM PACKAGE).

BHEL DOCUMENTS NO.: PE-TS-468-154-A001

VOLUME II-B

SECTION –C3

REV. NO. 00

DATE:

SECTION – C3 SPECIFIC TECHNICAL REQUIREMENTS (CONTROL AND INSTRUMENTATION)

	TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM (NaOH DOSING). PROJECT: 2X250 MW BHILAI TPP (NSPCL). (FGD SYSTEM PACKAGE).	BHEL DOCUMENTS NO.: PE-TS-468-154-A001	
		VOLUME II-B	
		SECTION –C3	
		REV. NO. 00	DATE:

OPERATION AND CONTROL PHILOSOPHY:

The normal mode of operation of NaOH dosing system shall be from **DDCMIS** including **ON/OFF** command to individual pumps.

A local panel comprising of '**ON**' & '**OFF**' push button and an emergency '**OFF**' push button along with '**ON/OFF**' indication shall be provided. The emergency '**OFF**' Push Button shall be wired directly to MCC whereas **ON & OFF** push button shall be routed to **DDCMIS**. The respected Auto stroke controllers shall also be provided in the local panel.

The local /remote selection along with remote control shall be provided in **DDCMIS** only.

The stroke position & adjustment will be done from DDCMIS and the stroke actuator shall be suitable for accepting 4-20 mA DC signal. The pumps shall be provided with 24 V DC, 2- wire LVDT Type Position feed back transmitter to generate 4-20 mA DC signal to indicate stroke position.

The starter of all the motors shall be clubbed with main plant MCC.

All controls, fault indicators/alarms, interlocks, logics shall be implemented in DDCMIS only.

The ON/OFF operation of all motorized stirrers/pumps shall also be provided in DDCMIS with local ON/OFF and emergency OFF facility along with ON/OFF check backs.

The following signals/status shall be shown on local panel.

- Pump 1/2-ON, Stirrer 1-ON.
- Pump 1/2-OFF, Stirrer 1- OFF.
- Pump 1/2-Tripped, Stirrer 1- Tripped.

Following interlocks shall be provided at low-low Level in the mixing cum storage tank.

- i) Running Dosing pump shall be tripped.
- ii) Stirrer motor of the respective tank shall be tripped.

Following fault indications shall be provided in DDCMIS:

- i. Low level in the mixing cum storage tank.
- ii. Running Dosing pump motor & stirrer motor tripped due to low-low level.
- iii. Dosing Pump-1/2 trip due to over load.

Following conditions to be ensured before starting a pump/stirrer

- ii Level in the tank adequate.
- iii MCC not disturbed.

All the field instruments shall be terminated at local panel.

	SPECIFIC TECHNICAL REQUIREMENTS (C&I) FOR NaOH DOSING SYSTEM	
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Specific Technical Requirements (C&I):

- 1.0 Chemical Dosing System (NaOH Dosing) shall be operated from DCS (DCS-BHEL Scope of supply) through operator work stations.
- 2.0 Bidder to provide local control panel(LCP) for NaOH dosing system. This LCP will act as interface between the DCS and the field devices for commands & feedbacks.
In addition, LCP shall have the provision of command (start/stop) & feedback interface with plant DCS.
- 3.0 Bidder to supply all the instruments (LT, LG,PT,DPT,PG etc.) required for the package along with necessary fittings, accessories and valve manifold etc. All instruments shall be provided with durable epoxy coating for housing and all exposed surfaces of the instruments.
- 4.0 All the Electronic Transmitter for Pressure, Differential Pressure and DP based Flow /Level measurements shall be genuine, verifiable PROFIBUS PA compatible instruments. The transmitters shall be connected to DDCMIS through PROFIBUS PA protocol complying to IEC 61158 directly from transmitter. This is subject to customer approval and BHEL decision shall be final.
- 5.0 The junction boxes/LIEs for termination of instruments are in bidder's scope.
- 6.0 Complete C&I system for Chemical Dosing System is in bidder's scope of supply. Items not specifically mentioned however required for the completeness of the system shall be supplied by bidder without any commercial implication.
- 7.0 415 V/230 V AC Power supply shall be provided by BHEL at a single point (Please refer the Electrical Specification for more detail), further distribution to various instruments/equipment of the system shall be in bidder scope. Bidder to include necessary power distribution board, changeover circuit in his scope. Any power supply other than the above , UPS power etc., 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.

**SPECIFIC TECHNICAL REQUIREMENTS (C&I) FOR
NaOH DOSING SYSTEM**

- 8.0 Power supply derived for Transmitters, contact interrogation, interposing relay and solenoid shall generally be ungrounded 24 V D.C. only.
- 9.0 The make of the items shall be from sub-vendor list .However the make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict or repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- 10.0 The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards.
- 11.0 The scope of cable shall be referred in Electrical scope split sheet in Electrical portion of the specification.
- 12.0 Bidder shall provide Cable Schedule in BHEL excel format provided in Electrical portion of the specification. All cable interconnection details for complete system shall be in Bidders' scope.
- 13.0 Instrument installation and accessories required for the same shall be in Bidder's scope and shall be subject to customer/BHEL's approval during detailed engineering.
- 14.0 Bidder to provide erection hardware including junction boxes, canopies, structural steel as required.
- 15.0 Every panel-mounted instrument, requiring power supply, shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.
- 16.0 Provision for separate Terminal block/wiring diagram for power and control blocks of control panel to be ensured.
- 17.0 To ensure availability, adequate redundancy in system design shall be provided at hardware, software and sensor level. For the protection system, independent sensing device shall be provided to ensure adequate safety of plant equipment.

**SPECIFIC TECHNICAL REQUIREMENTS (C&I) FOR
NaOH DOSING SYSTEM**

- 18.0 The design of the control systems and related equipment shall adhere to the principle of 'Fail Safe' Operation wherever safety of personnel / plant equipment is involved and shall not cause a hazardous condition. However, it shall also be ensured that occurrence of false trips are avoided/minimized.
- 19.0 All panels, desks, cabinets shall be provided with a continuous bare copper ground bus. The ground bus shall be bolted to the panel structure on bottom on both sides. The bolts shall face inside of panels. The system ground shall be isolated from the panel ground with suitable isolators. All internal component grounds or common shall be connected to the system ground, which shall be fabricated of copper flat (size 25mm x 6mm min., length as applicable).
- 20.0 Bidder to perform tests of C&I items/instruments/systems as per quality plans/type test attached in the specification.
- 21.0 The requirements given are to be read in conjunction with detailed Technical specification enclosed.
- 22.0 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.
- 23.0 All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland. Gaskets, Fasteners, Counter and mating flange (SS316 material), nuts & bolts etc. shall also be included, wherever required with the field instruments.
- 24.0 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, suitable pressure class and same shall be in bidder's scope .
- 25.0 All instruments should be supplied with valid calibration and test certificates provided by OEM.

	SPECIFIC TECHNICAL REQUIREMENTS (C&I) FOR NaOH DOSING SYSTEM	
--	---	--

- | | |
|------|---|
| 26.0 | At least 20% spare unused terminals shall be provided everywhere including local junction boxes, instrument racks/enclosures, termination/marshalling cabinets, etc. |
| 27.0 | Double root valve shall be provided for all pressure tapings where the design pressure exceeds 40kg/cm ² . |
| 28.0 | All the instruments PG/DPG/DPT/PT etc. as applicable shall have chemical/diaphragm seal. |
| 29.0 | <p>Editable & pdf copy of Drawings/Documents and data to be furnished after award of the contract: List of Drawings/Documents and data to be furnished by bidder after award of the contract are mentioned under section" List Of Documents/Deliverables".</p> <ul style="list-style-type: none"> • GA & wiring diagram of local panel. • Power requirement. • Local control panel & instruments data sheet. • Instrument schedule • Alarm Schedule • Any other document decided during detailed engineering. |

Note:-

1. All equipment items shall be of latest design with proven on track record.
2. The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.
3. Documents of C&I System shall be submitted to end user/owner for approval during detail engineering. Changes, if any, shall be accommodated by the bidder without any price/time implication.

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TITLE: TECHNICAL SPECIFICATION
 FOR CHEMICAL DOSING SYSTEM (NaOH DOSING).
 PROJECT: 2X250 MW BHILAI TPP (NSPCL).
 (FGD SYSTEM PACKAGE).

BHEL DOCUMENTS NO.: PE-TS-468-154-A001

VOLUME II-B

SECTION –D1

REV. NO. 00

DATE:

SECTION – D1 GENERAL TECHNICAL REQUIREMENTS (MECHANICAL)

VOID

8/2/2020/PS-PEM-MAX



TITLE: TECHNICAL SPECIFICATION
 FOR CHEMICAL DOSING SYSTEM (NaOH DOSING).
 PROJECT: 2X250 MW BHILAI TPP (NSPCL).
 (FGD SYSTEM PACKAGE).

BHEL DOCUMENTS NO.: PE-TS-468-154-A001

VOLUME II-B

SECTION –D2

REV. NO. 00

DATE:

SECTION – D2 GENERAL TECHNICAL REQUIREMENTS (ELECTRICAL)

ANNEXURE-A

MOTORS

1.00.00 GENERAL REQUIREMENTS

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

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

1.03.00 Contactor shall provide fully compatible electrical system, equipment's, accessories and services.

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

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

1.06.00 The responsibility of coordination with electrical agencies and obtaining all necessary clearances for Contactors equipment and systems shall be under the Contactor scope.

1.07.00 Degree of Protection

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

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

2.00.00 CODES AND STANDARDS

- | | | |
|---------------------------------|---|-----------------------|
| 1) Three phase induction motors | : | IS/IEC:60034 |
| 2) Single phase AC motors | : | IS/ IEC:60034 |
| 3) Crane duty motors | : | IS:3177, IS/IEC:60034 |
| 4) DC motors/generators | : | IS:4722, IS/IEC:60034 |

	TITLE	SPECIFICATION NO.
	MOTORS	
	DATA SHEET – C	VOLUME II B
		SECTION D
		REV NO. 00 DATE
		SHEET 1 OF 2

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

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

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	LV MOTORS DATA SHEET-A	SPECIFICATION NO.	
			VOLUME	II B
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			REV NO.	DATE:
			SHEET 1	OF 2

ANNEXURE-III

1.0	Design ambient temperature	:	50 °C
2.0	Maximum acceptable kW rating of LV motor	:	200KW *
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Details of supply system		
a)	Rated voltage (with variation)	:	415V ± 10%
b)	Rated frequency (with variation)	:	50 Hz + 3 % to - 5%
c)	Combined voltage & freq. variation	:	10% (sum of absolute values)
d)	System fault level at rated voltage	:	50 kA for 1 sec
e)	Short time rating for terminal boxes		
o	110 kW and above (Breaker Controlled)	:	50 KA for 0.25 sec.
o	Below 110 kW (Contactor Controlled)	:	50 KA protected by HRC fuse
f)	LV System grounding	:	Solidly
5.0	Winding & Insulation	:	Class F with temp rise limited to class B
6.0	Minimum voltage for starting (As percentage of rated voltage)	:	85% for motor ratings below 110kW 80% for motor ratings from 110kW to 200kW.
7.0	Power cables data	:	Shall be given during detailed engg.
8.0	Earth Conductor Size & Material	:	Shall be given during detailed engg.
9.0	Space heater supply (for motors >=30kw)	:	240 V, 1ϕ, 50 Hz
10.0	Rating up to which Single phase motor	:	Acceptable below 0.2 kW
11.0	Locked rotor current		
a)	Limit as percentage of FLC	:	As per IS 12615
12.0	Makes	:	BHEL/ Customer approval (Package owner to take care)
13.0	Paint shade	:	Blue (RAL 5012) – Corrosion proof
14.0	Degree Of protection for motor/ terminal box	:	Degree of protection for various enclosures as per IEC60034-05 shall be as follows:-
i) Indoor motors - IP 54			
ii) Outdoor motors - IP 55			
iii) Cable box-indoor area - IP 54			
iv) Cable Box-Outdoor area - IP 55			
* LT motors of continuous duty shall be energy efficient IE3 class conforming to IS-12615			
15.0 TESTING REQUIREMENTS: IN LINE WITH SPECIFICATION			

872/2020/PS-PEM-MAX



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101
VOLUME NO. : **II-B**
SECTION : **D**
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SHEET : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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



1.0 INTENT OF SPECIFICATION

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

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

2.0 CODES AND STANDARDS

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

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

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

3.0 DESIGN REQUIREMENTS

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

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

3.3 Starting Requirements

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

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



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

3.3.3 The following frequency of starts shall apply

- i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)
- iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

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

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

3.5 **Stress During bus Transfer**

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

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

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

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

4.0 **CONSTRUCTIONAL FEATURES**

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

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

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

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



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- 4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.
- 4.5. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.
- 4.6. In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.
 In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.
- 4.7. **Terminals and Terminal Boxes**
- 4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.
 Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".
- 4.7.2 unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.
- 4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.
- 4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.
- 4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.
- 4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.
- 4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.
- 4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.
- 4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.
- 4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.



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- 4.9.1 Motors provided for similar drives shall be interchangeable.
- 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.
- 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.
- 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.
- 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.
- 4.9.6 Name plate with all particulars as per IS: 325 shall be provided
- 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

5.0 INSPECTION AND TESTING

- 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.
- 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.
- 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.
- 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

- a) OGA drawing showing the position of terminal boxes, earthing connections etc.
- b) Arrangement drawing of terminal boxes.
- c) Characteristic curves:
(To be given for motor above 55 kW unless otherwise specified in Data Sheet).
 - i) Current vs. time at rated voltage and minimum starting voltage.
 - ii) Speed vs. time at rated voltage and minimum starting voltage.
 - iii) Torque vs. speed at rated voltage and minimum voltage.
 For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
 - iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

3.00.00

5) Energy Efficient motors : IS 12615, IEC:60034-30

TYPE

3.01.00

AC Motors:

- a) Squirrel cage induction motor suitable for direct-on-line starting.
- b) Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be **Premium Efficiency class-IE3**, conforming to IS 12615, or IEC:60034-30.
- c) Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.
- d) Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.

3.02.00

DC Motors Shunt wound.

4.00.00

RATING

- (a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor.
- (b) Whenever the basis for motor or driven equipment ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.

5.00.00

TEMPERATURE RISE

Air cooled motors

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

Water cooled

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

6.00.00

OPERATIONAL REQUIREMENTS

6.01.00

Starting Time

6.01.01

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

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

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

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

6.02.00 **Torque Requirements**

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

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

6.03.00 **Starting voltage requirement**

(a) Up to 85% of rated voltage for ratings below 110 KW

(b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW

(c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW

(d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW

(e) Up to 75 % of rated voltage for ratings above 4000KW

7.00.00 **DESIGN AND CONSTRUCTIONAL FEATURES**

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

7.02.00 All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). The method of movement of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per IEC 60034-6. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor. Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below

(a) Fuel oil area : Group – IIB

7.03.00	(b) Hydrogen generation : Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA /IEC60034) Winding and Insulation (a) Type : Non-hygroscopic, oil resistant, flame resistant (b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature. (c) 11kV & 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15. (d) 240VAC, 415V AC & 220V DC motors : Thermal Class (B) or better
7.04.00	Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.
7.06.00	Noise level for all the motors shall be limited to 85 dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14 . Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.
7.08.00	Motor body shall have two earthing points on opposite sides.
7.09.00	11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386. The offered SIC terminations shall be provided with protective cover and trifurcating sleeves. SIC termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.
7.10.00	3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Employer shall provide termination kit for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of

	thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided.
7.11.00	The spacing between gland plate & centre of terminal stud shall be as per Table-I.
7.12.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.
7.13.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.
7.14.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.
7.15.00	The size and number of cables (for HT motors) to be intimated to the successful Contactor during detailed engineering and the Contactor shall provide terminal box suitable for the same.
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance):
	(a) From 50KW & upto 110KW : 11.0
	(b) From 110 KW & upto 200 KW : 9.0
	(c) Above 200 KW & upto 1000KW : 10.0
	(d) From 1001KW & upto 4000KW : 9.0
	(e) Above 4000KW : 6 to 6.5
10.00.00	TYPE TEST
10.01.00	HT MOTORS
10.01.01	The Contactor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The Contactor shall indicate the charges for each of these type tests separately in the relevant schedule of Section VII (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the Employer's engineer.
10.01.02	The type tests shall be carried out in presence of the Employer's representative, for which minimum 15 days notice shall be given by the Contactor. The Contactor shall obtain the Employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.

- ~~(a) Degree of protection test for the enclosure followed by IP, HV and no load run test.~~
- ~~(b) Terminal box fault level withstand test for each type of terminal box of HT motors only.~~
- ~~(c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC 60034, part 15~~
- ~~(d) Surge withstand test on inter turn insulation shall be as per clause no. 4.2 of IEC 60034, part 15~~

10.02.00 **LT Motors**

10.02.01 LT Motors supplied shall be of type tested design. During detailed engineering, the Contactor shall submit for Employer's approval the reports of all the type tests as listed in this specification and carried out within last *ten* years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

10.02.02 However if the Contactor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Contactor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.

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

The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only

1. Measurement of resistance of windings of stator and wound rotor.
2. No load test at rated voltage to determine input current power and speed
3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors)
4. Full load test to determine efficiency power factor and slip
5. Temperature rise test
6. Momentary excess torque test.
7. High voltage test
8. Test for vibration severity of motor.

9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section)
10. Test for degree of protection and
11. Overspeed test.
12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1

10.03.00 All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.

10.04.00 The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

Motor MCR in KW of	Minimum distance between centre
-------------------------------	--

UP to 3 KW
**stud and gland plate in mm
As per manufacturer's practice.**

Above 3 KW - upto 7 KW	85
------------------------	----

Above 7 KW - upto 13 KW	115
-------------------------	-----

Above 13 KW - upto 24 KW	167
--------------------------	-----

Above 24 KW - upto 37 KW	196
--------------------------	-----

Above 37 KW - upto 55 KW	249
--------------------------	-----

Above 55 KW - upto 90 KW	277
--------------------------	-----

Above 90 KW - upto 125 KW	331
---------------------------	-----

Above 125 KW-upto 200 KW	203
--------------------------	-----

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

PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:

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

Motor MCR in KW	Clearance
------------------------	------------------

UP to 110 KW	10mm
--------------	------

Above 110 KW and upto 150 KW	12.5mm
------------------------------	--------

Above 150 KW	19mm
--------------	------

8/2/2020/PS-PEM-MAX



TITLE: TECHNICAL SPECIFICATION
 FOR CHEMICAL DOSING SYSTEM (NaOH DOSING).
 PROJECT: 2X250 MW BHILAI TPP (NSPCL).
 (FGD SYSTEM PACKAGE).

BHEL DOCUMENTS NO.: PE-TS-468-154-A001

VOLUME II-B

SECTION –D3

REV. NO. 00

DATE:

SECTION – D3 GENERAL TECHNICAL REQUIREMENTS (CONTROL AND INSTRUMENTATION)

872/2020/PS-PEM-MAX

C & I TECHNICAL SPECIFICATION
FOR DCS BASED
NaOH DOSING SYSTEM

SPECIFICATION FOR MEASURING
INSTRUMENTS & LCP etc.

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. 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.
1.07.00	The instruments, for which technical specification is not attached, shall be supplied as per the standard and proven practice of the contractor. The same shall be established by the contractor during detailed engineering by providing detailed explanation/concepts, if required by the employer, of such implementation along with standard documentation.

872/2020/NS-PEM-MAX		TECHNICAL REQUIREMENTS		एनटीपीसी NTPC							
		The vibration monitor racks with power supplies shall be mounted in a separate self standing cabinet to be located in control room. The number of racks and power supplies shall be such that on failure of a single power supply/module, not more than four monitors shall be affected. The vibration monitoring cabinet shall be fed from redundant 24V DC feeders with auto changeover scheme. The power supply arrangement for monitors shall ensure that failure of one power supply shall not affect any monitoring function in the system. Also any power supply failure /earth fault in any of the monitors will be isolated without affecting other monitors/ common power supply. If 230 V AC UPS power supply is required for panel PC/ desktop PC, UPS/Mini UPS for the same shall be provided by the contractor. The functional requirement for vibration monitoring system shall include but not be limited to the following: - Vibration monitor front face status indications shall be available for indications of healthy conditions of pick up circuit, monitor circuit and power supply. On sensor fault/wire break in the sensor circuit, the system shall have the feature of identifying the same through suitable means like the signal forced to a value less than 4 mA. In case, such a feature is not available then suitable contact shall be provided from the monitor for sensor fault. - The facility shall be available for online functional checking of monitors. - All vibration monitoring equipment shall be functionally tested for circuit continuity and output response. All the components & interconnection cables shall be tested to ensure compliance with the specification requirements & all other applicable codes & standards. In case it is the proven standard practice of a Contractor to provide vibration monitoring PC with TFT LCD monitor, instead of dedicated monitors with the signal conditioning equipment in control equipment room, the same shall also be acceptable. However, all relevant functional requirements detailed above shall be met and the system shall be subject to Employer's approval.									
16.00.00		FIELD INSTRUMENTS BASED ON FIELDBUS									
		The following instruments shall be connected to DDCMIS through fieldbus i.e. FOUNDATION Fieldbus/PROFIBUS PA protocol complying to IEC 61158 directly from transmitter.									
16.01.00		Electronic Transmitter for Pressure, Differential Pressure and DP based Flow / Level measurements.									
		<table><tr><th>S No.</th><th>Features</th><th>Essential/Minimum Requirements</th></tr><tr><td>1.</td><td>Type of Transmitter</td><td>FOUNDATION Fieldbus/PROFIBUS PA based output</td></tr></table>				S No.	Features	Essential/Minimum Requirements	1.	Type of Transmitter	FOUNDATION Fieldbus/PROFIBUS PA based output
S No.	Features	Essential/Minimum Requirements									
1.	Type of Transmitter	FOUNDATION Fieldbus/PROFIBUS PA based output									

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2	Accuracy	± 0.060 % of calibrated range (minimum) for calibrated range greater than 400 mmwc. +0.065% of calibrated range (minimum) for calibrated range greater than 250 kg/cm2. ± 0.10 % of calibrated range (minimum) for calibrated range less than 400 mmwc.
3.	Stability	0.25 % of calibrated range for 10 years for calibrated range greater than equal to 400 mmwc on standard conditions of manufacturer. 0.2 % of calibrated range for 1 years for calibrated range less than 400 mmwc on standard conditions of manufacturer. 0.15% of calibrated range for 5 years for DPT with static pressure greater than 250 kg/cm2.
4	Turn down	50:1 for greater than or equal to span of 400mmwcl. 20:1 for span below 400mmwcl. 10:1 for span greater than 250 kg/cm2 (Above mentioned (2,3,4) parameters/features of offered models shall be strictly as defined in standard published catalogue of the manufacturer only).
5	Housing	Weather proof as per IP-67, metallic housing with durable corrosion resistant coating
6.	Electrical connection	½" NPT(F) FOUNDATION Fieldbus/PROFIBUS PA compatible
7.	Process connection	½" NPT (F)
8.	Operating Ambient temperature	85 deg C without display. 70 deg C with display.
	Overpressure	150% of max operating pressure
9	Accessories	-Diaphragm seal, pulsation dampeners, syphon etc. as required by service and operating condition. -2 valve manifold for absolute & gauge pressure transmitters, -3-valve for DP and 5 valve manifold for level/flow applications. -The valve manifold shall be non-integral type. -For hazardous area, enclosure as described in NEC article 5.

872/2030/R6-PEM-MAX	TECHNICAL REQUIREMENTS	67 एनटीपीसी NTPC																					
	10. Mounting 2 inch pipe mounting with Enclosure/Rack/Canopy. 11. Diagnostics & display Self-Indicating feature and digital display on transmitter Notes - For primary air/ secondary air/flue gas/ furnace pressure applications, DP type transmitters shall be provided for pressure measurement below 2000 mmwc. - 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.																						
16.02.00	Temperature Transmitter																						
16.02.01	Single Input /Dual Input Temperature transmitter Temperature transmitter shall be provided which shall be fully compatible with thermocouples and RTDs being provided by the contractor. Temperature compensation for thermocouples shall be performed in the temperature transmitter itself. Transmitters shall be capable of withstanding ambient temperature up to 85 deg C. Following specifications are applicable for dual input/single input temperature transmitter. <table><tr><th>S No.</th><th>Features</th><th>Essential/Minimum Requirements</th></tr><tr><td>1.</td><td>Output</td><td>FOUNDATION fieldbus /PROFIBUS PA</td></tr><tr><td>2.</td><td>Input</td><td>Same transmitter shall be capable to handle Pt 100 RTD, Thermocouples –K, R & ,S types</td></tr><tr><td>3.</td><td>Housing</td><td>Weather proof as per IP 67, metallic housing with durable corrosion resistant coating</td></tr><tr><td>4.</td><td>Electrical connection</td><td>½” NPT(F) FOUNDATION Fieldbus/PROFIBUS PA compatible</td></tr><tr><td>5.</td><td>Diagnostics display</td><td>& Self-Indicating feature and digital display on transmitter</td></tr><tr><td>6.</td><td>Operating Ambient temperature</td><td>85 deg C without display. 70 deg C with display.</td></tr></table>	S No.	Features	Essential/Minimum Requirements	1.	Output	FOUNDATION fieldbus /PROFIBUS PA	2.	Input	Same transmitter shall be capable to handle Pt 100 RTD, Thermocouples –K, R & ,S types	3.	Housing	Weather proof as per IP 67, metallic housing with durable corrosion resistant coating	4.	Electrical connection	½” NPT(F) FOUNDATION Fieldbus/PROFIBUS PA compatible	5.	Diagnostics display	& Self-Indicating feature and digital display on transmitter	6.	Operating Ambient temperature	85 deg C without display. 70 deg C with display.	
S No.	Features	Essential/Minimum Requirements																					
1.	Output	FOUNDATION fieldbus /PROFIBUS PA																					
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5.	Diagnostics display	& Self-Indicating feature and digital display on transmitter																					
6.	Operating Ambient temperature	85 deg C without display. 70 deg C with display.																					
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1.00.00	GENEREAL REQUIREMENTS FOR FIELDBUS INSTRUMENTS AND ACTUATORS This section provides the basic guidelines for the design and implementation of Fieldbus (Foundation Field Bus/ Profibus) based control system.
1.01.00	The requirements given herein are minimum requirements to be considered by Contractor to ensure uniformity in basic design and shall not be considered as final requirements. The Fieldbus design shall be further validated by contractor and approved by Employer during detailed engineering and any variation/ changes required based on DDCMIS system requirements and actual field installation, operational philosophy etc. shall be considered by contractor without any implications.
1.02.00	The fieldbus segment design shall be finalized and validated based on functional requirements as per: • Process requirements (P&IDs/ operational requirements). • Loop response time of different loops device communication time i.e. cycle time for fast and slow loops with scheduled and unscheduled organization as per project. • Area classification requirements (e.g. hazardous or safe). • Fieldbus devices specifications (maximum current drawn from bus, block execution speeds, power conditioner suitable for field barrier, etc.) • Length of segments. • Instrument location plans with elevation details. • Host-system documentation showing configuration rules or restrictions. • For Foundation Fieldbus & Profibus PA chicken foot/ branch/ or combination of both topology shall be provided. For Profibus DP, Bus/ Line topology in Redundant mode shall be provided. That is, for Profibus DP redundant cables connected to redundant ports of devices shall be provided. Suitable field bus segment design shall be considered keeping the safety & integrity of the system intact so that the cabling, marshalling, junction boxes and system performance shall be optimized. However, all such segment device allocation, topology shall be decided during detailed engineering. Any modification shall be carried out by contractor without price implication.
1.03.00	Contractor to provide all standard functional blocks for all Foundation Fieldbus/ Profibus devices as per latest FF/ Profibus version and standard guidelines. Fieldbus components including power supply, terminators, isolators, etc. provided by Contractor shall comply to IEC 61158 and other standard Fieldbus guidelines.

1.04.01 Redundant host/ master card and redundant power supply along with advance diagnostic module shall be provided. All required libraries to execute various tasks like data acquisition, control/protection etc. shall be provided.

1.04.02 In fieldbus system following spare capacity in each FG shall be provided :

Item	Sub Item	Spare capacity
Controller	Software Blocks	30%
	Host	30%
Host/ Power supply	Installed spare capacity	10%
Host/ Power supply space	Only spare space	20%
Segment spare capacity		40%

If in a FG, conventional and fieldbus system both are implemented then above spare capacity shall be in proportion to fieldbus/ conventional system implementation.

1.04.03 The contractor shall present complete implementation scheme, including wiring scheme during detailed engineering stage for review and approval by Employer.

1.05.00 Fieldbus cable (specifically used for Foundation Fieldbus/ Profibus PA and Profibus DP) shall be Individually shielded twisted pair, with round steel wired armour (SWA) complying to IEC 61158, Type A. The cable construction shall meet EN 50288-7 standard for physical properties and the outer sheath shall be of PVC-TM53 as per EN 50290-2-22. Continuous operating temperature of Fieldbus cable shall be minimum 90 Deg C. For laying of fieldbus cables, cable trays envisaged for instrumentation cable with all the accessories shall be used by the contractor. Minimum 300 mm spacing to be kept between the fieldbus trays and other high voltage cables to avoid any interference.

SS Junction boxes specially designed for fieldbus application shall be provided on as required basis. These SS JB's shall house field mounted fieldbus components like distributors, tee, etc. These SS JB's shall have suitable cover and gasket and shall have protection class of IP-66 or better. SS Cable glands and blind plugs shall be provided by the Contractor.

1.06.00 Comprehensive Fieldbus Maintenance and Diagnostic software shall be provided. This software shall be capable of collecting complete diagnostic information from fieldbus network and all fieldbus devices and presenting in user friendly interface for detailed diagnostic and troubleshooting of the system. It shall be possible to completely configure parameters of fieldbus network and fieldbus devices from centralized system through this software. This software shall have feature of providing data related to maintenance of

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Annexure IIIC-05K

1.07.00

fieldbus devices as available through fieldbus system. This system/ software shall have provision to get updated to latest version/ release of various fieldbus devices.

During FAT suitable arrangement shall be made by Contractor to test Fieldbus modules including field devices as per approved FAT procedure.

1.08.00

The contractor shall use fieldbus segment design tool / software to design complete network verifying various design parameters like device voltage, total cable length, spur length, system power requirements etc. the contractor shall provide device voltage calculations for all segments, based on calculation in software package. All these calculations shall be handed over during detailed engineering in electronic format in a way that Employer can thoroughly verify design basis/ calculations carried out by Contractor.

1.09.00

Suitable short circuit protection, surge protection, grounding requirements shall be provided for all devices, so that fault in one device shall not impact the availability of other devices in the segment.

1.10.00

All required diagnostic and configuration tools/ hand held devices shall be provided for configuration and troubleshooting of devices and network.

Adjustment/ calibration	Using hand held HART calibrator/ centralized PC based system (as applicable).
Zero & span adjustment	Continuous, temper proof, remote as well as manual adjustability from instrument. It should be possible to calibrate the instrument without any level in the tank/sump etc.
Display	Integral digital display.
Load Impedance	500 ohms (minimum).
Electromagnetic compatibility	Shall meet EN 61326-1 (1997) and AmdtA1, class A equipment/EN 50081-2 & EN 5008 1-2 & EN 50082-2
Mounting	(i) External cage shall be provided where ever side mounting is required. External cage and other mounting accessories to be provided by the contractor. (ii) Where ever top mounting is required, all mounting accessories, stilling well (as required) etc., shall be provided by the contractor. (iii) All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations.

Note: Four wire type transmitters can also be provided for applications where 2- wire transmitter has some technical limitations, subject to employer's approval during detailed engineering stage. However, in such cases isolated 4-20 mA DC (analog) output shall be provided. Power supply required for such transmitters shall be 240V AC / 24V DC.

2.03.00

Ultrasonic Type level Transmitter

S.No.	Features	Essential/Minimum requirement
1.	Type of Transmitter	Non-contact Microprocessor based 2 wire type (loop powered), HART protocol compatible Ultrasonic transmitter.
2.	Output signal	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol).

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	3.	Accuracy	+/- 0.5% of calibrated span or minimum 5mm.
	4.	Power supply	24 V DC +/- 10%.
	5.	Temperature compensation	To be provided within transducer.
	6.	Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistance coating.
	7.	Adjustment/calibration/ maintenance	Using hand held HART calibrator/ centralized PC based system (as applicable).
	8.	Zero and Span adjustment	Continuous, tamper proof, remote as well as manual adjustability from instrument. It should be possible to calibrate the instrument without any level in the tank/sump etc.
	9.	Sensor Material	Corrosion resistant material to suit individual application requirement.
	10.	False signal tolerance	Transmitter shall be capable of ignoring false echoes from internal tank/sumps obstructions such as pipes, heating coils or agitator blades. Also transmitter shall have adjustable damping circuitry.
	11.	Range	Range of transmitter shall be capable of covering the complete level span of tank taking care of blocking distance, frequency attenuation due to surface, obstructions, vapors etc.
	12.	Display	Integral digital display
	13.	Diagnostics	Loss of echo alarm etc.
	14.	Load Impedance	500 ohms (minimum).
	15.	Electrical Connection	Plug and socket

16.	Accessories	- All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations. - All mounting accessories required for erection and commissioning shall be provided. - For hazardous area, explosion proof enclosure as described in NEC article 500
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Note:

- Contractor can also provide Radar type transmitter as per above specification in place of ultrasonic transmitter subject to approval by Employer during detailed Engineering. Sonic frequency based transmitters can also be provided under "ultrasonic transmitters" category for fly ash silo level.
- Four wire type transmitters can also be provided for applications where 2- wire transmitter has some technical limitations, subject to employer's approval during detailed engineering stage. However, in such cases isolated 4-20 mA DC (analog) output shall be provided. Power supply required for such transmitters shall be 240V AC / 24V DC.
- For applications where transmitter location is not accessible, the transmitter shall have separate sensor unit and electronic unit for such applications. It shall be possible to mount the electronic unit at accessible location.

2.04.00

Specification for ULTRASONIC TYPE FLOW TRANSMITTER

S.No	Features	Essential/Minimum requirement
1.	Type of Transmitter	Non contact Microprocessor based 2 wire type, HART protocol compatible Ultrasonic transmitter. Insertion type.
2.	Output signal	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol).
3.	Sensor Accuracy	+/- 2% of calibrated span.

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC																																										
	Notes (Common for a) to d) above):- 1. In case of failure (open or burn-out) of RTD/thermocouple, temp. Transmitter shall provide low temperature output. 2. Composite Accuracy is to be calculated as summation of all applicable accuracies of temp transmitter, for converting sensor input to output in 4-20 mA (e.g., basic accuracy, digital accuracy, D/A accuracy, etc.) and temperature effect on these accuracies at ambient temperature of 50 deg C, based on the figure/ formula given in the standard product catalogue for span as specified above for various types of Temperature Elements specified. All such accuracy/ temp effect figures in catalogue shall be first converted to deg C, and then percentage of this converted accuracy in specified span shall be calculated to compare with the specified composite accuracy figures. All temperature transmitters are to be interchangeable (i.e. can be used for either RTD or thermocouple) and composite accuracy shall be met for each type of input specified in (i) & (ii).																																											
4.00.00	SPECIFICATIONS FOR PR. GAUGE, D.P. GAUGE, TEMP. GAUGE AND LEVEL GAUGE. <table> <tr> <th data-bbox="278 982 356 1079">Sl. No</th><th data-bbox="356 982 565 1079">FEATURES</th><th colspan="3" data-bbox="565 982 1440 1079">ESSENTIAL/MINIMUM REQUIREMENTS</th></tr> <tr> <td data-bbox="278 1079 356 1214"></td><td data-bbox="356 1079 565 1214"></td><td data-bbox="565 1079 825 1214">Pr. Gauge/ DP Gauge/ Draught gauges</td><td data-bbox="825 1079 1085 1214">Temperature Gauge</td><td data-bbox="1085 1079 1440 1214">Level Gauge</td></tr> <tr> <td data-bbox="278 1214 356 1425">1</td><td data-bbox="356 1214 565 1425">Sensing Element</td><td data-bbox="565 1214 825 1425">Bourdon for high pressure, Diaphragm/ Bellow for low pr.</td><td data-bbox="825 1214 1085 1425">Inert gas actuated/ Liquid filled other than mercury</td><td data-bbox="1085 1214 1440 1425">Tempered * toughened Borosilicate gauge glass steel armoured reflex or transparent type.</td></tr> <tr> <td data-bbox="278 1425 356 1560">2</td><td data-bbox="356 1425 565 1560">Material of sensing element</td><td data-bbox="565 1425 825 1560">SS 316</td><td data-bbox="825 1425 1085 1560">SS 316</td><td data-bbox="1085 1425 1440 1560"></td></tr> <tr> <td data-bbox="278 1560 356 1659">3</td><td data-bbox="356 1560 565 1659">Material of movement</td><td data-bbox="565 1560 825 1659">SS 304</td><td data-bbox="825 1560 1085 1659">SS 304</td><td data-bbox="1085 1560 1440 1659"></td></tr> <tr> <td data-bbox="278 1659 356 1759">4</td><td data-bbox="356 1659 565 1759">Body material</td><td data-bbox="565 1659 825 1759">Die-cast aluminium</td><td data-bbox="825 1659 1085 1759">Die-cast aluminium</td><td data-bbox="1085 1659 1440 1759">Forged carbon steel/304 SS</td></tr> <tr> <td data-bbox="278 1759 356 1858">5</td><td data-bbox="356 1759 565 1858">Dial size</td><td data-bbox="565 1759 825 1858">150mm</td><td data-bbox="825 1759 1085 1858">150 mm</td><td data-bbox="1085 1759 1440 1858">Tubular covering entire range</td></tr> <tr> <td data-bbox="278 1858 356 1980">6</td><td data-bbox="356 1858 565 1980">End connection</td><td data-bbox="565 1858 825 1980">1/2 inch NPT (M)</td><td data-bbox="825 1858 1085 1980">1/2 inch or 3/4 inch NPT (M).</td><td data-bbox="1085 1858 1440 1980">Process connection as per ASME PTC and drain/vent 15 NB</td></tr> </table>	Sl. No	FEATURES	ESSENTIAL/MINIMUM REQUIREMENTS					Pr. Gauge/ DP Gauge/ Draught gauges	Temperature Gauge	Level Gauge	1	Sensing Element	Bourdon for high pressure, Diaphragm/ Bellow for low pr.	Inert gas actuated/ Liquid filled other than mercury	Tempered * toughened Borosilicate gauge glass steel armoured reflex or transparent type.	2	Material of sensing element	SS 316	SS 316		3	Material of movement	SS 304	SS 304		4	Body material	Die-cast aluminium	Die-cast aluminium	Forged carbon steel/304 SS	5	Dial size	150mm	150 mm	Tubular covering entire range	6	End connection	1/2 inch NPT (M)	1/2 inch or 3/4 inch NPT (M).	Process connection as per ASME PTC and drain/vent 15 NB			
Sl. No	FEATURES	ESSENTIAL/MINIMUM REQUIREMENTS																																										
		Pr. Gauge/ DP Gauge/ Draught gauges	Temperature Gauge	Level Gauge																																								
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3	Material of movement	SS 304	SS 304																																									
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6	End connection	1/2 inch NPT (M)	1/2 inch or 3/4 inch NPT (M).	Process connection as per ASME PTC and drain/vent 15 NB																																								

CLAUSE NO.

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7	Accuracy	±1% of span	± 1% of span	± 2%
8	Scale	Linear, 270° arc graduated in metric units	Linear, 270° arc graduated in °C	Linear vertical
9	Range selection	Shall cover 125% of max. operating press	Shall cover 125% of max. operating temp	Shall cover max. Operating level.
10	Over range	125% of FSD	125% of FSD	-
11	Housing	Weather and dust proof as per IP-55	Weather and dust proof as per IP-55	CS/304 SS leak proof
12	Zero/span adjustment	Provided	Provided	--
13	Identification	Engraved with service legend or laminated phenolic name plate		
14	Accessories	Blow out disc, siphon, snubber, pulsation dampener, chemical seal (if required by process) gauge isolation valve	SS Thermowell	Gasket for all KEL-F shield for transparent type vent and drain valves of Steel/SS as per CS/Alloy process Requirement.
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.

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
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 mm². 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 terne coated steel with , water leak, fire and rust proof protected for the areas of Mills, Drum, Main Steam, RH steam Air Heaters and Furnace, BFPDT's . <i>And for remaining applications, water leak, fire and rust proof flexible GI conduits shall be provided. The temperature rating of flexible conduit shall be suitable for actual application.</i>	
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 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	

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
	The overload capacity of the transformer and voltage stabilizer shall not be less than 300% for 200 millisecond duration. The voltage stabilizer shall employ servo-controlled circuitry and shall maintain the specified output voltage for 0-100% load with maximum input voltage variations as indicated above. The efficiency of the stabiliser shall be 95% or better. The type and other details shall be subject to Employer's approval.	
9.06.05	AC Distribution Board (ACDB) The details of the AC distribution board, i.e. exact, rating and number of feeders etc. of the 2x100% ACDB shall be designed to cater to the requirements of Contractors systems. 25% Spare feeders of each type and rating to be provided in each ACDB.	
9.06.06	The batteries shall be heavy duty Nickel-cadmium type and shall be sized for one hour of full load operation during non-availability of AC supply / chargers. The Ni-Cd batteries shall conform to IS: 10918. The batteries shall be sized as per relevant IEEE Standards. For sizing calculation, an aging factor of 0.8 and a temperature correction factor as per manufacturer's standard at 4 deg. C electrolyte temperature (Based on temperature characteristics curve to be submitted by the Contractor at a temperature of 4 deg. C). Capacity factor, Float Correction Factor, as per Battery Supplier Standard, shall be taken into consideration, if applicable and ambient temperature shall be considered as the electrolytic temperature. The sizing of the battery shall be as approved by Employer during detailed engineering. However, Contractor shall consider a suitable voltage drop from battery room to ACDB and ACDB to load, while sizing the battery.	
10.00.00	CONTROL CABINETS / PANELS / DESKS	
10.01.00	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.
10.01.05	Paint films which show sags, checks or other imperfections shall not be acceptable.
10.01.05	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.

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
10.04.00	CONTROL DESK	
10.04.01	Control desk shall be free standing table top type with doors at the back and shall be constructed of 3 mm thick CRCA steel plates. A 19 mm thick wooden top shall be provided on the desk to keep the TFT monitors at top and computers inside. Control desk shall consist of vertical, horizontal and base supports with their coverings for work surface, keyboard trays, mouse pads, monitor shelf and concealed cable and wire way management, perforated trays with covers in both horizontal and vertical directions. PA system hand sets, telephone sets, very few PB stations and lamps shall be mounted on the control desk on mosaic grid structure and same shall be decided during detailed engineering. ASCII Keyboard shall be capable of being pulled out through a tray.	
10.04.02	The cabling / wiring between OWS & CPU'S, power supply cables etc. shall be aesthetically routed and concealed from view.	
10.05.00	FURNITURE Chairs – Industry standard revolving chairs with wheels and with provision for adjustment of height (hydraulically/gas lift) shall be provided for the operators, unit-in-charge & other personnel in control room area. These shall be designed for sitting for long duration such that these are comfortable for the back. Chair pedestal shall be made of 5mm thick MS plate covered with poly-propylene cladding. Arm-rests in one piece shall be of poly-urethane and twin wheel castor of glass filled nylon. The exact details shall be finalized & approved by Employer during detailed engineering.	
11.00.00	ANNUNCIATION SYSTEM	
11.01.00	Only OWS based alarm system shall be provided with audio alarm facility (beep/tone generator). No facia annunciation is envisaged in the control room. Hooters are to be provided.	
11.02.00	The system shall display history of alarms in chronological order on any of the OWS. The HMIS shall have the capability to store a minimum of 500 alarms each with paging features allowing the operator to view any page. The system shall have all alarm functions and related function keys like alarm acknowledge, reset, paging, summaries etc. Other design features like set point/dead band adjustments, provision of alarm priority, manual inhibition & automatic inhibition based on predefined logic etc., shall be provided and shall be as finalised during detailed engineering. The alarm display/report format shall be as approved by the Employer.	

CLAUSE NO.	TECHNICAL REQUIREMENTS
11.03.00	Facility of audio annunciation shall be provided in OWS upon the occurrence OWS alarms irrespective of whether alarms are displayed or not. Facility to disable the audio annunciation shall be provided.
11.04.00	At least three levels of alarm priority shall be available which will be displayed in different colour. It shall be possible to display & print alarms of any of the three levels.
11.05.00	Alarm boxes shall be provided in each display to alert the operator about an alarm when he is viewing some other picture. No of alarm boxes shall be finalised during detailed engineering for each process area & each priority therein.
11.06.00	The annunciator sequence shall conform to ISA sequence ISA-2A.
12.00.00	SOFTWARE DOCUMENTATION AND SOFTWARE LISTINGS
12.01.00	All technical manuals, reference manuals, user's guide etc., in English required for modification/editing/addition/deletion of features in the software of the PLC System shall be furnished. The Contractor shall furnish a comprehensive list of all system/application software documentation after system finalization for Employer's review and approval.
12.02.00	All The software listings including Source code for application software, All special - to-project data files etc. shall be submitted by the Contractor.
13.00.00	SOFTWARE LICENCES The Contractor shall provide software license for all software being used in Contractor's System. The software licenses shall be provided for the project (e.g. organisation or site license) and shall not be hardware/machine-specific. That is, if any hardware/machine is upgraded or changed, the same license shall hold good and it shall not be necessary for Employer to seek a new license/renew license due to upgradation/change of hardware/machine in Contractor's System at site. All licenses shall be valid for the continuous service life of the plant. As a customer support, the Contractor shall periodically inform the designated officer of the Employer about the software upgrades/new releases that would be taking place after the system is commissioned so that if required, same can be procured & implemented at site.

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		VOLUME	II B
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1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site, ~~supervision, erection, and commissioning at site~~ of Local Panels required for control and monitoring of the Auxiliary Plant & Equipment.

2.0 CODES AND STANDARDS

2.1 All the equipments specified herein shall comply with the requirements of the latest issue of the relevant National and International standards.

2.2 As a minimum requirement, the following standards shall be complied with:

- a) IS-6005 : 1998 : Code of practice for phosphating of iron and steel.
- b) IS-5 : 2007 : Colors for ready mixed paints and enamels.
- c) IS-1248:2003 : Direct Acting Indicating Analog Elec Measuring Instruments.
- d) IS/IEC 60947:Part 1:2004 : Low Voltage switchgear & control gear: Part-I (General Rules)
- e) IS-8828:1996 : Circuit breaker for household and similar installations.
- f) IS-13947 (Part-I):1993 : Low Voltage switchgear & control gear : Part-I (General Rules)
- g) ISA-18.1:1979 : Annunciator Sequences and Specification
- h) NFPA-496:2003 : Purged & Pressurised Enclosure for Electrical Equipment in Hazardous Locations.

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

3.1.1 The local panels shall house the secondary instruments, annunciation system, Single loop controller, Control switches / push buttons, indicating lamps/LED cluster, relays, timers and other devices required for operation and monitoring of the equipment locally.

3.1.2 The panels shall be of free standing type either welded construction on angle iron (minimum section of 50 x 50 x 4 mm) structure or folded construction by sheet metal formation depending upon the equipments to be mounted on it. The panels shall be robustly built and stiffeners as necessary shall be provided.

3.1.3 The panel shall be suitably reinforced to ensure adequate support for all instruments mounted thereon. All welds on exposed panel surfaces shall be ground smooth.

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel

Frame thickness: Not less than 3.0mm

Enclosure thickness: Not less than 2.5 mm for load bearing sections (Mounted with instruments)
1.6 mm for doors and Not less than 2.0 mm for others

Gland plate thickness: 3.0mm

Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.

3.1.5 The panel shall be provided with rear doors with integral lockable handle. The door when locked shall be held at minimum three places. The door width shall not be more than 550mm. The doors shall be provided with suitable stiffeners to prevent buckling. The handle shall be on the right side of the door. The door shall be removable type with concealed hinges to facilitate maintenance work. Suitable pocket inside the door shall be provided for keeping the drawings / documents. Double door shall be provided with suitable glass windows, as per the requirement.

3.1.6 Suitable neoprene gasket shall be provided on all doors and removable covers. Suitable ventilation system along with louvers shall be provided at bottom and top of the doors covered with removable wire mesh.

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- 3.1.7 The class of protection shall be in accordance with IP-42 unless otherwise specified
- 3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish. Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.
- 3.1.9 The cable glands of the required size and type shall be supplied alongwith the Panel.
- 3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function. No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.
- 3.1.11 Single / dual control power supply feeders of voltage class shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.
- 3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm² size. AC & DC wires shall be kept separate from each other. Separate coloured wires to be used for AC and DC circuits. All wires shall be properly numbered and identified with ferrules as per the Control scheme / wiring diagram. Wires shall be routed and run through PVC troughs.
- 3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm² to 2.5mm² external cables. **The TB points in terminal block shall be cage clamp type / screw type.** The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm **height from finished floor. The panel shall have ten (20) percent spare terminal.**
- 3.1.14 The interior of each panel shall be suitably illuminated through fluorescent **lamps / tube lights with shrouded cover of minimum 15W** operable on 240V 50 Hz AC power supply through panel door switch. A 15 Amp. 3-pin Power receptacle shall be provided.
- 3.1.15 Suitable space heaters operable on 240 Volts 50 Hz AC power system shall be provided at the panel bottom. These shall be designed to maintain the panel temperature five (5) deg. C above the ambient temperature during maintenance shutdown. Suitable isolating and control devices comprising of MCB, thermostat etc. shall be provided for the space heater.
- 3.1.16 The panel shall be provided with a copper earth bus of 25 x 6 mm size running throughout the width of the panel. It shall be terminated internally with 10 mm bolts at extreme ends for connection to; main station earth. The panel mounted equipments / devices shall be connected to earth bus through green coloured PVC insulated stranded copper conductor of 2.5 mm² size.
- 3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte

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Sheet / 2 mm Anodised Aluminium Plate. The inscription shall be with white letters on black background on traffolyte sheet. The labels shall be fixed by self tapping non-rusting screws.

3.1.18 Vendor shall furnish electric load and heat load list (in case panel is to be placed in ac environment) of each panel.

3.2 Hazardous Area Panel Requirement

3.2.1 The Local Panel located in hazardous area shall be pressurized as per NFPA-496 requirements to render it non-hazardous. Alarms shall be provided for local and remote annunciation when pressurisation falls below 2.5 mm of water column. Protection shall be of type Z of NFPA-496. It shall not be possible to switch ON the power of purged section unless it is purged as per the recommendation of NFPA-496. Vendor must provide a protective device on the panel to protect the panel from over pressurisation.

3.2.2 Vendor shall supply pressurisation kit consisting of valves, restriction orifices, dual filter regulation, pressure gauges, pressure switches, rotameter etc. Pressurisation kit shall be surface mounting on a metal board and located outside the local panel. Pressurisation kit shall further consist of solenoid valve flow switch, timer blow off safety device etc., so as to make purging fully automatic. However final start shall be manual. Panel protection against over pressure to be provided as per NFPA-496.

3.2.3 Pressurised local control panel pressurization kit assembly design shall provide minimum leakage flow through the Local Control Panel. Panel venting shall be as per NFPA-496.

3.2.4 All components in the local panel like indicating instruments, push buttons switches, lamps etc., which are required to be energized without panel pressurization or before completion of purge cycle shall be explosion proof as per NEMA-7 & suitable for area classification.

3.2.5 All push buttons etc. requiring frequent operation during machine running shall have good positive sealing. Weatherproof housing or cover to be provided wherever necessary. Vendor shall provide pressurisation bypass switch outside explosion proof enclosure of pressurized panel with lamp indication. This shall be used only during maintenance. All hinges, screws, other non-painted metallic parts shall be of stainless steel material.

3.2.6 Provision to switch off manually all types of power shall be provided in the panel. In addition, it shall also be possible to switch off power circuits / components which are powered from motor control centre or control room manually in case of pressurization failure. All such cables from MCC and main control room shall be terminated in explosion proof boxes (NEMA-7).

3.3 Control & Monitoring devices

3.3.1 Instruments like Indicators, recorders, single loop controllers etc. as applicable and specified elsewhere for the plant / equipment shall be supplied and mounted on the panel.

3.3.2 Alarm Annunciator System

It shall be solid state discrete facia type having a sequence of ISA-S18.1A or as specified, opaque facia windows of 70 mm x 50 mm size, having two (2) lamps per window, and hooter of 10W, and provision for repeat group alarm at remote. The annunciator shall be provided with ten (10) percent spare windows or minimum two (2) windows along with electronics.

3.3.3 Relays

The relays shall be electromagnetic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable. There shall be ten (10) percent spare contacts.

3.3.4 Timers

The timers shall be electronic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However, minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable.

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3.3.5 Control / Selector Switches

Switches shall be Rotary Cam type with minimum of 5 Amps AC & 2 Amp DC continuous current rating. Selector switches shall be stay put type while control switches shall be spring-return-to-neutral type. Contact configuration and rating shall be as per the control function requirement. The switches shall be lockable type wherever specified. Each switch shall be provided with engraved plates indicating the switch position / functions.

3.3.6 Push Buttons / Indicating Lights

The push buttons shall be momentary action self-resetting type, however stop P.B. for unidirectional drives shall be provided with manual reset facility. Its contact configuration & rating shall be as required for the control function but minimum 2 NO + 2 NC of 5 Amp. AC rating. It shall have round coloured projecting tab and engraved escutcheon plate / inscription plate. Colour coding of push buttons shall be as under:

RED	Motor OFF / Valve CLOSE	YELLOW	Alarm acknowledge	Left Hand Side
GREEN	Motor ON / Valve OPEN	BLACK	Lamp test	Right Hand Side

Indicating lights shall be suitable for direct connections across specified power supplies. It shall be fitted with built in resistance to prevent circuit tripping on shorting of lamp filament. It shall be fitted with LED cluster type lamp replaceable from front.

GREEN	Motor OFF / Valve CLOSED condition	AMBER	Motor tripped	Left Hand Side
RED	Motor ON / Valve OPEN condition	WHITE	Normal / healthy	Right Hand Side

3.3.7 Ammeters

Ammeter shall be 96 x 96 mm size, 90 deg. deflection, 1.5% accuracy, 1 Amp. CT operated or with 4-20mA input and Flush mounting type

Ammeters for motors shall have six (6) times folded scale at upper end to enable motor starting current indication

3.3.8 Miniature Circuit Breaker (MCB)

These shall be instantaneous magnetic trip type for short circuit in addition to current time inverse delayed thermal trip feature for over current protection. The housing of MCB shall be made of non-ignitable, high impact material. It shall have minimum short circuit rating of 9 KA for AC Voltages and 4 KA for DC Voltages.

3.3.9 Makes of various instruments / devices shall be as given below

1.	Alarm Annunciators	:	Procon / IIC
2.	Ammeters	:	AEP / IMP
3.	Control / Selector Switches	:	Alsthom / Kaycee / Siemens / L&T
4.	Push Buttons / Indicating Lamps	:	Siemens / L&T / Teknic / Alsthom
5.	Auxiliary Relays	:	Jyoti / Siemens / L&T / OEN
6.	Timers	:	L&T / Alsthom / Bhartiya Cutler Hammer
7.	MCBs	:	S&S Power Engg. / Indo Asian / MDS
8.	Terminal Blocks	:	Jyoti / Elmex

4.0 TESTING AND INSPECTION

4.1 The bidder shall adopt suitable quality assurance program to ensure that the equipments offered will meet the specification requirements in full.

4.2 BHEL's standard Quality Plan for LCP is enclosed with the specification. The bidder shall furnish his acceptance to BHEL's QP and submit the signed and stamped copy of QP along with the offer.

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4.3 The vendor shall conduct the following tests as a minimum requirement:

4.3.1 Routine Tests

1. High Voltage (H.V.)
2. Insulation Resistance (I.R.)
3. Functional

4.3.2 Type Tests

1. Enclosure Class Test

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5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

The bidder shall supply all commissioning spares and consumables 'as required' during Start-up, as part of the main equipment supply.

5.2. Mandatory Spares

The bidder shall offer alongwith main offer, the Mandatory Spares as specified elsewhere in the specification. The Mandatory Spares offered shall be of the same make and type as the main equipment.

5.3. Recommended Spares

The bidder shall furnish a list of Recommended Spares indicating the normal service expectancy period and frequency of replacement; quantities recommended for 3 years operation alongwith unit rate against each item to enable BHEL/BHEL's Customer to place a separate order later, if required.

6.0 DRAWINGS AND DOCUMENTS

6.1 The bidder shall furnish the following documents in required number of copies along with the bid :

1. Data Sheet
2. General Arrangement Drawing.
3. Catalogue and technical information for instruments and devices.
4. Quality Plan.

6.2 The vendor shall furnish the following documents in required number as agreed after the award of contract:

1. Data Shee
2. GA Drawing indicating layout of instruments, construction details, foundation details, cable gland plate alongwith cable glands and all details mentioned in this specification.
3. Control Schematic Diagram along with grouping of different terminals for various functions.
4. Catalogue and technical information for instruments and devices with selected options clearly marked.
5. O&M Manuals.
6. "As Built" Drawing.
7. CDs.

7.0 MARKING AND PACKING

7.1 Panel with all instruments / devices mounted on it shall be suitably packed & protected for the entire period of despatch, storage and erection against impact, abrasion, corrosion, incidental damage due to vermin, sunlight, high temperature, rain moisture, humidity, dust, sea-water spray (where applicable) as well as rough handling and delays in Transit and storage in open.

872/2020/PS-PEM-MAX

C & I TECHNICAL SPECIFICATION
FOR DCS BASED
NaOH DOSING SYSTEM

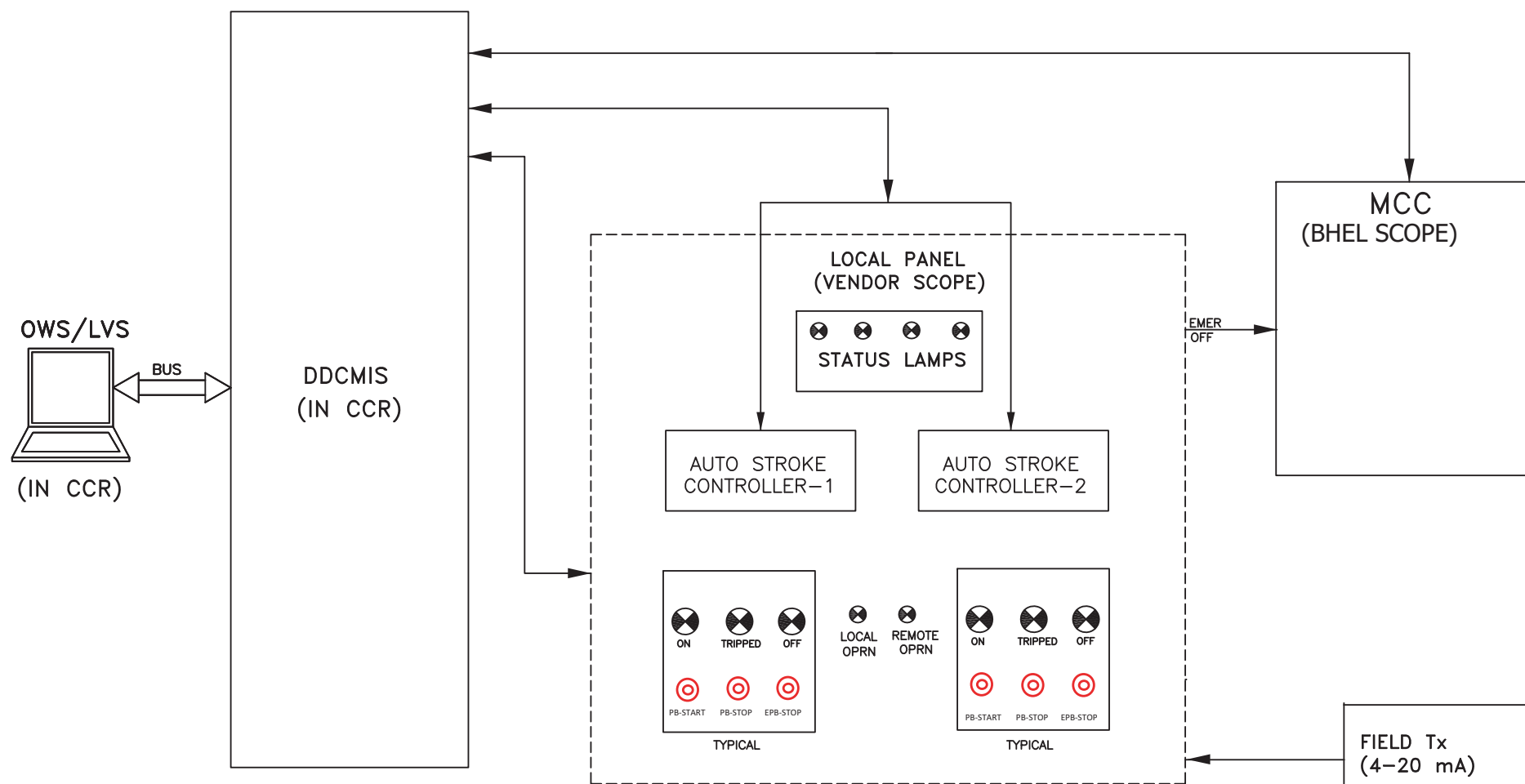
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872/2020/PS-PEM-MAX

C & I TECHNICAL SPECIFICATION
FOR DCS BASED
NaOH DOSING SYSTEM

SIGNAL EXCHANGE BETWEEN DRIVES & DCS

BLOCK INTERFACE FOR CHEMICAL DOSING SYSTEM (TYPICAL)



NOTES:

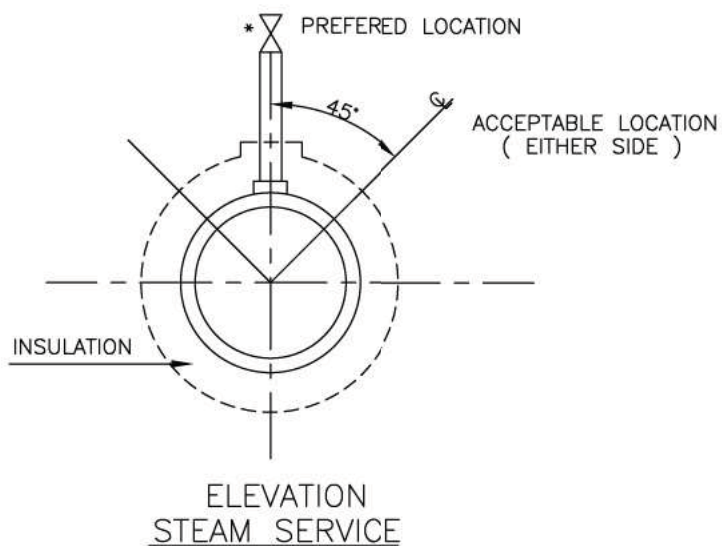
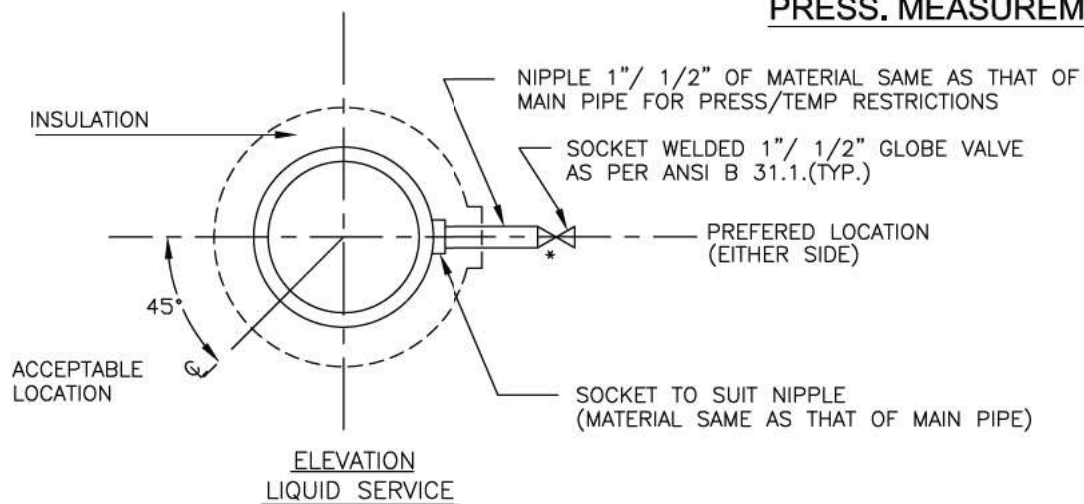
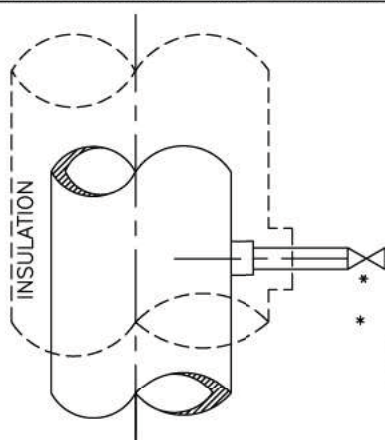
1. SIGNAL EXCHANGE BETWEEN DDCMIS & CHEMICAL DOSING LOCAL PANEL BE AS PER CONTROL PHILOSOPHY.
2. FIELD INSTRUMENT SHALL BE TERMINATED IN LOCAL PANEL.
3. SIGNALS FOR INTERFACE TO/FROM DDCMIS ARE ALSO TERMINATED IN LOCAL PANEL.

	TITLE STANDARD BLOCK INTERFACE DIAGRAM FOR LP DOSING SYSTEM	DRG.NO.	PE-DG-999-145-1273A
		DATE	
		REV.NO.	01
		SHT	

872/2020/PS-PEM-MAX

C & I TECHNICAL SPECIFICATION
FOR DCS BASED
NaOH DOSING SYSTEM

INSTRUMENT STUB DETAILS

PRESS. MEASUREMENT**PRESSURE CONNECTION ON HORIZONTAL PIPE****PRESSURE CONNECTIONS ON VERTICAL PIPES****FOR TENDER PURPOSE ONLY**

NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

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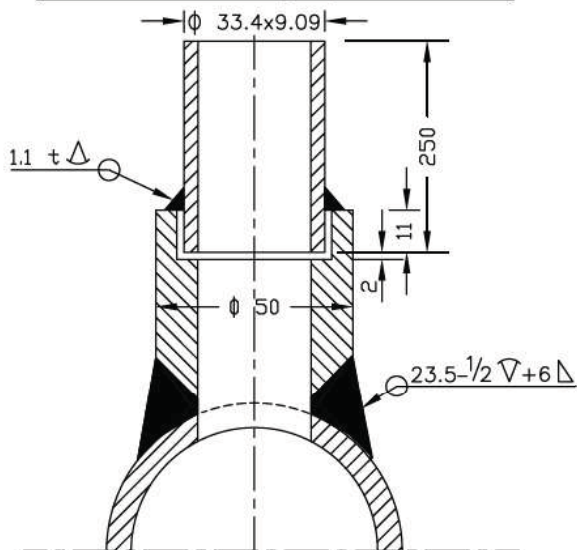
PROJECT

TYPICAL THERMAL POWER PROJECT

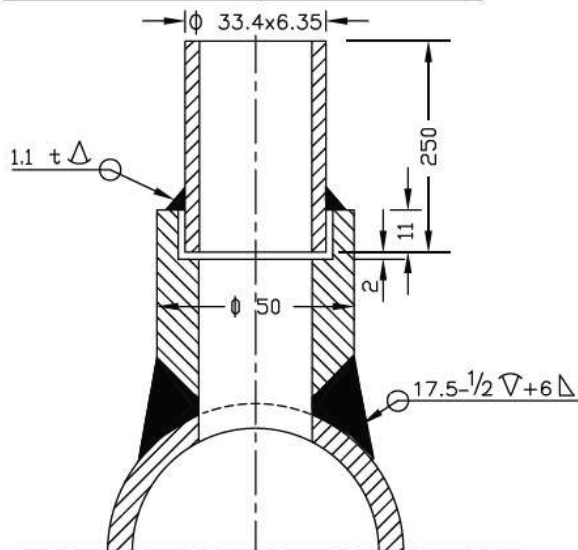
TITLE

PRESSURE MEASUREMENT

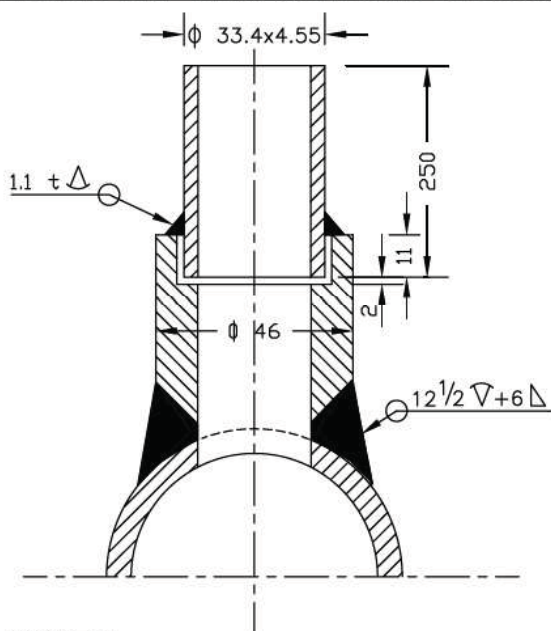
(SYSTEM PR. >40Kg/Sq Cm CL 9000)



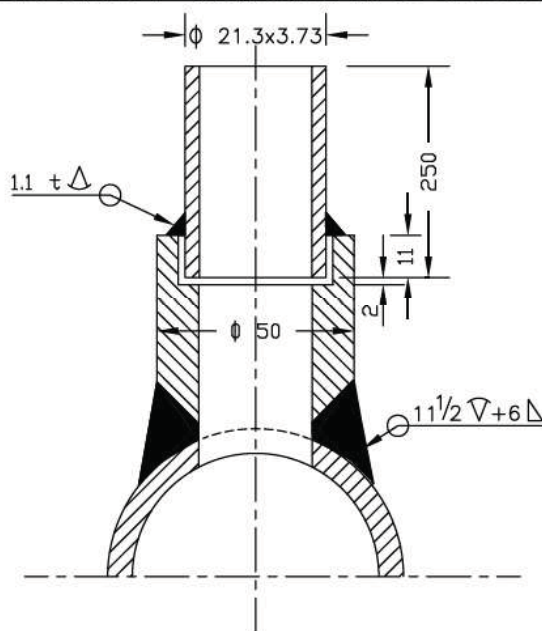
(SYSTEM PR. >40Kg/Sq Cm CL 6000)



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



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



NOTES:-

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

FOR TENDER PURPOSE ONLY

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NTPCNTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT

TYPICAL THERMAL POWER PROJECT

TITLE

INSTRUMENT SOURCE CONNECTION DETAILS

BHEL TECH SPEC NO.: PE-TS-468-154-A001

872/2020/PS-PEM-MAX

C & I TECHNICAL SPECIFICATION
FOR DCS BASED
NaOH DOSING SYSTEM

INSTRUMENT INSTALLATION DRAWING

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC								
	PROCESS CONNECTION AND PIPING									
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/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/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/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									

TECHNICAL REQUIREMENTS



	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 1/2" 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 1/2 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-III-E-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. for FGD system and other system being provided under the contract shall be suitably grouped together and mounted inside (i) local instruments enclosures in case of open areas of the plant and (ii) In local instrument racks in case of covered areas. The GA of LIE with purging indicated in the Drg. No. 0000-999-PQI-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.

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 enclosures shall be constructed of 3 mm sheet plate and shall be of modular construction with one or more modules and two end assemblies bolted together to form an enclosure. Double inter locking doors shall be provided. The doors shall be the three-point locking type constructed of not less than 1.6 mm thick steel. Doors shall have concealed quick removal type pinned hinges and locking handles. Door locks shall accept the same key.

The instrument racks shall be free standing type constructed of suitable 5 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.

5.01.00

ENCLOSURE / RACKS FOR DUAL I/P TEMPERATURE TRANSMITTERS

All Dual Input temperature transmitters for FGD system and other system being provided under the contract shall be suitably grouped together and mounted inside (i) Enclosures in case of open areas of the plant and (ii) Racks in case of covered areas. 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.

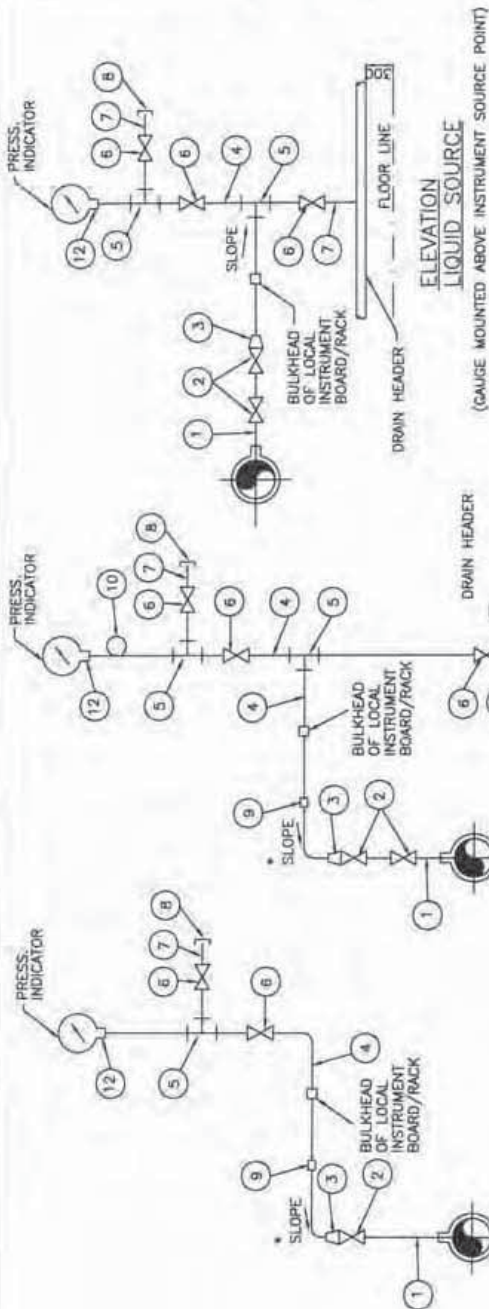
Enclosure and Racks shall be free standing type.

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.

LIST OF MATERIALS

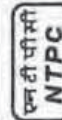
ITEM NO.	DESCRIPTION
1.	1/2" 3/4" 1" NPS SCH 40/80/160/XXS/P91 (AS PER PROCESS REQUIREMENT) NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	1/2" 3/4" 1" SW GLOBE VALVE/GATE VALVE
3.	3/4" 1" x 1/2" SW REDUCING INSERT
4.	1/2" 3/4" PIPE
5.	1/2" 3/4" SW EQUAL TEE
6.	1/2" 3/4" SW GLOBE VALVE
7.	1/2" 3/4" NPS SW x 1/2" 3/4" NPT(M) CARBON/ALLOY STEEL NIPPLE
8.	1/2" 3/4" NPT(F) CAP.
9.	1/2" 3/4" PIPE UNION
10.	6" SS SYPHON
11.	1/2" BLIND 300lbs RF ANSI FLANGE DRILLED AND TAPED FOR 1" NPT PIPE
12.	SUITABLE ADAPTER
13.	1/4" CHROME MOLY STEEL TUBE.
14.	
15.	1" 3/4" SW EQUAL TEE.
16.	DIAPHRAGM(WATER ELEMENT)
17.	ISOLATION VALVE 316 SS, 1/4" SW

ELEVATION LIQUID SOURCE
(GAUGE MOUNTED ABOVE INSTRUMENT SOURCE POINT)ELEVATION INST./ SERVICE AIR
(PRESSURE INDICATORS MOUNTED REMOTE FROM INSTRUMENT SOURCE POINT)ELEVATION STEAM SERVICE
(GAUGE MOUNTED BELOW INSTRUMENT SOURCE POINT)

NOTES:-

1. THE MATERIAL SPECIFICATION AND SCHEDULE NO. OF IMPULSE PIPE & NIPPLE AS LISTED HEREIN SHALL BE AS PER TECHNICAL SPECIFICATIONS.
2. THE MATERIAL SPECIFICATION AND RATING OF FITTINGS AS LISTED SHALL BE AS PER SPECIFICATIONS. WELDED/THREADED FITTINGS SHALL CONFORM TO ANSI-B.16-11.
3. INSTRUMENTS VALVES BODY STEM MATERIAL AND PRESSURE CLASS SHALL BE AS PER TECHNICAL SPECIFICATIONS.
4. FOR BOILER AIR/FLUE GAS SERVICES SOURCE CONNECTIONS IMPULSE PIPING AND ALL FITTINGS SHALL BE OF 3/4" NB SIZE.
5. GAUGES SHALL NOT BE MOUNTED ON THE PIPE. IT WILL BE MOUNTED ON A CHANNEL OR FRAME OR A RACK.
6. * SLOPE APPROX. 50 MM / METRE.

FOR TENDER PURPOSE ONLY



NTPC LIMITED

(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

TYPICAL THERMAL POWER PROJECT

PROJECT

INSTRUMENT INSTALLATION DIAGRAM
(FOR PRESSURE GAUGE)

TITLE

SIZE
A3SCALE
N.T.S.

DRG. NO.

0000-999-POI-A-022

REV. NO.
A

DESCRIPTION

FIRST ISSUE

REV. NO.

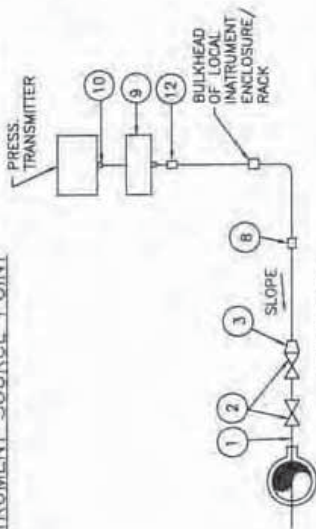
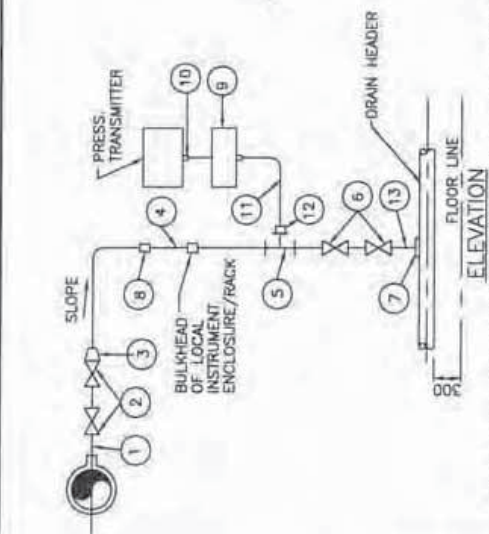
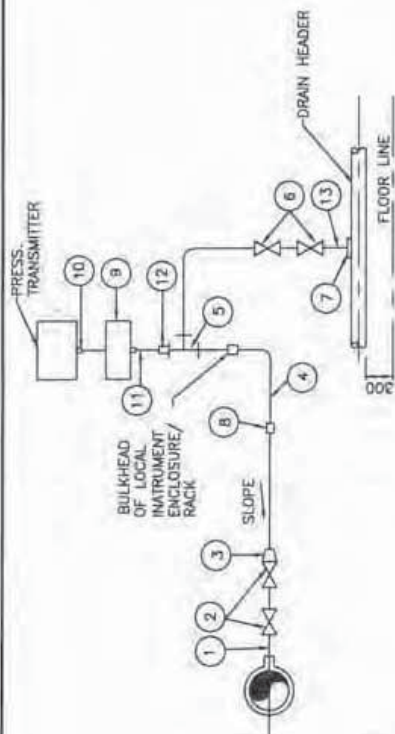
LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	1/2" x 3/4" x 1" NPS SCH. 80/160 XXS/PS1 NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	3/4" x 1" SW GLOBE VALVE.
3.	3/4" x 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 SW 1/2" CS/AS COUPLER
8.	1/2" PIPE UNION
9.	2/3 VALVE MANIFOLD (FOR DETAIL SEE DRAWING NO.0000-102-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 SW 1/2" NPT(M) CS/AS NIPPLE

ELEVATION

TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

LIQUID PRESSURE MEASUREMENT



ELEVATION

VACUUM PRESSURE MEASUREMENT

NOTES:-

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.

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TYPICAL THERMAL POWER PROJECT

PROJECT

INSTRUMENT INSTALLATION DIAGRAM

(PRESSURE MEASUREMENT USING PRESS /DP
TRANSMITTERS STEAM/LIQUID VACUUM)

TITLE

DATE

APPD

ARCH.

C&I

E

M

CHKD.

DESIGN

DRAWN

FIRST ISSUE

REV.NO.

DESCRIPTION

Cleared by

M

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T.G.

21.08.12

REV. NO.

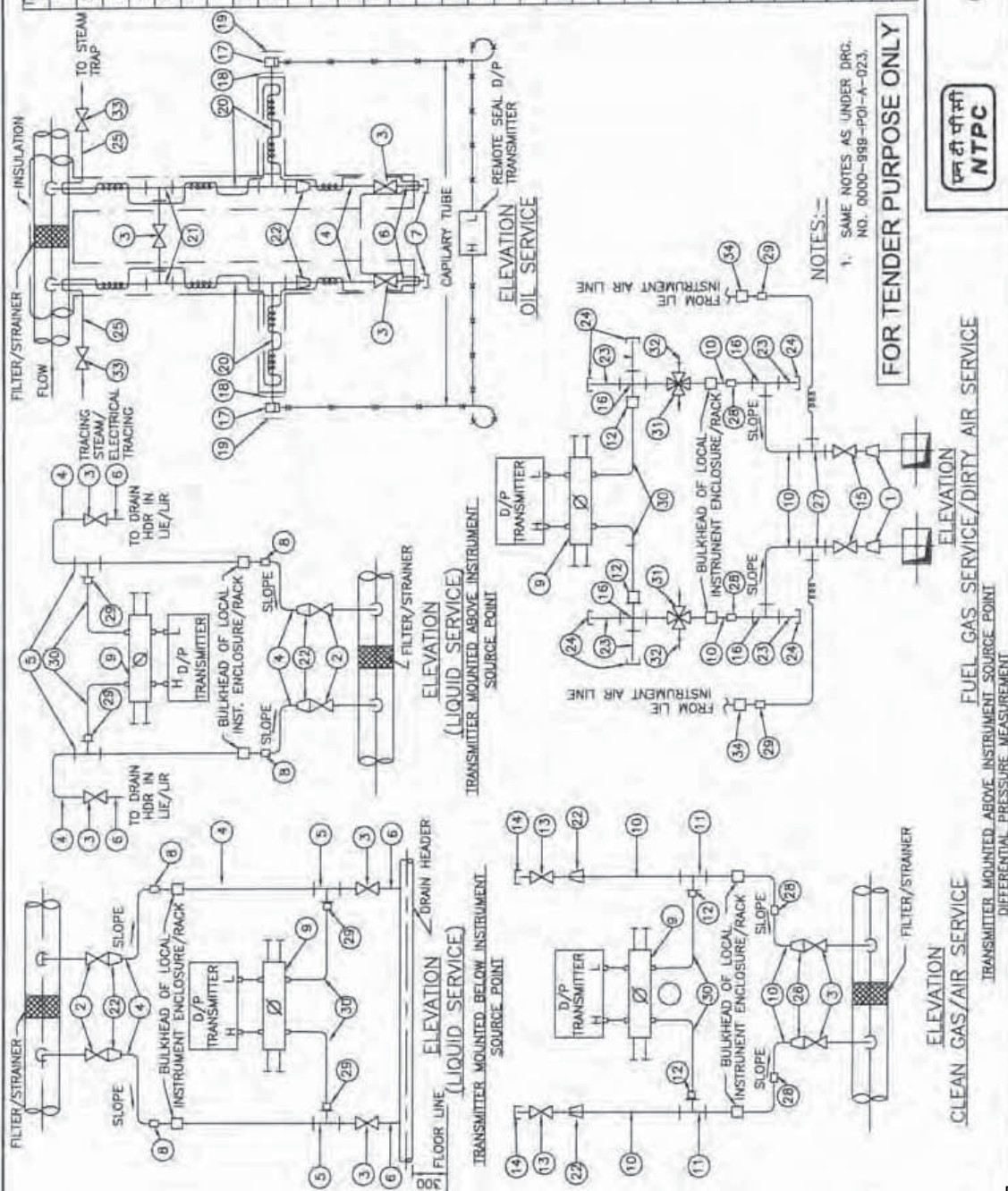
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0000-999-POI-A-025

REV. NO.

A

LIST OF MATERIALS	
ITEM NO.	DESCRIPTION
1.	42x2 TO 3/4" SW REDUCING INSERT.
2.	3/4" SW GLOBE VALVE.
3.	1/2" SW GLOBE VALVE FOR LIQUID APPLICATION & 3/4" x 1" IN 1/2" SW GLOBE VALVE FOR GAS APPLICATION (AS PER PROCESS REQUIREMENT)
4.	CARBON/ALLOY STEEL PIPE.
5.	1/2" SW EQUAL TEE.
6.	1/2" NPS SW x 1/2" NPT (M) NIPPLE.
7.	1/2" NPT (F) CAP.
8.	1/2" PIPE x 1/2" PIPE UNION.
9.	5 VALVE MANIFOLD (FOR DETAIL REFER DRAWING NO.0000-999-POL-A-026.
10.	3/4" SCH 80 CARBON/ALLOY STEEL PIPE.
11.	3/4" x 1/2" SW EQUAL TEE.
12.	3/4" x 1/2" TUBE UNION.
13.	1/2" SCREWED GLOBE VALVE.
14.	1/2" NPT (M) PLUG.
15.	3/4" SW GATE VALVE.
16.	3/4" SW EQUAL CROSS.
17.	WATER ELEMENT FOR USE WITH 3" ANSI R.F. VALVE.
18.	3" BLIND 300166 R.F. WELD NECK FLANGE DRILLED FOR 1" SCH. 40/80 PIPE.
19.	3" BLIND FLANGE.
20.	1" NPS SCH. 40/80 (AS PER PROCESS REQUIREMENT) CS PIPE.
21.	1" SW EQUAL TEE.
22.	3/4" x 1/2" SW REDUCING INSERT.
23.	3/4" SW x 3/4" NPT (M) CS/AS NIPPLE.
24.	3/4" NPT (F) CS/AS CAP.
25.	1/4" NPS ALLOY STEEL PIPE.
26.	1" x 3/4" SW REDUCING INSERT.
27.	3/4" SW x 1/2" PSW BRANCH TEE.
28.	3/4" PIPE UNION
29.	1/2" CLAMP UNION (THREADED) SUITABLE FOR FLEXIBLE CONNECTION OF NYLON REINFORCED PVC TUBE.
30.	SS TUBE
31.	3/4" SW 4 WAY VALVE
32.	QUICK DISCONNECT FITTINGS.
33.	1/4" SW ISOLATION VALVE. 316SS
34.	1/2" x 1/2" SS PIPE UNION.



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NOTES:-

1. SAME NOTES AS UNDER DRG.
NO. 0000-999-POL-A-023.

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TYPICAL THERMAL POWER PROJECT

INSTRUMENT INSTALLATION DIAGRAM

DIFF. PRESS. MEASUREMENT (LIQUID, OIL, AIR/GAS SERVICE)

DRG. NO.

SIZE

13

[illegible]

SHKD.

NAME	DATE
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1

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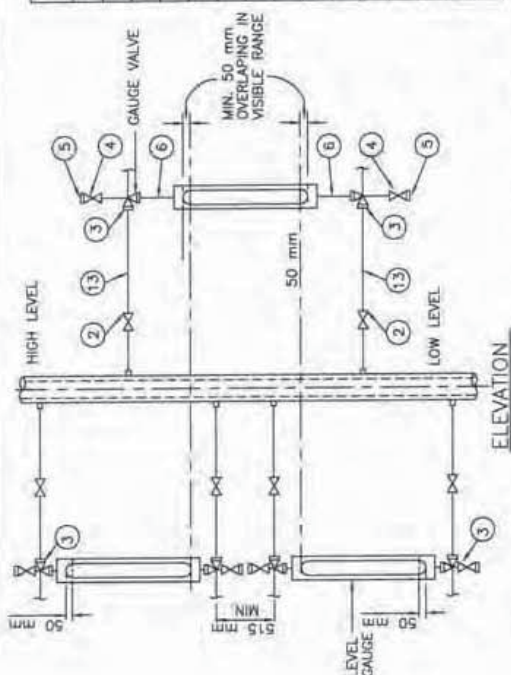
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0000-999-POI-A-030

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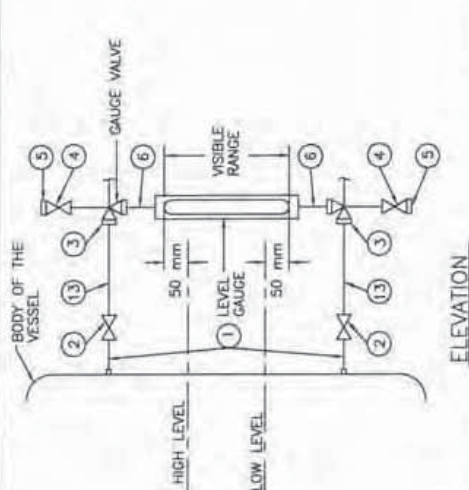
LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	3/4" 1" NPS SCH.40/80/160/P91 (AS PER PROCESS REQUIREMENT) CARBON ALLOY STEEL PIPE.
2.	3/4" SW GLOBE VALVE.
3.	3/4" SW UNION.
4.	3/4" NPT GLOBE VALVE.
5.	3/4" NPT (M) CAP.
6.	3/4" NPT (F) UNION CONNECTION.
7.	1" SW EQUAL UNION.
8.	1" x 1/2" SW REDUCING INSERT.
9.	1" SW EQUAL TEE.
10.	1/2" SW GLOBE VALVE.
11.	1/2" NPS SWx1/2" NPT(M) CS/AS NIPPLE.
12.	1/2" NPT (F) CAP
13.	3/4"x1/2" NPS SCH.40/80 CS/AS PIPE.
14.	1/2" NPS SCH.80/160 CS/AS NIPPLE.
15.	1" SW GLOBE VALVE.

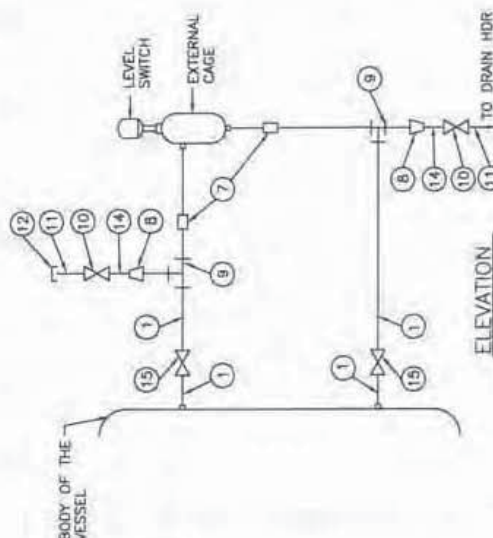


③ ^{up}
A ELEVATION

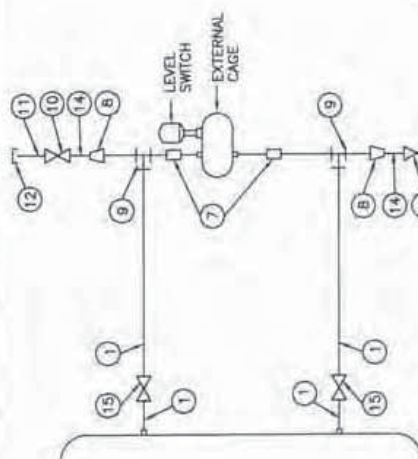
LOCAL LEVEL INDICATION USING MULTIPLE GAUGES
FOR INCREASED RANGE NOT COVERED IN A SINGLE UNIT



LOCAL LEVEL INDICATION USING GAUGE GLASS



FLOAT OR DISPLACER OPERATED EXTERNAL CAGE TYPE LEVEL SWITCH INSTALLATION



ELEVATION

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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TYPICAL THERMAL POWER PROJECT

INSTRUMENT INSTALLATION DIAGRAM (LEVEL GAUGE & SWITCHES)

SCALE	DRG. NO.
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0000-999-POI-A-031

REV. NO. A

	C & I TECHNICAL SPECIFICATION FOR DCS BASED NaOH DOSING SYSTEM	

CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY

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

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

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 Not used.

6.00.00

TERMINAL BLOCKS

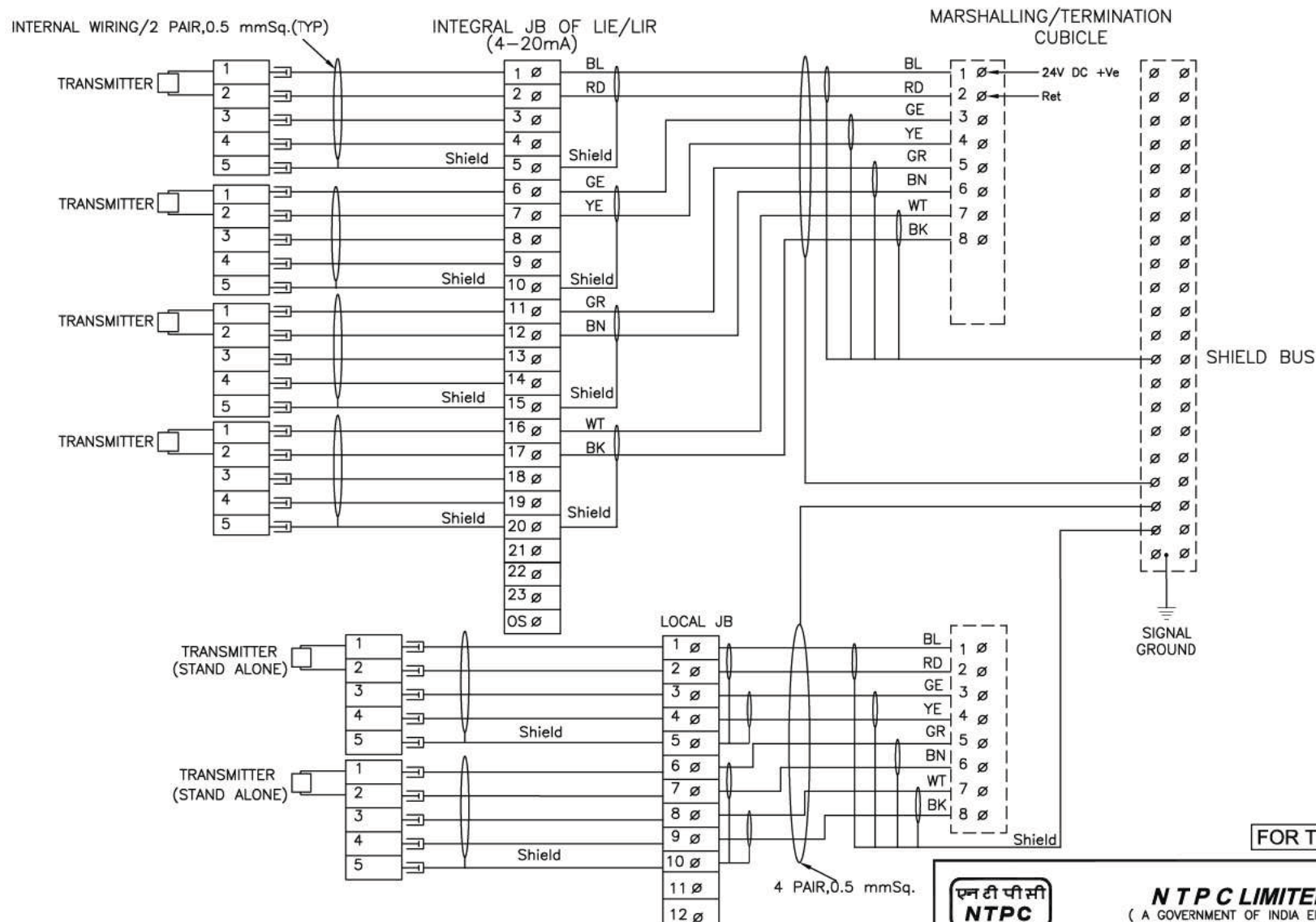
6.01.00

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

TECHNICAL REQUIREMENTS



	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 ferrules 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.)

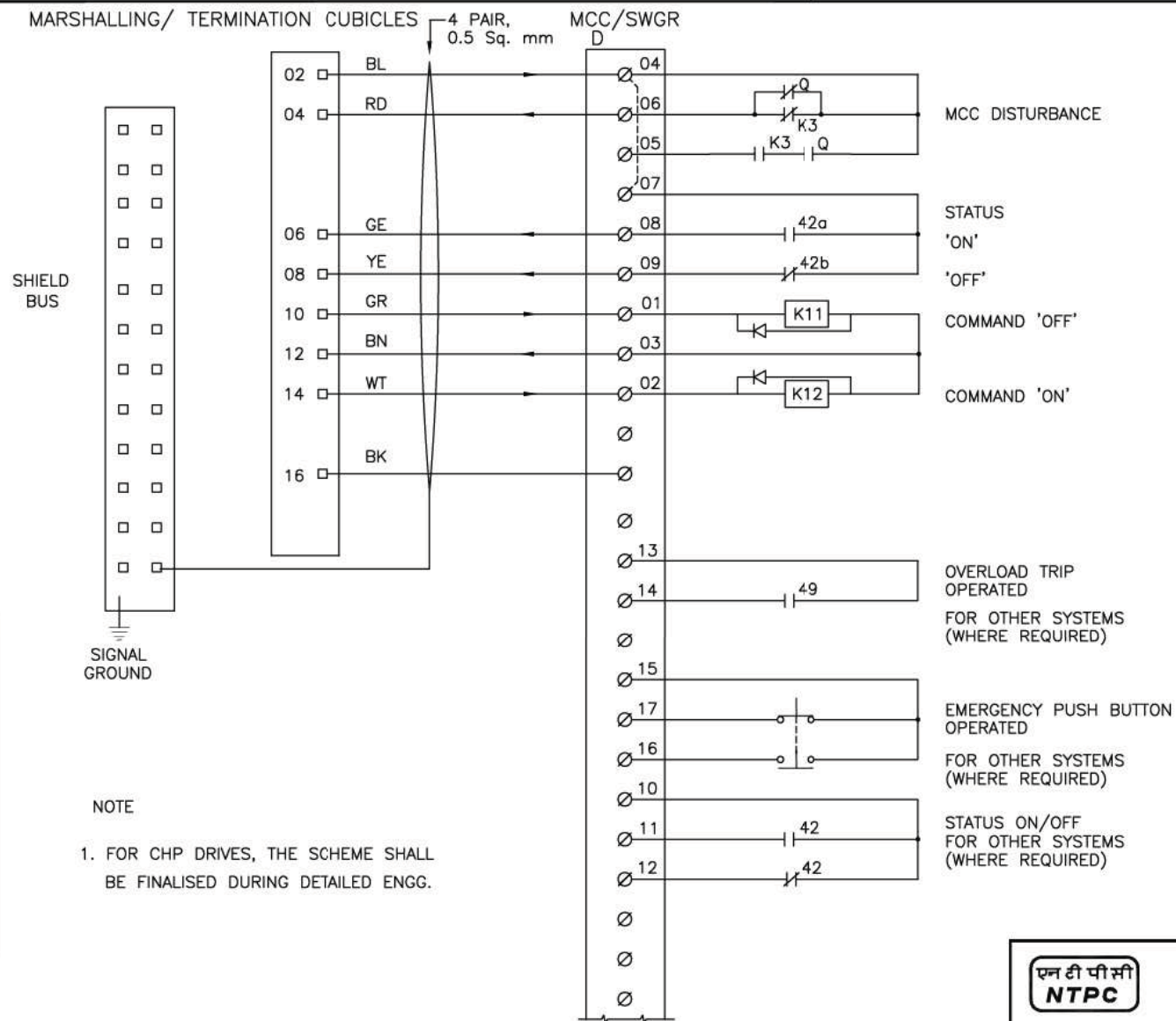


FOR TENDER PURPOSE ONLY



NTPC LIMITED
 (A GOVERNMENT OF INDIA ENTERPRISE)
 ENGINEERING DIVISION

												PROJECT TYPICAL THERMAL POWER PROJECT									
B	INTERNAL WIRING FOR LIE/LIR MOUNTED SHOWN WIRING OF STAND ALONE TXTR SHOWN																21.08.12	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	B				
Page 104 of 152																					



FOR TENDER PURPOSE ONLY



NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

												PROJECT		TYPICAL THERMAL POWER PROJECT	
												TITLE		INTERFACING OF FIELD INSTRUMENTS INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR (LT MOTORS)	
A	FIRST ISSUE										21.08.12	SIZE	SCALE	DRG. NO.	REV. NO.
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE	A3	NTS	0000-999-POI-A-065	A
CLEARED BY															

8/2/2020/PS-PEM-MAX



TITLE: TECHNICAL SPECIFICATION
 FOR CHEMICAL DOSING SYSTEM (NaOH DOSING).
 PROJECT: 2X250 MW BHILAI TPP (NSPCL).
 (FGD SYSTEM PACKAGE).

BHEL DOCUMENTS NO.: PE-TS-468-154-A001

VOLUME III

REV. NO. 00

DATE:

VOLUME-III

8/2/2020/PS-PEM-MAX



TITLE: TECHNICAL SPECIFICATION
FOR CHEMICAL DOSING SYSTEM (NaOH DOSING).
PROJECT: 2X250 MW BHILAI TPP (NSPCL).
(FGD SYSTEM PACKAGE).

BHEL DOCUMENTS NO.: PE-TS-468-154-A001

VOLUME: III

SECTION:

REV NO: 00

DATE:

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

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE					
NAME	DESIGNATION	SIGNATURE	DATE		COMPANY SEAL

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DEVIATION SHEET (COST OF WITHDRAWAL)									
 TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM (NaOH DOSING). PROJECT: 2X250 MW BHILAI TPP (NSPCL). (FGD SYSTEM PACKAGE).									
TECH SPC NO: PE-TS-468-154-A001									
TENDER ENQUIRY REFERENCE:-									
NAME OF BIDDER:-									
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 WITHDRAWL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWL 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 withdrawl of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.									
2. For directly dispatchable items, cost of withdrawl 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 withdrawl 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 withdrawl 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 withdrawl 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 withdrawl is to be given seperately for each deviation. In no event bidder should club cost of withdrawl of more than one deviation else cost of withdrawl of such deviations which have been clubbed together shall be considered as NIL.									
13. In case nature of cost of withdrawl (positive/negative) is not specified it shall be assumed as positive.									
14. In case of descrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.									

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COMPLIANCE CUM CONFIRMATION CERTIFICATE

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

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

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DRAWING/DOCUMENTS SUBMISSION SCHEDULE FOR CHEMICAL DOSING SYSTEM

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

For the Drawings/Documents Submission Procedure, please refer **Sec-C1**. The submission of soft copy or hard copy of the drawing/document whichever is later will be considered as final date of submission of the drawing/document. The bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only.

Bidder to note that the drawings to be submitted by bidder in the event of award of contract shall be as per the below given drawing/document list. Bidder to note that any additional drawings/documents requirement during detailed engineering shall be provided by bidder without any technical, commercial and delivery implications to BHEL. Bidder confirmed that every revised submission incorporating comments – within 7 days.

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

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

Sl. No.	BHEL Drg. No.	Title	CATEGORY	No. of weeks for document submission after placing LOI/LOA	SIZE OF DRAWING/ DOCUMENT
1	PE-V1-468-154-A001	P&I DIAGRAM	A	4	A1
2	PE-V1-468-154-A002	GA DRAWING	A	4	A1
3	PE-V1-468-154-A003	DATA SHEET FOR SYSTEM	A	6	A4
4	PE-V1-468-154-A004	LCP DRAWING	A	6	A4
5	PE-V1-468-154-A005	QAP	A	4	A1
6	PE-V1-468-154-A006	PACKING PROCEDURE	A	8	A4
7	PE-V1-468-154-A007	O& M MANUAL	A	8	A4

(b) Bidder to note that drawings/documents submission shall be through web based Document Management System. Bidder would be provided access to the DMS for drawings/documents approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

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

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NOTES:

1. A= APPROVAL. I = INFORMATION.
2. ANY ADDITIONAL DRAWINGS-DOCUMENTS REQUIRED DURING DETAILED ENGINEERING STAGE SHALL BE PROVIDED BY BIDDER WITHOUT ANY COMMERCIAL, TECHNICAL AND DELIVERY IMPLICATION TO BHEL AND CUSTOMER.
3. BIDDER TO SUBMIT REUSABLE DATABASE FORMATS IN BHEL/NTPC APPROVED FORMATS LIKE MS EXCEL, MS WORD OF DOCUMENTS LIKE INSTRUMENT SCHEDULE, I/O LIST, DRIVE LIST, FIELD JB TERMINATIONS, CABLE SCHEDULE & INTERCONNECTION, ETC. SOFT COPY OF FORMATS SHALL BE PROVIDED TO SUCCESSFUL BIDDERS.
4. DOCUMENTS PERTAINING TO PROVENNESS TO BE SUBMITTED BY THE BIDDER.
5. DWG. / DOCUMENT SHALL BE UPLOADED BY THE SUCCESSFUL BIDDER ON WRENCH /DMS. PROCEDURE FOR THE SAME WILL BE INFORMED AFTER AWARD OF CONTRACT.

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DECLARATIONS

Icertify 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