



MAHARASHTRA STATE POWER GENERATION COMPANY LIMITED

1X660 MW BHUSAWAL TPS

TECHNICAL SPECIFICATIONS FOR CHEMICAL DOSING SYSTEM

SPECIFICATION NO.: PE-TS-415-154-A001, R00



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

	TITLE:	SPECIFICATION NO. PE-TS-415-154-A001
	1X660 MW BHUSAWAL TPS	SECTION
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION -
		REV.NO. 00 DATE: 27.05.2019

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PROJECT INFORMATION

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: II
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1.0 <u>INTRODUCTION</u> The proposed 1x 660 MW Bhusawal Thermal Power Project will be set up by Maharashtra State Power Generation Co. Ltd. (MAHAGENCO) in Dipnagar near Bhusawal, Maharashtra, India. The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given herein under is for general guidance and shall not be contractually binding on the Owner. All relevant site data/information as may be necessary shall have to be obtained /collected by the Bidder. 2.0 <u>APPROACH TO SITE</u> Deepnagar is well connected by rail and road. By road, it is about 8 Km from Bhusawal city. Nearest railway station is at Bhusawal. The nearest Airport is at Aurangabad. The nearest sea port is at Mumbai. The site is located on the Mumbai-Nagpur Highway. 3.0 <u>LAND</u> Bhusawal Thermal Power Plant is already having 1x62.5 MW + 2x210 MW Units and Two (2) Units of 500 MW each are under execution stage. About 108.94 Hectares of land is acquired by MAHAGENCO near existing TPS. It is proposed to install 1x 660 MW unit on this land. 4.0 <u>SOURCE OF COAL</u> Indian coal would be sourced from Machaakata coal blocks in Orissa state. The Coal will be received at Plant site directly by rail. The coal from the railway wagons would be unloaded by means of wagon tipplers and will be either bunkered or stacked in the stock pile at site. 5.0 <u>SOURCE OF WATER</u> The main source of water is considered Ozerkheda Reservoir which is located at around 18 km from plant site.		

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6.0 ASH DISPOSAL AREA

The ash generated from 1 x 660 MW unit shall be disposed off in slurry form to the existing Ash Pond located at Velhala, approx. 12 Km from the site.

7.0 PROJECT INFORMATION

7.1	Client / Owner	:	Maharashtra State Power Generation Co. Ltd.
7.2	Consultant	:	Procon Engineers, Navi Mumbai (Division of Nimoto Consulting Engineers Pvt. Ltd.)
7.3	Project Title	:	BHUSAWAL T.P.S. UNIT – 6 : 1X660 MW
7.4	Location	:	Dipnagar, Near Bhusawal, Maharashtra, India
7.5	Nearest railway station	:	Bhusawal
7.6	Nearest Airport	:	Aurangabad
7.7	Nearest Harbour	:	Mumbai
7.8	Access Roads	:	NH 6 (Mumbai-Nagpur Highway)
7.9	Elevation above MSL	:	210 M
7.10	Longitude/latitude	:	75° 51' 10" East / 21° 02' 30" North
7.11	Seismic Zone	:	Zone III as per IS:1893
7.12	<u>AMBIENT TEMPERATURE</u>		
7.12.1	Mean of daily maximum temperature	:	48.25 °C (during May)
7.12.2	Mean of daily minimum temperature	:	18 °C (during January)
7.12.3	Highest temperature recorded	:	48.7°C

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7.12.4	Lowest temperature recorded : 13°C		
7.13	Wet bulb temperature : 27°C (Maximum)		
7.14	Rainfall : 112 mm average annually		
7.15	Wind Speed : 0 to 39 Km/hr		
7.16	Wind direction : East North East to West South West		
	<u>ELECTRICAL</u>		
7.17	<u>MAIN POWER SOURCE FROM GRID</u>		
7.17.1	Rated Voltage : 400kV		
7.17.2	Voltage variation : ± 10 %		
7.17.3	Frequency Variation : ± 5 %		
7.17.4	Rated Short Circuit : 50 kA, Three Phase Symmetrical Level		
7.18	<u>AUXILIARY POWER SUPPLY</u>		
	Auxiliary electrical equipment shall be suitable for operation on the following supply system:		
7.18.1	Motors above 1000 kW & other Power devices : 11kV,3Ph,3wire,50Hz system		
7.18.2	Motors below 1000 kW & above 160kW & other power devices : 3.3kV, 3 ph, 3 wire 50 Hz, Non Effectively earthed		
7.18.3	Motors upto 160 kW & other power devices : 415V, 3 ph, 4 wire 50 Hz		
7.18.4	Motor Starting Methods : Direct on Line		
7.18.5	(a) Lighting fixtures, Space heaters, and single Phase motors : 240V, 1 phase, 50 Hz Supply through suitably rated transformers to limit the short circuit level to 9kA – 1 sec.		

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(b) Control & : 240V, 1 Phase, 50 Hz from UPS Instrumentation 7.18.6 Short circuit levels of 11kV, 3.3 kV and 415V system equipments The equipment shall be suitable for the following short circuit levels (a) 11kV Switchgears : 44 kA/3 sec (b) 3.3kV Switchgears : 40 kA/3sec (c) 415V PCC/ : 50 kA/1sec PMCC/ MCC (d) Lighting : 9 kA/1sec Distribution Boards & 240V A.C. supply 7.18.7 Auxiliary DC supply The auxiliary DC supply will be used for control, indication & protection, Turbine lube oil system, AVR, Emergency DC lighting of power plant and Control & Instrumentation etc. (a) Voltage : (i) 220V DC for utility purpose (ii) 24V DC for Control and Instrumentation (b) Voltage variation : + 10 %, - 15 % 7.18.8 Emergency power supply (a) Purpose : (i) Standby power to normal incomer of emergency MCC (ii) Alternate power source to Fire water Pumps (b) Rated voltage and frequency : 415 V, 3 phase, 3 wire, 50 Hz.		

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7.18.9	UPS power supply (a) Purpose : (i) Vital process loads (ii) Critical lighting (iii) Control and Instrumentation (iv) Office for LAN power supply/Server etc. (b) Rated Voltage : 415V, 3 ph, neutral/240V single phase, 50Hz	
7.19	The variation in voltage and frequency may be $\pm 10\%$ and $\pm 5\%$ respectively. The combined voltage and frequency variation may be $\pm 10\%$. All devices shall be suitable for continuous operation over the entire range of voltage variation without any change in their performance	
7.20	Power socket shall be 415V AC, 50 Hz, 4 pin 32/63 Amps. Power socket outlets for portable tools, hand lamps etc shall be 240 volts, single phase, 3 pin, metal clad industrial type	
7.21	All electrical equipment shall be designed for the following ambient conditions (a) Maximum ambient temperature : 50°C (b) Minimum Ambient temperature : 13°C	

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SECTION - I

SPECIFIC TECHNICAL REQUIREMENTS

SECTION I-A: SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

SECTION I-B: SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

SECTION I-C: SPECIFIC TECHNICAL REQUIREMENTS (C&I)

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SECTION - IA

SPECIFIC TECHNICAL REQUIREMENTS - MECHANICAL

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1. SCOPE:

Design (i.e. preparation and submission of drawing /documents including “As Built” drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection/ testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables (excluding chemicals), mandatory spares along with spares for erection, start-up and commissioning as required, forwarding, proper packing, shipment and delivery at site for **1 X 660 MW BHUSAWAL TPS UNIT-6**. Chemical Dosing System, complete with all accessories for the total scope as specified hereinafter for the following systems:

- a) HYDRAZINE DOSING SYSTEM - 1 No. Skid.
- b) AMMONIA DOSING SYSTEM - 1 No. Skid.
- c) NaOH DOSING SYSTEM - 1 No. Skid.

2. DESIGN BASIS:

Customer specification.

The following drawings/ data sheets are enclosed for the reference:

- a) P&ID for Hydrazine dosing system.
- b) P&ID for Ammonia dosing system.
- c) P&ID for NaOH dosing system.
- d) DATA SHEET – A for all above systems.

3. SCOPE OF SERVICE

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

- a. Design and engineering.
- b. Fabrication of the skid mounted chemical dosing system.
- c. Inspection and testing of the skid as per the approved quality assurance plan.
- d. Supply of the skid mounted chemical dosing system up to the power plant site along with all accessories as defined in the technical specification.
- e. Painting as per approved painting requirement to be finalized during detailed engineering. However the same shall be prepared in line with the painting requirement enclosed in ANNEXURE IV of technical specification.

4. DESIGN PHILOSOPHY

Chemical dosing systems are designed to dose required quantity of chemicals to maintain the quality of boiler feed water. Chemicals are dosed both in low pressure side of feed water cycle as well as in ECW system.

5. LOW PRESSURE CHEMICAL DOSING

The LP dosing consists of Hydrazine dosing system, ammonia dosing system for boiler feed water and NaOH dosing skids for ECW system. The details of each dosing system are given below:

4.1 HYDRAZINE DOSING SYSTEM: (TOTAL NO. OF SKIDS= 1 NO.)

(Refer Drawing no. PE-DG-415-154-A001-R01)

One number of Hydrazine Dosing System consists of the following:

- a) Two number Hydrazine solution preparation cum metering tank.
- b) Six number (3 X 50%) Hydrazine Dosing Pumps.
- c) One number Barrel Pump.

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- d) Associated Piping, valves, fitting as indicated in the P&ID of hydrazine dosing system and data sheet-A enclosed and as required to make the system complete.
- e) Control & instrumentation as per P&ID of Hydrazine Dosing System, Data sheet-A, Section IA, IC.

4.2 AMMONIA DOSING SYSTEM: (TOTAL NO. OF SKIDS= 1 NO.)

(Refer Drawing no. PE-DG-415-154-A002-R01)

One number of Ammonia Dosing System consists of the following:

- a) Two number Ammonia solution preparation cum metering tank.
- b) Six number (3 X 50%) Ammonia Dosing Pumps.
- c) One number Barrel Pump.
- d) Associated Piping, valves, fitting as indicated in the P&ID of Ammonia Dosing System and data sheet-A enclosed and as required to make the system complete.
- e) Control & instrumentation as per P&ID of Ammonia Dosing System, Data Sheet-A, Section IA, IC.

4.3 NAOH DOSING SYSTEM FOR ECW SYSTEM: (TOTAL NO. OF SKID = 1 NO.)

(Refer Drawing. No. PE-DG-415-154-A003-R01)

One number of NaOH Dosing System consists of the following:

- a) One number NaOH solution preparation cum metering tank.
- b) Two (2 X 100%) NaOH Dosing Pumps.
- c) 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.
- d) Control & instrumentation as per P&ID of NaOH Dosing System, Data Sheet-A, Section IA, IC.

6. CIVIL SCOPE

Nil.

7. TERMINAL POINTS (also refer P&I Diagrams enclosed)

- a) All piping beyond battery limit of skid as indicated in P&ID's enclosed with the technical specification is excluded from bidder's scope.
- b) Electrical scope shall be as per Std. Electrical Scope Matrix attached in Section IB of the technical specification.
- c) All drains shall be brought at one point on the skid by the bidder via a drain header and further connection to the nearest plant drain shall be done by BHEL/ Customer.
- d) Counter flanges for all the piping terminal points (as per P&IDs) and for the terminal point of drain header shall be in bidder's scope.

8. QP AND SUB VENDOR APPROVAL

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

8.2 The sub vendor list (Annexure- II) enclosed is indicative only and is subject to approval/

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acceptance by customer. Bidder to propose his sub vendor list with back up documents (experience list, end user performance certificate as applicable) etc. The same shall subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL/ Customer.

9. DOCUMENTS TO BE SUBMITTED BY BIDDER ALONG WITH THE BID

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

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

Bidder to note that if bidder has taken any deviation from the technical specification requirements, the same shall be clearly mentioned in the bid in the BHEL prescribed format of Schedule of Deviations attached as Section - III of this technical specification.

In case of no deviation, Bidder to furnish signed and stamped copy of "Schedule of Deviations with cost of withdrawal" stating "**No Deviation**". No other technical document is required along with bidder's offer. Any other document submitted by bidder shall not be evaluated by BHEL and shall be considered as withdrawn. Bidder to note that any un-declared deviation mentioned in bidder offer other than specified in the scheduled of Deviations shall be considered as null and void.

10. DRAWING/ DOCUMENTS REQUIREMENT

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

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

11. SPARES

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

12. MANDATORY SPARES

- The list of mandatory spares considered essential by the BHEL & Customer is indicated in Annexure- V.
- All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipment.
- Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the total population of the item in the station (project), unless specified otherwise and the fraction will be rounded off to the next higher whole number.
- "One (1) Set" and "One (1) set of each type & rating" is defined as total numbers as required for one complete replacement for one equipment of similar size & capacity.
- Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the

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higher quantity until & unless specified otherwise.

- f) Mandatory spares listed in Price Schedule is bare minimum requirement. In case any additional mandatory spares requirement is covered elsewhere in the tender specification apart from specified above, same shall be deemed to have been covered in bidder's scope of supply.
- g) All mandatory spares shall be supplied as per the requirement of the specifications. In case any spare indicated in the specification is "not applicable" for particular equipment, then suitable applicable alternate spare has been offered / shall be supplied by the bidder without any financial implication."
- h) Bidder to write "Quoted / Not Applicable" against all items. Any item which is quoted as "not applicable" by the bidder in the above list and is found to be "applicable" at a later date shall be supplied by the bidder without any commercial and delivery implication.
- i) Any cell left blank in the unpriced schedule shall be treated as "Quoted" and is included in total price.
- j) The spares shall be treated and packed for a long storage under the climatic condition prevailing at site.
- k) Each spare part shall be clearly marked and labelled on the outside of the packing with its description. When more than one spare part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers, and other packages must be suitably marked and numbered for the purpose of identification.
- l) The Bidder shall note that if there in any change/ variation in equipment/ system during detail engineering which causes any change/ variation in the essential spares quantity, the same shall be supplied without any commercial implications. The price indicated for the mandatory spares shall be considered for the purpose of evaluation.

13. START-UP AND COMMISSIONING SPARES

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

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

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

14. SPECIAL TOOLS AND TACKLES

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

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and tackles required. Bidder shall also include all maintenance tools and tackles in their scope. Total price of all the maintenance tools and tackles shall be included in the quoted lump sum price.

15. PACKING

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

THE ACTUATOR OF THE PUMP SHALL BE PACKED IN AIR TIGHT PACKING ALONG WITH THE PUMP IN INSTALLED CONDITION FOR PREVENTING DAMAGE OF ACTUATOR.

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

16. PAINTING

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

17. DESIGN REQUIREMENTS

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

- a) In addition to the requirements of Section-I & II the following shall also be complied under scope of this specification: The P&ID is enclosed herein in this section for bidder's compliance.
- b) The material of construction specified in Data Sheet-A are minimum requirements and material of construction for other components not specified shall be similarly selected by the bidder for intended duty which shall be subjects to Customer/ BHEL approval during detailed engineering.
- c) All instrument-wetted parts will be suitable for requested application.
- d) All high points on any, tanks, pumps, piping or instrumentation will be vented and provided with valve. All low points on any, tanks, pumps, piping or instruments will be drained and provided with valve.
- e) 5 mm (min.) thick IS 2062 Checker plate shall be provided covering the skid frame and for elevated platform for the preparation/ measuring tank, wherever applicable. The tanks support, pumps and pipe supports and LCP/ LCP supports shall be welded to the checker plate.
- f) Stuffing box shall be provided for mounting the agitator to avoid air ingress.
- g) Vent/ overflow pipe from tank shall at least reach the bottom half of the breather/ water seal/ CO₂ absorber.
- h) SS pad shall be provided for welding MS structural supports to SS tanks.
- i) Step ladder and chemical charging platform shall be provided for easy access to top of tank.
- j) All the terminal points shall be easily accessible and towards one side of skid.
- k) All valves shall be easily accessible for the operator.
- l) All tanks/ pumps shall have name plate clearly indicating the equipment name.
- m) Pipe fittings of the system shall be done using elbows and tees. Pipe bending is not acceptable.
- n) All equipment shall have SS name plate.
- o) All LCP shall be mounted in their respective dosing skids only.
- p) Energy efficient level IE3 LT Motors shall be provided by the bidder.
- q) All the terminal points where flange joints are involved, bidder shall terminate it along with matching counter flange, nuts, bolts, gaskets etc.
- r) KKS codes for all drives and instruments for the project have to be followed.
- s) All the instruments/ equipment/ electrical items shall be provided & designed with maximum star rating as available in line with energy conservation policies notified by BEE, GOI at the time of supply.

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18. ELECTRICAL LOAD DATA

Bidder has to comply with following electrical load data for Chemical Dosing System:

S. No.	Load title	Max. Cont. Demand (kW)	Working	Standby	Voltage	Feeder
1.	Hydrazine Motorised Barrel Pump	< 1	1	0	415 V	Unidirectional
2.	Hydrazine Dosing Pump	0.75	2	1	415 V	Unidirectional
3.	Hydrazine Mixing cum Storage Tank Stirrer	0.75	2	0	415 V	Unidirectional
4.	Hydrazine Dosing System LCP	1.0	1	0	415 V	Supply
5.	Ammonia Motorised Barrel Pump	< 1	1	0	415 V	Unidirectional
6.	Ammonia Dosing Pump	0.75	2	1	415 V	Unidirectional
7.	Ammonia Mixing cum Storage Tank Stirrer	0.75	2	0	415 V	Unidirectional
8.	Ammonia Dosing System LCP	1.0	1	0	415 V	Supply
9.	NaOH Dosing Pump	0.37	1	1	415 V	Unidirectional
10.	NaOH Tank Stirrer	0.37	1	0	415 V	Unidirectional
11.	NaOH Dosing System LCP	1.0	1	0	415 V	Supply

19. MISCELLANEOUS REQUIREMENTS

- Initial charge of all lubricants & grease.
- All special tools necessary for proper maintenance or adjustment of the equipment packaged in permanent box.
- Finish paints for touch-up painting of equipment after erection at site in sealed container.
- All the first fill and one Year's topping requirements or 10 % of first fill quantity, whichever is more of consumable such as greases, oil, lubricants, servo fluids/ control fluids, gases and etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be furnished by the bidder. Suitable standard lubricants as available in India are desired. Efforts should be made to limit the variety of lubricants to minimum.
- Document approval by Customer/ BHEL under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval.
- Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to Customer and BHEL for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
- In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion. However, in case changes are necessitated due to any constraints at Customer/BHEL end, delay in review/ approval of drawing beyond one month will be to Customer/BHEL account.
- Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule. Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the BHEL's switch gear /MCC on account of changed loads.
- Wherever CIVIL works is excluded from the bidder's scope, successful bidder shall furnish civil assignment / scope drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by vendor, BHEL reserves the right to debit cost of such rework to vendor".
- Bidder to submit BBU during detailed engineering after approval of Basic documents. BBU shall be equal to BOQ for the package and there shall be no price and delivery implication is applicable to BHEL / CUSTOMER for the same. None of the items supplied for the project as non-billable. Incomplete BBU shall not be reviewed by BHEL.

	TITLE:	SPECIFICATION NO. PE-TS-415-154-A001
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- k) Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.
- l) Relevant requirements as per GTR, GCC, ECC & SCC. Any statutory requirement / clearance required for the packages from government / local body shall be in bidder's scope.
- m) In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- n) Vendor to attend regular engineering meeting with BHEL and Customer fortnightly in BHEL or Customer office as decided during detail engineering. Vendor will depute his entire concerned engineering representatives along with the project manager for discussion and approval. Meeting can be held at site also.
- o) Latest version of all codes and standards to be followed.
- p) For detailed dispatch instructions, Bidder to refer special condition of contract (SCC) of the project.

20. SCOPE OF SERVICE.

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

i. Supervision of Commissioning.

Bidder shall be required to depute his qualified/capable personnel at any stage to supervise, Commissioning of Chemical dosing skids for each unit for five (5) days. This will include supervision of commissioning of Chemical Dosing system in totality.

The Five (5) days are to be considered as Five (5) working days at site. (i.e. 5 days per unit, excluding the travel time.)

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	STEAM GENERATOR AND AUXILIARIES	Page 183 of 223
2.4 <u>ELECTRICAL WORK</u> Bidder need to note that Two (2) (1W +1S) supply feeders of 415V, 3 phase, 4 wire AC system shall be provided for each skid from suitable LT switchgear. Complete skid including changeover between feeders\ starters\LCP\interlocks\protection devices\any other supply etc. shall be in Bidder's scope only. Skid complete with internal cabling and earthing need to be supplied by Bidder. Supply and erection of electrical items (power/control cables, cabling materials, local push button station & earthing) external to skid shall also be included. Any other equipment/ materials required for completeness of all electrical work (though not mentioned specifically) is in Bidder's scope. (a) Necessary electric motors for all motor driven equipment along with couplings, reduction gears and all other accessories as required for the complete Chemical Feed Systems. (b) Local Emergency Stop Push Button Stations with for unidirectional & bi-directional motors as specified for the complete Chemical Feed Systems. (c) Control Panels each with all accessories as follows: (i) START – STOP Push Buttons, ON-OFF Indicating Lamps along with other devices/accessories specified elsewhere in this document. selector switches (as determined by operational requirement) for all drives/equipment of		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: III-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 4
REV: R0	STEAM GENERATOR AND AUXILIARIES	Page 184 of 223
	Chemical Feed Systems shall be provided in the control panel. (ii) For all motors of rating 30 KW and above, ammeter shall be provided in the Control Panel. (iii) Trip alarm annunciation for all motors shall be provided in the Control Panel. (d) Special cables if any. (e) Grounding of skid mounting equipment and skid grounding. (f) All structures, steel attachments embedded components etc. as required for complete electrical work. 2.5 Chipping and dressing of foundation and grouting work as would be required for erection of equipment and accessories, pipes, nozzles, instrumentations, valves, fittings, all embedment and all other accessories are included in Bidder's scope under this specification. 2.6 All necessary structural works required for satisfactory operation and maintenance of complete Chemical Feed Systems. The items of work shall include but not be limited to the following: (a) All stairs, platforms, railings, ladders, etc. (b) All inserts, bolts, necessary structural supports along with anchor bolts. 2.7 Supply and application of shop painting and final painting at manufacturer's works and at site for the entire Water Treatment Plant as specified elsewhere in this specification. 2.8 For Mandatory Spares, Spares required for erection and commissioning, Recommended Spares, Special Tools And Tackles, fixtures etc., as required for regular operation and maintenance of the equipment offered for the entire Chemical Feed Systems and supply of first charge of lubricating oil,	

CONSULTANT : PROCON ENGINEERS

	TITLE: 1X660 MW BHUSAWAL TPS	SPECIFICATION NO. PE-TS-415-154-A001
		SECTION I
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ANNEXURES

- ANNEXURE I: QUALITY PLAN
- ANNEXURE II: SUB VENDORS LIST
- ANNEXURE III: DRAWING DOCUMENTS DISTRIBUTION PROCEDURE
- ANNEXURE IV: PAINTING SPECIFICATION
- ANNEXURE V: MANDATORY SPARES LIST
- ANNEXURE VI: LIST OF ERECTION & COMMISSIONING SPARES
- ANNEXURE VII: DRAWING/ DOCUMENTS SUBMISSION SCHEDULE
- ANNEXURE VIII: FORMAT FOR OPERATION AND MAINTENANCE MANUAL

	TITLE:	SPECIFICATION NO. PE-TS-415-154-A001
	1X660 MW BHUSAWAL TPS	SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION - I A
		REV.NO. 00 DATE: 27.05.2019

ANNEXURE I: QUALITY PLAN

ANNEXURE-I

		MANUFACTURER'S NAME & ADDRESS :		QUALITY PLAN				PROJECT 1 X 660 MW BHUSAWAL TPS				
				ITEM: CHEMICAL DOSING SYSTEM SUB - SYSTEM : CHEMICAL DOSING SYSTEM		QP.NO : REV. : 0 DATE : PAGE : 1 OF 4		PACKAGE CONTRACT NO. MAIN SUPPLIER BHEL/PEM, NOIDA				
S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY**			REMARKS
1	2	3	4	5	6	7	8	9	M	B	R	11
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	CHEMICAL & PHY. PROPERTIES	MA	CHEM & PHY TEST	1/PLATE/HT BATCH	ASTM A 240 GR.TP 304	ASTM A 240 GR.TP 304	MFG.TC/LAB REPORT	P	V	V	IDENTIFICATION BY BHEL
		IGC TEST	MI	IGC TEST	1/PLATE/HT BATCH	ASTM A 262 PR.'E'	ASTM A 262 PR.'E'					
2.1.2	PIPE FOR NOZZLE	CHEMICAL & PHY. PROPERTIES	MA	CHEM. & PHY.TEST	1/HT BATCH/SIZE	ASTM A 312 GR.TP 304	ASTM A 312 GR.TP 304	MFG.TC/LAB REPORT	P	V	V	
		MICRO STRUCTURE	MI	GRAIN STRUCTURE	1/HT BATCH/SIZE	FOR HEAT TREATMENT	FOR HEAT TREATMENT	MFG.TC/LAB REPORT	P	V	V	
		IGC TEST	MI	IGC TEST	1/HT BATCH/SIZE	ASTM A 262 PR.'E'	ASTM A 262 PR.'E'	MFG.TC/LAB REPORT	P	V	V	
		HYDRO TEST	NA	LEAKAGE	100%	NO LEAKAGE	NO LEAKAGE	MFG. TC/IR	P	V/W	V	REFER NOTE 4
2.1.3	FLANGES FOR TANKS	CHEMICAL & PHY PROPERTIES	MA	CHEM & PHY TEST	1/HT BATCH	ASTM A 182 GR. F 304	ASTM A 182 GR. F 304	MFG.TC/LAB REPORT	P	V	V	
2.2	IN PROCESS											
2.2.1	DISHED ENDS	DIMENSIONS	MA	MEASUREMENT WITH TEMPLATE	100%	APPD.DWG.(BY BHEL)	APPD.DWG.(BY BHEL)	MFG.TC./LAB REPORT	P	V	V	
		SURFACE DEFECTS ON WELDMENTS		DP TEST	100%	ASTM E 165	NO SURFACE DEFECTS	MFG.TC	P	V	V	
2.3	FINAL ASSEMBLY FOR TANKS:	DIMENSIONS & ORIENTATION	MA	MEASUREMENT	100%	APPD.DWG.(BY BHEL)	APPD.DWG.(BY BHEL)	MFG.TC/INSP REPORT	P	W	W	TO BE OFFERED ALONG WITH FINAL SKID ASSEMBLY INSPECTION.
		ORIENTATION	MA	VISUAL		APPD.DWG.(BY BHEL)	APPD.DWG.(BY BHEL)	MFG.TC/INSP REPORT	P	W	W	
2.3.1		LEAKAGE	MA	WATER FILL FOR 2 HR	100%	N.A.	NO LEAKAGE	MFG.TC/INSP. REPORT	P	W	W	
3.0	STIRRER :											
3.1	RAW MATERIAL FOR SHAFT	CHEM. & PHY. PROPERTIES	MA	CHEM & PHY TEST	1/BAR	ASTM A 479 GR.TP 304	ASTM A 479 GR.TP 304	MFG.TC/LAB REPORT	P	V	V	
		IGC TEST	MA	IGC TEST	1/HT BATCH	ASTM A 262 PR.'E'	ASTM A 262 PR.'E'	MFG.TC/LAB REPORT				
3.2	IMPELLER	CHEMICAL PROP.	MA	CHEMICAL TEST	1/PLATE	ASTM A 240 GR.TP 316	ASTM A 240 GR.TP 316	MFG.TC/LAB REPORT	P	V	V	
3.3	COMPLETE STIRRER UNIT WITH MOTOR	PERFORMANCE IN WATER FILLED TANK										
		- VIBRATION	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V	
		- WOBBLING	MA	VISUAL	100%	NO WOBBLING	NO WOBBLING	MFG.TC	P	V	V	
		- POWER CONSUMPTION/ CURRENT DRAWN	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V	
4.0	MOTORS:	ROUTINE TEST	MA	MFG. TC	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V	
		TYPE TEST	MA	MFG. TC	1/ SIMILAR FRAME SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V	
		DEGREE OF PROTECTION	MA	MFG. TC	1/ SIMILAR FRAME SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V	
				** LEGEND : M : MANUFACUTRER/SUB-CONTRACTOR/SUB-VENDOR B : BHEL/ NOMINATED INSPECTION AGENCY "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION								
MANUFACTURER/ SUB CONTRACTOR		MAIN SUPPLIER--BHEL		R: CUSTOMER								
SIGNATURE						SIGNATURE OF APPROVAL BY CUSTOMER						

THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-415-154-A001

ANNEXURE-I

		MANUFACTURER'S NAME & ADDRESS :		QUALITY PLAN ITEM: CHEMICAL DOSING SYSTEM SUB - SYSTEM : CHEMICAL DOSING SYSTEM				QP.NO : REV. : 0 DATE :		PROJECT 1 X 660 MW BHUSAWAL TPS PACKAGE CONTRACT NO. CHEMICAL DOSING SYSTEM MAIN SUPPLIER BHEL/PEM, NOIDA									
								PAGE : 2 OF 4											
				S.NO.		COMPONENTS/ OPERATION		CHARACTERISTICS CHECKED				CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY**	REMARKS
				1	2	3	4	5	6			7	8	9	M	B	R	10	11
5.0	METERING PUMP:																		
5.1	RAW MATERIAL :																		
5.1.1	WETTED PARTS	CHEM & PHY. PROPERTIES	MA	CHEM. & PHY. TEST	1/BAR	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V								
		SURFACE TEST	MI	UT ON BAR>25 MM DIA	100%	ASTM A 388	REF. NOTE # 1	MFG.TC/LAB REPORT	P	V	V								
				DP ON M/C SURFACE	100%	ASME - E - 165	NO SURFACE DEFECTS	MFG.TC/LAB REPORT	P	V	V								
5.2	FINAL INSPECTION																		
5.2.1	PUMP WITH MOTOR	LINEARITY	MA	PERFORMANCE	100%	API 675	API 675	INSPECTION REPORT	P	W	V								
		STEADY STATE ACCURACY	MA	SHOP TEST	100%	API 675	API 675	INSPECTION REPORT	P	W	V								
		REPEATABILITY	MA	SHOP TEST	100%	API 675	API 675	INSPECTION REPORT	P	W	V								
		POWER DRAWN @ 100% STROKE	MA	MEASURED AT WORK	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	INSPECTION REPORT	P	W	V								
		LEAKAGE	MA	HYDRO TEST	100%	@1.5X DESIGN PRESSURE	NO LEAKAGE	INSPECTION REPORT	P	W	V								
		DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	V								
		NOISE	MA	MEASUREMENT	100%	--	< 85 dbA AT 1 M RADIUS	INSPECTION REPORT	P	W	V								
		VIBRATION	MA	MEASUREMENT	100%	--	≤45 MICRONS (PEAK TO PEAK)	INSPECTION REPORT	P	W	V								
7.0	PRESSURE RELIEF VALVE	SET & RESET PRESSURE.	MA	PERFORMANCE	100%	BHEL APPD.DATA SHEET & API RP-520	BHEL APPD.DATA SHEET & API RP-520	MFG. TC	P	V	V								
		DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG. TC	P	V	V								
		LEAKAGE DURING PERFORMANCE TEST	MA	VISUAL	100%	NO LEAKAGE	NO LEAKAGE	MFG. TC	P	V	V								
8	VALVES (GATE, GLOBE & NRV)																		
8.1	RAW MATERIAL :																		
8.1.1	BODY, BONNET COVER	CHEM.& PHY PROPERTIES	MA	CHEM.& PHY TEST	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG. TC/LAB REPORT	P	V	V								
		HEAT TREATMENT	MA	HEAT TREATMENT	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG. TC/LAB REPORT	P	V	V								
8.1.2	TRIM MATERIAL	CHEM.& PHY PROPERTIES	MA	CHEM.& PHY TEST	1/BAR/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG. TC/LAB REPORT	P	V	V								
8.2	ASSEMBLY																		
		LEAKAGE (BODY & SEAT)		HYDRO TEST	100%	BHEL APPD.DATA SHEET	NO LEAKAGE	MFG TC	P	V	V								
		LEAKAGE (SEAT)		PNEUMATIC TEST	100%	BHEL APPD.DATA SHEET	NO LEAKAGE	MFG TC	P	V	V								
		DIMENSIONS		MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG TC	P	V	V								
MANUFACTURER/ SUB CONTRACTOR		MAIN SUPPLIER--BHEL		** LEGEND : M : MANUFACUTRER/SUB-CONTRACTOR/SUB-VENDOR B : BHEL/NOMINATED INSPECTION AGENCY "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION				R: CUSTOMER											
SIGNATURE										SIGNATURE OF APPROVAL BY CUSTOMER									
THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-415-154-A001																			

ANNEXURE 1



MANUFACTURER'S
NAME & ADDRESS :

ITEM:
CHEMICAL DOSING SYSTEM
SUB - SYSTEM :

QUALITY PLAN

QP.NO :
REV. : 0
DATE :

CHEMICAL DOSING SYSTEM

PAGE : 3 OF 4

PROJECT

1 X 660 MW BHUSAWAL TPS

PACKAGE
CONTRACT NO.

CHEMICAL DOSING SYSTEM

MAIN SUPPLIER

BHEL/PEM, NOIDA

S.NO	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY**			
1	2	3	4	5	6	7	8	9	M	B	R	11
9.0	FITTING/FLANGES FOR PIPING:											
9.1	RAW MATERIAL	CHEM. & PHY PRPERTIES	MA	CHEM. & PHY TEST	1/HT BATCH	ASTM A 182 GR.TP 304	ASTM A 182 GR.TP 304	MFG.TC/LAB REPORT	P	V	V	
		HEAT TREATMENT	MA	HEAT TREATMENT	100%	ASTM A 182 GR.TP 304	ASTM A 182 GR.TP 304	MFG.TC/LAB REPORT	P	V	V	
		IGC TEST	MI	IGC TEST	1/HT BATCH	ASTM A 262 PR. 'E'	ASTM A 262 PR. 'E'	MFG.TC/LAB REPORT	P	V	V	
9.2	FINAL INSPECTION	DIMENSIONS	NA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG/ ANSI B 16.11/16.5	BHEL APPD.DATA SHEET/DWG/ ANSI B 16.11/16.5	MFG.TC	P	V	V	
10.0	STRAINERS :											
10.1	RAW MATERIAL FOR BODY	PHY. & CHEM. PROPERTIES	MA	PHY. & CHEM.TEST	1/BAR/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TCLAB REPORT	P	V	V	
10.2	SCREEN	CHEMICAL	MA	CHEMICAL	1/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V	
		MESH SIZE	MA	MEASUREMENT	1/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V	
10.3	FINAL INSPECTION	DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V	
		LEAKAGE		HYDRO TEST	1	BHEL APPD.DATA SHEET	NO LEAKAGE	MFG.TC	P	V	V	
11.0	PIPE (SEAMLESS)											
11.1	MATERIAL	CHEMICAL	MA	CHEMICAL	1/HT BATCH/SIZE	ASTM A 312 GR.TP 304	ASTM A 312 GR.TP 304	MFG.TC/LAB REPORT	P	V	V	IDENTIFICATION BY BHEL. REFER NOTE 4.
		MECHANICAL TEST	MA	MECHANICAL TEST	1/HT BATCH/SIZE	ASTM A 312 GR.TP 304	ASTM A 312 GR.TP 304	MFG.TC/LAB REPORT	P	V	V	
		MICRO STRUCTURE	MI	GRAINS STRUCTURE	1/HT BATCH/SIZE	FOR HEAT TREATMENT	FOR HEAT TREATMENT	MFG.TC/LAB REPORT	P	V	V	
		IGC TEST	MI	IGC TEST	1/HT BATCH/SIZE	ASTM A 262 PR 'E'	ASTM A 262 PR 'E'	MFG.TC/LAB REPORT	P	V	V	
		HYDRO TEST	MA	LEAKAGE	100%	NO LEAKAGE	NO LEAKAGE	MFG.TC/IR	P	V/W	V	
12.0	LEVEL GAUGE :											
12.1	RAW MATERIAL	CHEM.PROPERTIES	MA	CHEM.TEST	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V	
12.2	FINAL INSPECTION	DIMENSION	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V	
		LEAKAGE	MA	HYDRO TEST	100%	BHEL APPD.DATA SHEET	NO LEAKAGE	MFG.TC	P	V	V	
13.0	PRESSURE & DP GAUGE											
13.1	MAT. FOR WETTED PARTS & BOURN	CHEM.PROPERTIES	MA	CHEM.TEST	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V	INSTRUMENTS AS APPLICABLE FOR THE MODULE ORDERED SHALL BE CONSIDERED.
13.2	FINAL INSPECTION	DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG.TC/LAB REPORT				
13.3	PERFORMANCE	ACCURACY & OVERLOAD PROTECTION	MA	CALIBRATION	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG. TC	P	V	V	
14.0	SWITCHES(LEVEL, PRESURE & DP) & TRANSMITTERS (LEVEL, PRESSURE & DP):											
14.1	MAT. FOR WETTED PARTS	CHEM.PROPERTIES	MA	CHEM.TEST	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V	
14.2	PERFORMANCE	FUNCTIONAL	MA	CALIBRATION & VISUAL	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V	
		IR-HV-IR		ELECTRICAL	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	V	
		DIMENSIONS		MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG.TC	P	V	V	
		DEGREE OF PROTECTION	MI	VERIFICATION OF TYPE TEST CERT	TYPE TEST	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	V	
				** LEGEND :								
MANUFACTURER/ SUB CONTRACTOR		MAIN SUPPLIER--BHEL		M : MANUFACUTRER/SUB-CONTRACTOR/SUB-VENDOR B : BHEL/NOMINATED INSPECTION AGENCY "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION				R: CUSTOMER				
SIGNATURE								SIGNATURE OF APPROVAL BY CUSTOMER				

THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-415-154-A001

		MANUFACTURER'S NAME & ADDRESS :		ANNEXURE-I				PROJECT 1 X 660 MW BHUSAWAL TPS PACKAGE CHEMICAL DOSING SYSTEM CONTRACT NO. MAIN SUPPLIER BHEL/PEM, NOIDA				
				QUALITY PLAN								
				ITEM: CHEMICAL DOSING SYSTEM		QP.NO : REV. : 0						
				SUB - SYSTEM :		DATE :						
				CHEMICAL DOSING SYSTEM		PAGE : 4 OF 4						
S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORDS	AGENCY**			REMARKS
1	2	3	4	5	6	7	8	9	M	B	R	11
15.0	CONTROL PANEL :	DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	CONTOL PANEL TEST TO BE OFFERED ALONG WITH FINAL SKID ASSEMBLY.
		CONTINUITY, IR-HV-IR	MA	ELECTRICAL	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		VERIFICATION OF MAKE	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		RATING OF COMPONENTS	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		PAINT SHADES, THICKNESS	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		ADHESION	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		DEGREE OF PROTECTION	MI	VERIFICATION OF TYPE TEST CERTIFICATE	TYPE TEST	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG.TC/LAB REPORT	P	V	W	
16.0	COMPLETE SKID ASSEMBLY:	DIMENSIONS & ORIENTATION	CR	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		LEAKAGE, CHECK ON WELDMENTS		VISUAL & HYDRO TEST	100%	DISCH.PIPING - 1.5 x DISCH PR. OF PUMP	NO LEAKAGE	INSPECTION REPORT	P	W	W	
		FUNCTIONAL TEST FOR INTERLOCKS	MA	VISUAL	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
	PMI Test for SS	GRADE CONFIRMATION	MA	CHEM.TEST	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		PAINTING	MA	VISUAL & MEASUREMENT	100%	BHEL APPD PAINTING SCHEME	APPD DWG/PAINTING	INSPECTION REPORT	P	W	W	
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) CHEMICAL DOSING SKID VENDOR SHALL BE SELECTED FROM CUSTOMER APPROVED SOURCES. ALL THE BOUGHT OUT ITEMS OF THE CHEMICAL DOSING VENDOR SHALL BE PROCURED FROM BHEL APPROVED SOURCES.												
NOTE- 3) ALL VENDOR DRAWINGS/DATASHEETS SHALL BE APPROVED BY BHEL. ONLY MANUFACTURING QP(PREPARED IN LINE WITH THIS STANDARD QP) OF THE VENDOR SHALL BE FORWARDED FOR CUSTOMER APPROVAL. ALL THE BHEL APPROVED DOCUMENTS SHALL BE FURNISHED TO CUSTOMER FOR INFORMATION/RECORDS ALONG WITH O&M MANUAL. COPY OF THE SAME SHALL ALSO BE FURNISHED TO INSPECTION AGENCY DURING INSPECTION.												
NOTE 4) 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 5) FOR RAW MATERIAL (BARS/PIPES/CASTINGS/FORGINGS) WHERE HEAT TREATMENT ARE CARRIED OUT BY MATERIAL PRODUCERS ON BULK QUANTITIES, THEIR TEST CERTIFICATE SHALL BE REVIEWED (EXCEPT TIME TEMPERATURE CHART)												
NOTE 6) 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												
		** LEGEND :										
MANUFACTURER/ SUB CONTRACTOR		MAIN SUPPLIER--BHEL		M : MANUFACUTRER/SUB-CONTRACTOR/SUB-VENDOR B : BHEL/NOMINATED INSPECTION AGENCY "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION				R: CUSTOMER				
SIGNATURE										SIGNATURE OF APPROVAL BY CUSTOMER		
THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-415-154-A001												

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ANNEXURE II: SUB VENDORS LISTS

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SUB VENDOR LIST - MECHANICAL

SR. NO.	ITEM		SUPPLIER	PLACE	REMARK
1.0	BOILER, TURBINE, GENERATOR (BTG)				
1.1	CONDENSOR ON LINE TUBE CLEANING SYSTEM	(a)	GEA-BGR		
		(b)	TAPROGGE GMBH		
1.2	CARBON STEEL PIPE FITTING	(a)	ALLIED INTERNATIONAL S.P.A. ITALY		
		(a)	ASIAN PAINTS		
1.3	PAINTINGS	(b)	BURGER PAINTS		
		(c)	SHALIMAR PAINTS		
		(d)	NEROLAC PAINTS		
		(e)	JOHNSON & NICHOLSON		
1.4	SPRING SUPPORT AND	(a)	SARATHI		
		(a)	WEIR PUMPS		
1.5	BOILER FEED PUMP	(b)	KSB AKTIENGESELLSCHAFT		
		(c)	SULZER PUMPS		
		(d)	TORISHIMA PUMPS		
1.6	CONCRETE VOLUTE PUMPS	(a)	KBL		
		(b)	FLOWERVE INDIA CONTROL PVT LTD, INDIA		
		(a)	SPIRAX MARSHALL PVT LTD		
1.7	STEAM TRAPS	(b)	GREAVES LTD		
		(c)	PENNANT ENGINEERING PVT LTD		
		(d)	LEADER VALVES LTD		
		(e)	CRESCENT VALVES MFG CO PVT LTD		
1.8	VACUUM PUMPS	(a)	SIEMENS		
		(b)	UNIQUE SYSTEM, NEW JERSEY, USA		
1.9	RAPH	(a)	L & T HOWDEN PVT LTD		
1.10	ID/FD/PA FANS	(a)	L & T HOWDEN PVT LTD		
1.11	SEAL AIR FANS	(a)	TLT ENGINEERING INDIA PVT LTD, GUJARAT		
1.12	SCANNER COOLING AIR FAN	(a)	C. DOCTOR		
1.13	MILLS	(a)	L & T-MHI		
		(b)	BHEL		
1.14	GEAR BOX (COAL MILL)	(a)	FLENDER		
1.15	SOOT BLOWERS	(a)	CLYDE BERGEMANN INDIA, NOIDA		
1.16	BOILER CIRCULATION PUMP	(a)	M/S HAYWARD TYLER LIMITED, UK		
1.17	METALLIC EXPANSION	(a)	MILLAR FITTINGS, UK		
1.18	NON- METALLIC EXPANSION	(a)	KE - BURGMANN FLEXIBLE INDIA PVT. LTD.		
1.19	SCREW PUMPS	(a)	TUSHACO PUMPS PVT. LTD.		
		(a)	LLYODS INSULATION (INDIA) LTD.		
1.20	INSULATION	(b)	ROCKWOOL INDIA LTD.		
		(c)	HYDERABAD INDUSTRIES LTD.		
		(d)	MINWOOL ROCK FABRICS LTD.		
1.21	PLATES (BOILER)	(a)	SAIL		
		(b)	TATA STEEL		
		(c)	JINDAL STEEL		
1.22	SECONDARY STRUCTURE & BUCKSTAY FOR BOILER	(a)	METALFAB HIGHTECH PVT. LTD., NAGPUR		
1.23	BOILER DUCTS & SECONDARY STRUCTURE	(a)	SEAM INDUSTRIES NAGPUR		
		(b)	ENESTEE ENGINEERING LTD, NAGPUR		
1.24	HANDRAILS & GRATING	(a)	INDIANA GRATING PVT. LTD., MUMBAI		
1.25	COAL MILL COMPONENT	(a)	M/S AIA ENGINEERING LTD., AHMEDABAD		
1.26	COAL PIPES	(a)	M/S PRATIBHA INDUSTRIES LTD., MUMBAI		
		(a)	SEAM INDUSTRIES NAGPUR		
1.27	MISC. TANK FABRICATION	(b)	ENESTEE ENGINEERING LTD, NAGPUR		
		(c)	ERA BUILDING SYSTEM		
		(d)	RATNAMANI TUBES & METAL		
1.28	GASKETS (METALLIC &	(a)	IGP (MADRAS)		
1.29	BOLTS & NUTS (FASTENERS)	(a)	DEEPAK FASTENERS LTD. LUDHIYANA		
		(b)	POINEER NUT & BOLTS PVT. LTD.		
1.30	SAFETY VALVE	(a)	DRESSER		
		(b)	FISCHER CONTROLS		
1.31	SAFETY RELIEF VALVE	(a)	SPIRAX MARSHALL		
		(b)	LEADER VALVES		
1.32	CERAMIC LINED BENDS	(a)	CARBORUNDUM UNIVERSAL LTD.		
		(a)	SPIRAX MARSHALL		
1.33	FAB/CAST/FORGED STRAINERS/ Y TYPE STRAINERS	(b)	GUJARAT OTOFILT		
		(c)	MULTITEX FILTRATION		
		(d)	GRAND PRIX FAB		
		(e)	MICON VALVES (I) PVT. LTD		
		(f)	FLOWTECH ENGINEERS		
1.34	STEEL CASTINGS FOR COAL MILL	(a)	SYNERGY STEELS LTD, NEW DELHI		
		(b)	SRINATHJI ISPAT LTD., GAZIABAD		
		(c)	G.S. ALLOY CASTINGS LTD., ANDHRA		
		(d)	N.S. ENGINEERING COMPANY PVT. LTD.,		
1.35	FUEL OIL HEATING & PRESSURISING SYSTEM	(a)	TECHNOFAB ENGINEERING LTD., NEW DELHI		
		(b)	THERMOSYSTEM PVT. LTD., HYDERABAD		
1.36	BFP DRIVE TURBINE	(a)	HTC, CHINA		
		(a)	FOURESS LIMITED		
1.37	FORGED STEEL VALVE (UP TO 50 NB SIZE)	(b)	KSB LIMITED		
		(c)	L & T		
		(d)	BANKIM		
		(e)	BDK VALVES		
		(f)	LEADER		
		(a)	FOURESS LIMITED		
		(b)	CRESCENT		
	FORGED CARBON STEEL	(c)	TECHNO VALVES		

1.38	VALVE	(d)	R & D MULTIPLES		
		(e)	BHEL		
		(f)	LEADER		
		(g)	A.V. ENGG.		
1.39	RUBBER EXPANSION JOINT	(a)	D'WAREN & CO.		
		(b)	S.L. MANEKLAL		
		(c)	CORI ENGG. PVT. LTD		
1.40	CONDENSATE EXTRACTION PUMPS	(a)	WEIR PUMPS		
		(b)	KIRLOSKAR BROS. LTD., PUNE		
1.41	GEAR BOX FOR BFP	(a)	TRIVENI ENGG. & IND. PVT. LTD., MYSORE		
1.42	CONDENSER TUBES	(a)	PLYMOUTH, USA		
		(b)	SHIN HAN METAL CO. LTD., KOREA		
		(c)	REMI EDELSTAL TUBULARS LTD.		
1.43	FABRICATION & SUPPLY OF STEEL STRUCTURE	(a)	DIAMOND ENGG., TAMILNADU		
		(b)	VASAN INDUSTRIES, TAMILNADU		
		(c)	ERA BUILDING SYSTEM LTD., RUDRAPUR		
1.44	WINDBOX	(a)	GK SONS ENGG. ENTERPRISES PVT. LTD.,		
1.45	STRUCTURAL STEEL FABRICATED COMPONENTS FOR ESP	(a)	VRINDA ENGG. PVT. LTD., KOLKATA		
		(b)	S.S. FABRICATORS & MANUFACTURERS,		
		(c)	DYNAMECH DESIGNER COMPANY,		
		(d)	JAS EQUIPMENT & ENGINEERS PVT. LTD.,		
		(e)	THE UNITED ENGINEERS, KOLKATA		
		(f)	UNI PROFILES PVT. LTD., ORISSA		
		(g)	FRIENDS ENGG. CORPORATION. BHILAI		
		(h)	ENCORE PROJECTS PVT. LTD., BHILAI		
		(i)	QUALITY ENGG. WORKS, KOLKATA		
		(j)	EASTERN ENGINEER & ASSOCIATES,		
		(k)	DEHU ENGINEERS (I) PVT. LTD., PUNE		
1.46	ALUMINUM SHEET	(l)	NAAISON ENGINEERS PVT. LTD.,		
		(m)	SRINIVASA ENGINEERS PVT. LTD.,		
		(a)	BHARAT ALUMINUM CO. LTD.		
		(b)	HINDALCO INDUSTRIES LTD.		
1.47	C.S. PIPING & ALLOY STEEL PIPING	(c)	NATIONAL ALUMINUM COMPANY LTD.		
		(a)	VALCOVNY TRUB CHIUMUTOV		
		(b)	ARCELOR MITTAL TUBULAR ROMAN S.A.,		
1.48	SLIDING BEARING FOR ESP	(a)	METAL ENGG. & TREATMENT CO. PVT.LTD.,		
		(b)	ROLLON BEARING PVT. LTD., BANGALORE		
1.49	PLATE TYPE HEAT EXCHANGER	(a)	GEA ECOFLEX INDIA, NAVI MUMBAI		
		(b)	FUNKE WARMETAUSCHER, Gmbh GERMANY		
		(c)	TRANTER INDIA PVT. PUNE		
1.50	HYDRAULIC UNIT FOR LOADING DEVICE & ROLLER	(a)	HYDAC (INDIA) PVT. LTD., MUMBAI		
1.51	DUCTING SUPPORT &	(a)	PIPE HANGER & SUPPORT VT. LTD.,		
1.52	ESP FOUNDATION BOLTS	(a)	VRINDA ENGINEERING PVT. LTD., KOLKATA		
		(b)	COMMERCIAL ENGINEERING BODY BUILDERS		

6.0	VERTICAL TURBINE PUMPS	(a)	KIRLOSKAR BROTHERS LTD. (KBL)		
		(b)	MATHER & PLATT		
		(c)	WPIL		
		(d)	JYOTI PUMPS		
		(e)	FLOWMORE		
		(f)	SAM		
		(a)	KBL		
		(b)	KSB PUMPS		
		(c)	MATHER & PLATT		

7.0	HORIZONTAL CENTRIFUGAL PUMPS	(d)	SAM TURBO		
		(e)	WPIL		
		(f)	JYOTI PUMPS		
		(g)	FLOWMORE		
		(h)	SULZER		
8.0	METERING/DOSING PUMPS	(i)	KISHOR PUMPS		
		(a)	MILTON ROY INDIA (P) LTD.		
		(b)	V.K. PUMPS		
9.0	SUMP PUMP	(c)	SHAPO TOOLS		
		(a)	KIRLOSKAR BROTHERS LTD. (KBL)		
		(b)	SAM		
		(c)	KISHOR PUMPS		
		(d)	FLOW MORE		
10.0	FUEL OIL PUMPS	(e)	KSB		
		(f)	VARTAK PUMPS		
		(g)	MAXFLOW		
		(a)	TUSHACO		
		(b)	ALKETON, MADRAS		
11.0	AIR BLOWER (LOBE TYPE)	(c)	PSI ENGINEERING		
		(d)	ROTO PUMPS		
		(e)	BOURNMEN, GERMANY		
		(f)	DELTA CORPORATION		
		(g)	ALL WEILER, GERMANY		
12.0	BUTTERFLY VALVES (MANUAL/PNEUMATIC)	(h)	TMO, SWEDEN		
		(a)	EVEREST TRANSMISSION		
		(b)	KAY ENGG. WORKS		
		(c)	SWAM PNEUMATICS		
		(d)	ROOTS		
13.0	RUBBER EXPANSION JOINT	(a)	KIRLOSKAR BROTHERS LTD.		
		(b)	FOURESS		
		(c)	L & T		
		(d)	INTERVALVE (INDIA) LTD		
		(e)	R&D MULTIPLES		
14.0	STRAINERS	(f)	AUDCO		
		(g)	INSTRUMENTATION LTD		
		(h)	HAWA VALVES		
		(i)	VENUS PUMPS & ENGINEERING WORKS		
		(j)	BHEL		
15.0	CAST IRON VALVE (GATE /GLOBE/CHECK/ AIR RELEASE VALVE)	(k)	FLOW VEL		
		(l)	LEADER VALVES		
		(a)	D'WAREN & CO		
		(b)	S.L. MANEKLAL		
		(c)	SRM EXOFLEX PVT LTD		
16.0	CAST STEEL VALVES (GATE/GLOBE/CHECK/ BALL VALVE)	(d)	CORI ENGINEERS		
		(a)	SPIRAX MARSHALL		
		(b)	MICON VALVES (I) PVT. LTD.		
		(c)	FLOWTECH ENGINEERS		
		(d)	FOURESS LTD.		
17.0	STAINLESS STEEL (GATE/GLOBE/CHECK VALVE)	(e)	KSB LTD.		
		(f)	L & T		
		(g)	LEADER		
		(h)	PROCEDYNE ENGINEERS		
		(a)	LEADER VALVE		
18.0	GUN METAL/BRASS/ BRONZE VALVES	(b)	VENUS PUMP		
		(c)	FOURESS		
		(d)	LEVCON		
		(e)	DURGA ENGG CO.		
		(f)	L & T		
19.0	FORGED STEEL VALVE	(g)	R & D MULTIPLES		
		(h)	FLUIDLINE VALVES CO PVT LTD		
		(i)	INTER VALVE (INDIA) LTD		
		(j)	NSSL LIMITED		
		(a)	L & T		

		(f)	LEADER		
		(g)	A.V.ENGG		
		(h)	CRESCENT		
		(i)	BHEL		
20.0	L.D. PIPING	(a)	SETH & SURA ENGG. CO. LTD.		
		(b)	IVCRL		
		(c)	RAUNAQ		
		(d)	ZUBERI		
		(e)	INDIAN HUME PIPES LTD		
		(f)	DYNAMIC SS ENGG PVT LTD		
21.0	L.P.PIPING	(a)	UNITECH MACHINES, NEW DELHI		
		(b)	AARTI INFRASTRUCTURE, NAGPUR		
		(c)	ZUBERI, JAIPUR		
		(d)	SETH & SURA ENGG CO. LTD		
22.0	DIESEL ENGINES	(a)	KIRLOSKAR CUMMINS		
		(b)	GREAVES COTTON		
		(c)	ASHOK LEYLAND		
23.0	FLANGES & FITTINGS	(a)	ALLIANCE		
		(b)	JYOTI		
		(c)	EBY		
24.0	AIR DRYING UNIT	(a)	DONALDSON		
	(Refrigerant Type)	(b)	SABRO		

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1.	TANKS/DISSOLVING BASKETS/WATER SEAL/CO2 ABSORBER/BREATHER	SELF MAKE OF MAIN VENDOR		
2.	METERING PUMPS	VK PUMPS	NASIK	
		MILTON ROY INDIA	CHENNAI	
		SWELLORE	AHMEDABAD	
		POSITIVE METERING PUMPS	NASIK	
		METACHEM	MUMBAI	
3.	AGITATOR	REMI PEOCESS PLANT & M/C	MUMBAI	
		FIBRE & FIBRE	MUMBAI / SILVASA	
		CEECONS	CHENNAI	
		STANDARD ENGINEERS	MUMBAI	
		RATHI VESSELS & SYSTEMS PVT LTD		
4.	BALL VALVE (MANUAL /PNEUMATIC/ ELECTRIC) CLASS 150	A.V. VALVES LTD	AGRA	
		AKAY INDUSTRIES PVT.LTD.	DHARWAD	
		BELGAUM AQUA VALVES PVT. LTD.	BELGAUN	
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS.	CHENNAI	
		ATAM VALVES PVT. LTD.	JALANDHAR	
		DEMBLA VALVES LTD.	THANE	
		M/S GM ENGINEERING	RAJKOT	
		HAWA VALVES (INDIA) PVT. LTD.	NAVI MUMBAI	
		INTERVALVE (INDIA) LTD.	PUNE	
		LEADER VALVES LTD.	JALANDHAR	
		MICROFINISH VALVES PVT LTD.	HUBLI	
		NILON VALVES PRIVATE LIMITED	AHMEDABAD	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	
		UNIFLOW	CHENNAI	
		VALTECH INDUSTRIES	MUMBAI	
		VAAS AUTOMATION PVT. LTD.	NEW DELHI	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
		SHANCO		
		BDK COMPANY		
		OSCAR		
		LEGRIS		
		RB (ITALIAN)		

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		FLOWCON		
5.	DIAPHRAGM VALVE (MANUAL / PNEUMATIC) CLASS 150	WEIR BDK	HUBLI	
		CRANE FLOW PROCESS	SATARA	
		PROCON	MUMBAI	
		MAJESTIC VALVES (LABLINE)	-	
		HAWA ENGINEERS	AHMEDABAD	
6.	DUAL PLATE CHECK VALVES	ADVANCE VALVES PVT. LTD.	NOIDA	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	1. DUAL PLATE CHECK VALVE CI - CLASS 150 & UP TO 600NB, 2. DUAL PLATE CHECK VALVE CCS - CLASS 150 & UP TO 500NB
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CI, CCS & STAINLESS STEEL SPRING ASSISTED DUAL PLATE CHECK VALVES UPTO 700 NB AND 150 CLASS RATING.
7.	Y-TYPE STRAINER / STRAINER (WATER SERVICE)	OTOKLIN GLOBAL BUSINESS LIMITED	MUMBAI	
		GRAND PRIX	NEW DELHI	
		JAYPEE	NEW DELHI	
		GREAVES COTTON	MUMBAI	
		MULTITEX FILTRATION ENGINEERS LIMITED,	NEW DELHI / NOIDA	
		FILTRATION ENGINEERS (I) PVT. LTD	MUMBAI	
		FLUIDNYE	-	
		SUNGOV ENGINEERING PVT. LTD.	DELHI	
		GRAND PRIX	FARIDABAD	
		JAYPEE INDUSTRIES PVT. LTD.	DELHI	
		BHATIA ENGINEERING CO.	DELHI	
8.	SS PIPES / TUBES	APEX TUBES	BEHROR (ALWAR)	
		RATNAMANI	CHATTRAL	
		REMI	TARAPUR	
		PRAKASH STEELAGE	-	
9.	SAFETY SHOWER	UNICARE	-	
		MOHAN INDUSTRIES	-	
		SUPER SAFETY SERVICES	-	
10.	STROKE CONTROLLER	V K PUMPS	NASIK	
		METACHEM	MUMBAI	
		SWELORE	AHMEDABAD	

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		MILTON ROY INDIA	CHENNAI	
11.	SAFETY VALVES/RELIEF VALVES	METACHEM	MUMBAI	
		KEYSTONE	BARODA	
		V K PUMPS	NASIK	
		MILTON ROY	CHENNAI	
12.	STEEL GATE/GLOBE/NR VALVES	A.V. VALVES LTD	AGRA	
		ATAM VALVES PVT. LTD.	JALANDHAR	(1) CARBON STEEL GATE VALVES & NON RETURN VALVES: 15 NB TO 50 NB (#800) & 65 NB TO 300 NB (#150) (2) CARBON STEEL GLOBE VALVES: 15 NB TO 50 NB (#800) & 65 NB TO 200 NB (#150)
		FLUIDLINE VALVES COMPANY PVT.LTD.	KAUSHAMBI	
		M/S GM ENGINEERING	RAJKOT	
		INTERVALVE (INDIA) LTD.	PUNE	A) STEEL GATE VALVES: UPTO 50NB, #800 AND 65NB TO 150NB, #150 B) STEEL GLOBE VALVES: UPTO 50NB, #800 AND 65NB TO 100NB, #150 C) SUPPLIER NOT REGISTERED FOR NR VALVES
		LEADER VALVES LTD.	JALANDHAR	
		NITON VALVE INDUSTRIES PVT LTD	MUMBAI	
		NSSL LIMITED.	NAGPUR	
		STEEL STRONG VALVES (I) PVT. LTD.	NAVI MUMBAI	LIMITED TO RANGES & CLASSES AS AVAILABLE IN VD FILE.
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	CC/CSS-GATE-BBT- UPTO600NB CL UPTO300,GATE-PSBT UPTO250NB CL 1500, GLV-BBT- UPTO300NB CL UPTO600, SCNRV- BBT-UPTO600NB CL UPTO150, SCNRV- BBT-UPTO300NB CL 300, SCNRV-PSBT- UPTO150NB CL UPTO900

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		VALTECH INDUSTRIES	MUMBAI	CAST CARBON & ALLOY STEEL - VALVE/RATING/SIZE- GV/150/900, GV/300/400, GV/600/300, GV/GLV/NRV/900/250, GLV/300/300, GLV/150/350, SCNRV/150/700, SCNRV/300/350, SCNRV/600/250.
		V.K. VALVES PVT. LTD.,	JALANDHAR	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
		AUDCO VALVES (L & T),	CHENNAI	
		KSB VALVES,	COIMBATORE	
		TYCO RAIMONDI,	ITALY	
		BABCOCK BORSIG,	SPAIN	
		TOA / MEIWA,	JAPAN	
		VELAN VALVES,	USA/CANADA	
		FLOW SERVE (Edward),	USA	
		NSSL LIMITED,	Nagpur	
		FOURESS ENGINEERING (INDIA) LTD.,	Aurangabad	
		OSWAL INDUSTRIES LIMITED. ,	India	
		STEEL STRONG VALVES (I) P.LTD.,	Mumbai	
		HP VALVES OLDENZAAL B.V.,	Netherlands	
		KOKUSAI COMMERCE CO. LTD. (Okano Valves).	Japan	
13.	FITTINGS (CS/SS)	M.S. FITTINGS	KOLKATA	
		METAL LLOYDS	MUMBAI	
		TRUE FORGE	FARIDABAD	
		TUBE PRODUCTS	BARODA	
		NL HAZRA	KOLKATA	
		GUJRAT INFRA PIPES	BARODA	
		EDWARDS	USA	
		PIPEFIT ENGINEERS	BARODA	
		SIDDARTH & GAUTAM	FARIDABAD	
		EBY	MUMBAI	
14.	FLANGES (SS/CS)	PRADEEP METALS LTD	MUMBAI	
		TUBE PRODUCT INCORPORATION	BARODA	
		MS FITTINGS	KOLKATA	
		HAWA ENGINEERING	-	
		ALIANCE PIPE & PLANGES	KOLKATA	

	TITLE:	SPECIFICATION NO. PE-TS-415-154-A001
	1X660 MW BHUSAWAL TPS	SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION - I A
		REV.NO. 00 DATE: 27.05.2019

		JAI AMBE	MUMBAI	
15.	PAINT			
		BERGER PAINTS INDIA LTD		
		GOODLASS NEROLAC		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		SHALIMAR PAINTS LTD.		
		ADDISON PAINTS LTD		
		GRAND POLYCOAT		
		BOMBAY PAINTS		
		HEMPLE PAINTS (SINGAPORE)		
		JOTUN PAINTS		
16.	MOTORISED ACTUATOR	ROTARK	-	
		AUMA	-	
		LIMITORK	-	
		ANTRIEB TECHNIC (P) LTD	-	

NOTE:

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

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

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

	TITLE:	SPECIFICATION NO. PE-TS-415-154-A001
	1X660 MW BHUSAWAL TPS	SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION - I A
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SUB VENDOR LIST ELECTRICAL

SUB-VENDOR LIST

The list of approved make of the LT Motors are as mentioned below:

S.No.	LIST OF LT MOTORS
1.	BHARAT BIJLEE LTD.
2.	CROMPTON GREAVES
3.	ASEA BROWN BOVERI
4.	KIRLOSKAR ELECTRIC CO LTD.
5.	NGEF
6.	SIEMENS
7.	MARATHON
8.	GE-POWER
9.	RAJINDRA ELECT INDUSTRIES
10.	LAXMI HYDRAULICS PVT. LTD

However, the final list of makes for the LT Motors is subjected to BHEL/Customer approval, during contract stage, without any commercial implications.

	TITLE:	SPECIFICATION NO. PE-TS-415-154-A001
	1X660 MW BHUSAWAL TPS	SECTION I
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SUB VENDOR LIST C&I

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4.0 <u>LIST OF APPROVED VENDORS – CONTROL & INSTRUMENTATION</u>			
<u>SR. NO.</u>	<u>NAME OF EQUIPMENT / ITEM</u>		<u>APPROVED VENDORS</u>
1.0	<u>FIELD / PRIMARY INSTRUMENTS:</u>		
1.1	RTD & THERMOCOUPLES	(a)	PYRO ELECTRIC INSTRUMENTS GOA PVT. LTD.
		(b)	GENERAL INSTRUMENTS CONSORTIUM, MUMBAI
		(c)	DETRIVE, MUMBAI
		(d)	TEMSSENS INSTRUMENTS(I) PVT. LTD, UDAIPU
1.2	SMART ELECTRONIC TRANSMITTERS (PRESSURE, DIFF. PRESSURE)	(a)	EMERSON PROCESS MANAGEMENT (I) LTD
		(b)	FUJI, JAPAN
		(c)	YOKOGAWA, JAPAN/ YOKOGAWA INDIA
		(d)	ABB, GERMANY / FARIDABAD
		(e)	HONEYWELL, USA / PUNE
1.3	DISPLACER TYPE LEVEL TRANSMITTER	(a)	CHEMTROL MIL
		(b)	DRESSER, COIMBTORE
		(c)	V-AUTOMAT, DELHI
		(d)	ECKARDT, GERMANY
1.4	LEVEL TRANSMITTERS (DISPLACEMENT TYPE)	(a)	DRESSER MASONIELAN, FRANCE (DRESSER VALVES INDIA LTD. COIMBATORE)
		(b)	CHEMTROLS, MUMBAI (ECKARDT, GERMANY)
		(c)	ECKARDT, GERMANY

CONSULTANT : PROCON ENGINEERS

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1.5	LEVEL TRANSMITTERS (ULTRASONIC TYPE)	(d)	ENDRESS+HAUSER, GERMANY/INDIA
		(e)	KROHNE, FRANCE
		(f)	PEPPERL+FUCHS, GERMANY/INDIA
		(g)	VEGA, GERMANY
		(h)	KAB INSTRUMENTS LTD.
1.6	RADAR TYPE LEVEL TRANSMITTERS	(a)	SIEMENS MILLTRONICS
		(b)	ENDRESS & HAUSER
		(c)	SBEM
		(d)	EMERSON
		(e)	AMETEKEDREXELBRROK (CHEMTROLS)
1.7	TEMPERATURE TRANSMITTERS	(a)	EMERSON PROCESS (FORMERLY FISHER ROSEMOUNT), USA/DAMAN
		(b)	ABB, GERMANY / FARIDABAD
		(c)	FUJI, JAPAN
		(d)	HONEYWELL, USA / PUNE
		(e)	YOKOGAWA, JAPAN/ YOKOGAWA INDIA
		(f)	MOORE, USA
1.8	MAGNETIC LEVEL SWITCHES	(a)	LEVCON INSTRUMENTS PVT. LTD., KOLKATA
		(b)	V.AUTOMAT, NEW DELHI
		(c)	ASIAN INDUSTRIAL VALVES, CHENNAI
1.9	LEVEL SWITCHES CONDUCTIVITY TYPE	(a)	BHARAT HEAVY ELECTRICALS LTD.
		(b)	YARWAY, USA

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		(c) LEVELSTATE, UK
		(d) SOLARTON, UK (PRESENTLY CALLED AS MOBREY)
		(e) CHEMTROL
		(f) LEVEL STATE (HITECH SYSTEMS)
		(g) MOBREY
1.10	FLOW SWITCHES	(a) SWITZER, CHENNAI
		(b) KRONHE MARSHALL
		(c) GENERAL INSTRUMENTS MUMBAI
		(d) CHEMTROL
1.11	BYPASS ROTAMETER	(a) IEPL, HYDERABAD
		(b) PLACKA INSTRUMENTS INDIA PVT. LTD., CHENNAI
		(c) TRAC, HYDERABAD
		(d) EUREKA, PUNE
1.12	ROTAMETER	(a) INSTRUMENTATION ENGINEERS PVT. LTD.
		(b) SIGMA INSTRUMENTS CO.
		(c) EUREKA INDUSTRIAL EQPT. PVT. LTD.
		(d) TELACE EQUIPMENT PVT. LTD.
1.13	FLOW INTEGRATOR (ELECTRONIC TYPE)	(a) ABB, GERMANY / FARIDABAD
		(b) MASIBUS, GANDHINAGAR
		(c) YOKOGAWA, JAPAN/ YOKOGAWA INDIA
		(d) LEKKTROTEK, PUNE
		(e) EMERSON

CONSULTANT : PROCON ENGINEERS

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		(f)	ENDRESS & HAUSER
		(g)	FORBES MARSHALL
1.14	GAUGES (PRESSURE, DIFF. PRESSURE)	(a)	A N INSTRUMENTS PVT. LTD., KOLKATA
		(b)	GENERAL INSTRUMENTS CONSORTIUM, GOA/ MUMBAI
		(c)	GOA THERMOSTATIC INSTRUMENTS, GOA
		(d)	FORBES MARSHALL LTD., HYDERABAD
		(e)	WAAREE INDUSTRIES, MUMBAI
		(f)	H.GURU INSTRUMENTS (SOUTH INDIA), BANGALORE
		(g)	WIKA INSTRUMENTS INDIA PVT. LTD., PUNE
		(h)	GOA INSTRUMENTS PVT. LTD.,
		(i)	MONOMETER, MUMBAI
		(j)	BELLS CONTROLS LTD., KOLKATA
		(k)	SWITZER INSTRUMENTS LTD., CHENNAI
		(l)	WIKA ALEXANDER WIEGAND GMBH&CO., GERMANY
		(m)	BUDENBURG GUAGE CO. LTD
		(n)	INSTRUMENTATION PVT. LTD., BANGALORE
		(o)	INDOSONIC INSTRUMENT, MUMBAI
		(p)	PRECISION
		(q)	ASHCROFT

CONSULTANT : PROCON ENGINEERS

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1.15	TEMPERATURE GAUGE	(a)	GOA THERMOSTATIC INSTRUMENTS, GOA
		(b)	GENERAL INSTRUMENTS CONSORTIUM,
		(c)	A.N. INSTRUMENTS PVT. LTD., KOLKATA
		(d)	H. GURU INSTRUMENTS (SOUTH INDIA), BANGALORE
		(e)	FORBES MARSHALL, HYDERABAD
		(f)	WIKI INSTRUMENTS INDIA PVT. LTD., PUNE
		(g)	WAREE, DADRA GOA INSTRUMENTS PVT. LTD.,
		(h)	BELLS CONTROLS LTD., KOLKATA
		(i)	SWITZER INSTRUMENTS LTD., CHENNAI
		(j)	WIKI ALEXANDER WIEGAND GMBH&CO., GERMANY
		(k)	BUDENBURG GAUGE CO. LTD.
		(l)	INDOSONIC INSTRUMENT, MUMBAI
1.16	SWITCHES (PRESSURE, DIFF. PRESSURE)	(a)	INDFOSS INDUSTRIES LTD., GHAZIABAD
		(b)	SWITZER INSTRUMENTS COMPANY, CHENNAI
		(c)	SOR INC., USA
		(d)	PYROELECTRIC, GOA
		(e)	DRESSER INDUSTRIES INC, USA
		(f)	REGULATEURS GEORGIN, FRANCE

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		(g)	DELTA CONTROLS LTD., U.K.
		(h)	KDG INSTRUMENTS LTD. U.K.
		(i)	ASHCROFT
		(j)	DWAYER, USA
		(k)	GENERAL INSTRUMENTS CONSORTIUM
1.17	TEMPERATURE SWITCH	(a)	INDFOSS INDUSTRIES LTD., GHAZIABAD
		(b)	SWITZER INSTRUMENTS COMPANY, CHENNAI
		(c)	GENERAL INSTRUMENTS CONSORTIUM, MUMBAI
		(d)	SOR INC., USA
		(e)	PYROELECTRIC, GOA DRESSER INDUSTRIES INC, USA
		(f)	REGULATEURS GEORGIN, FRANCE
		(g)	DELTA CONTROLS LTD., U.K.
		(h)	KDG INSTRUMENTS LTD. U.K.
1.18	AIR FILTER REGULATOR	(a)	PLACKA, CHENNAI
		(b)	SHAVO NORGREN, INDIA
1.19	MASS FLOW METER (CORROLIOUS PRINCIPLE)	(a)	EMERSON PROCESS MANAGEMENT (I) LTD
		(b)	ABB
		(c)	YOKOGAWA
		(d)	ENDRESS+ HAUESER
		(e)	GE SENSING & INSPECTION TECHNOLOGIES
		(f)	FORBES MARSHALL

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1.20	I/P CONVERTER	(a)	ECKHARDT, GERMANY
		(b)	MTL, CHENNAI
		(c)	ABB
		(d)	WATSON SMITH (PRESENTLY NORGREN)
		(e)	EMERSON PROCESS MGMT ASIA PACIFIC LTD.
		(f)	MOORE CONTROLS
1.21	FLOW ELEMENTS	(a)	INSTRUMENTATION LTD.
		(b)	MICRO PRECISION PRODUCTS
		(c)	ENGINEERING SPECIALITIES PVT. LTD.
		(d)	GENERAL INSTRUMENTS
1.22	LEVEL GAUGES (FLOAT TYPE)	(a)	SB ELECTRO
		(b)	SIGMA
		(c)	V AUTOMAT
		(d)	LEVCON
		(e)	CHEMTROLS
		(f)	ASIAN INDUSTRIAL VALVES
1.23	ORP TRANSMITTERS	(a)	FORBES MARSHALL
1.24	DENSITY METER (NUCLEONIC TYPE)	(a)	ENDRESS + HAUSER
		(b)	THERMO MEASURE TECH.
		(c)	CHEMTROL (THERMO FISHER)
1.25	DENSITY METER (NON-NUCLEONIC TYPE)	(a)	ENDRESS + HAUSER
		(b)	THERMO MEASURE TECH.
		(c)	CHEMTROL (THERMO FISHER)

CONSULTANT : PROCON ENGINEERS

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1.26	SOLID MASS FLOW METER	(a)	SIEMENS MILLTRONICS
		(b)	CHEMTROL (THERMO FISHER)
		(c)	SIEMENS INSTRUMENTS, CANADA
1.27	PULL CORD SWITCH	(a)	JAYASHREE ELECTRODEVICES PVT. LTD.
		(b)	A.G. SYSTEM CONTROLS, MUMBAI
1.28	BELT SWAY SWITCH	(a)	JAYASHREE ELECTRODEVICES PVT. LTD.
		(b)	A.G. SYSTEM CONTROLS, MUMBAI
1.29	ZERO SPEED SWITCH	(a)	A.G. ELECTRONICS
		(b)	JAYASHREE ELECTRODEVICES PVT. LTD.
1.30	PROXIMITY SWITCH	(a)	AW
		(b)	JAYASHREE ELECTRODEVICES PVT. LTD.
1.31	LEVEL SWITCH (RF TYPE)	(a)	EIP ENVIRO LEVEL CONTROLS
2.0	<u>DCS, HMI, MONITORING AND PLC SYSTEMS:</u>		
2.1	DDCMIS	(a)	ABB.
		(b)	YOKOGAWA
		(c)	SIEMENS.
		(d)	BHEL
		(e)	EMERSON PROCESS MANAGEMENT
		(f)	MHI
2.2	PLC	(a)	ALLEN BRADLEY.
		(b)	SCHNEIDER
		(c)	ROCKWELL

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		(d)	GE FANUC
2.3	MASTER SLAVE CLOCK	(a)	SYMMETRICOM INC., USA
		(b)	HOPF, GERMANY
		(c)	HATHWAY, USA
		(d)	SERTEL ELECTRONICS, CHENNAI
		(e)	ADVANCE MICRONIC
2.4	DOT MATRIX PRINTER	(a)	HP / EPSON / WIPRO / TVS / SAMSUNG
2.5	LASER & COLOUR INKJET PRINTERS	(b)	HP / EPSON / CANON / IBM / XEROX / SAMSUNG
2.6	COMPUTERS FOR OPERATOR / ENGINEER / HISTORY STATION, SHIFT SUPERVISOR, STORIAN, SOFT LINK STATION FOR INTERFACING WITH OTHER SYSTEMS, PERFORMANCE CALCULATION AND SER STATION	(a)	IBM
		(b)	DELL
		(c)	HP/COMPAQ
2.7	TFT MONITOR	(a)	LG / SAMSUNG / HP / COMPAQ / IBM / DELL
2.8	VIBRATION MONITORING SYSTEM & TURBO-SUPERVISORY INSTRUMENTS	(a)	ROCKWELL AUTOMATION, USA
		(b)	BENTLEY NEVADA, USA / INDIA
		(c)	SHINKAWA, JAPAN / FORBES MARSHALL,
		(d)	VIBROMETER, SWITZERLAND
2.9	LARGE VIDEO SCREENS	(a)	BARCO BELGIUM / BARCO, INDIA
		(b)	PLANAR, USA / PYROTECH, INDIA
		(c)	CHRISTIE, USA / CHRISTIE, INDIA

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		(d) SYNELEC
		(e) DELTA, THAILAND / DELTA POWER SYSTEMS, INDIA
2.10	HART COMMUNICATOR	(a) HONEYWELL, USA/PUNE
		(b) EMERSON PROCESS (FORMERLY FISHER ROSEMOUNT), USA / DAMAN
		(c) YOKOGAWA, JAPAN / YOKOGAWA, INDIA
		(d) MERIAM, USA / CHEMTROLS, MUMBAI
		(e) ABB, GERMANY / INDIA
		(f) FUJI, JAPAN
2.11	HART MANAGEMENT SYSTEM	(a) PEPPERL+FUCKS, GERMANY / INDIA
		(b) MTL, UK / INDIA
		(c) EMERSON PROCESS, USA / DAMAN
2.12	ALARM ANNUNCIATION SYSTEM	(a) PROCON, CHENNAI
		(b) I I C, HYDERABAD
		(c) MINILEC, PUNE
		(d) IIC, MUMBAI
		(e) PIRIE, MUMBAI
		(f) PECON, VADODARA
		(g) POSITRONICS
2.13	RMCMs (ROTATING MACHINE CONDITION MONITORING SYSTEM)	(a) VIBROTECH (M/S MEGITT INDIA PVT. LTD.)
		(b) M/S SKF INDIA LTD.
2.14	ACOUSTIC PYROMETER	(a) BONNENBERG + DRESCHER GMBH, GERMANY

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2.15	ACOUSTIC STEAM LEAK DETECTION SYSTEM (ASLD)	(a)	HI-TECH SYSTEM & SERVICES LTD, NEW DELHI (AMI MAKE)
		(b)	SARTECH INTL, CHENNAI (INSTROTECH MAKE INSPECTA FFT
2.16	EPABX SYSTEM	(a)	SIEMENS
		(b)	BPL
2.17	FURNACE TV CAMERA SYSTEM	(c)	HITECH SYSTEM & SERVICES LTD. (M/S LENOX INSTRUMENT COMPANY INC., USA
3.0	<u>ELECTRICAL & SECONDARY INSTRUMENTS:</u>		
3.1	DIGITAL INDICATOR	(a)	ABB, GERMANY / FARIDABAD
		(b)	MASSIBUS, GANDHINAGAR PYROTECH, UDAIPUR
		(c)	LEKTROTEK, PUNE
		(d)	GOSEN / CAMILLE BAUER / METRAWATT YOKOGAWA, JAPAN / INDIA
		(e)	SIEMENS
3.2	BARGRAPH INDICATORS	(a)	ABB, GERMANY / FARIDABAD
		(b)	MASSIBUS, GANDHINAGAR
		(c)	PYROTECH, UDAIPUR
		(d)	LEKTROTEK, PUNE
		(e)	GOSEN / CAMILLE BAUER / METRAWATT
		(f)	M-SYSTEM, JAPAN (CHINO LAXSONS DAMAN)
		(g)	SIEMENS

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3.3	PEN, POINT AND CHARTLESS RECORDERS	(a)	EUROTHERM, UK
		(b)	TATA HONEYWELL
		(c)	YOKOGAWA, JAPAN (YOKOGAWA, INDIA)
		(d)	CHINO (LAXSON), JAPAN
		(e)	ABB, UK / GERMANY
		(f)	FUJI ELECTRIC, JAPAN
3.4	TRANSDUCERS	(a)	SEIMENS
		(b)	AUTOMATIC ELECTRIC LTD., MUMBAI
		(c)	PYROTECH, UDAIPUR
		(d)	SOUTHERN TRANSDUCERS, CHENNAI
		(e)	ACCORD, PUNE MECO, MUMBAI
		(f)	ABB
		(g)	SITU, MUMBAI
		(h)	RISHABH
		(i)	ADEPT, PUNE
3.5	ELECTRICAL ANALOG (PANEL) METERS	(a)	AUTOMATIC ELECTRIC LTD., MUMBAI
		(b)	MECO, MUMBAI
		(c)	RISHAB, NASIK
3.6	SELECTOR SWITCHES AND CONTROL SWITCHES	(a)	KAYCEE
		(b)	ALSTOM
		(c)	L & T
		(d)	SIEMENS

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3.7	MOSAIC ANALOG (MOVING COIL) INDICATORS	(a)	GOSSEN, GERMANY
		(b)	WEIGEL, GERMANY
3.8	MOSAIC DIGITAL INDICATORS	(a)	GOSSEN, GERMANY
		(b)	WEIGEL, GERMANY
3.9	INTERPOSING RELAYS FOR COMMAND OUTPUT TO MCC	(a)	JYOTI
		(b)	H&B
		(c)	ALSTOM
		(d)	ELASTA
		(e)	OEN SIEMENS
		(f)	ABB
3.10	RELAYS / AUX. CONTACTORS	(a)	TELEMECANIQUE & CTRLS
		(b)	ABB
		(c)	SIEMENS
		(d)	GEC – ALSTOM
		(e)	L & T
3.11	LIMIT SWITCHES	(a)	BHARTIYA CUTLER & HAMMER, FARIDABAD
3.12	MINIATURIZED PUSH BUTTONS / ILPB (24X48MM) MOSAIC GRID COMPATIBLE	(a)	SIEMENS
		(b)	TEW, GERMANY (OLD NAME SUBKLEW)
4.0	<u>CONTROL DESKS & PANELS:</u>		
4.1	UNIT CONTROL PANELS (UCP)/ ELECTRICAL CONTROL PANEL (ECP)/ CONTROL DESK (MOSAIC GRID BASED)	(a)	BHEL EDN
		(b)	PYRO TECH, UDAIPUR
		(c)	INSTRUMENTATION LTD. KOTA
		(d)	KHODAY CONTROL SYSTEMS, BANGALORE

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		(e)	CHEMIN CONTROLS, PONDICHERRY
4.2	CRT DESK / OPERATOR DESK	(a)	PYRO TECH, UDAIPUR
		(b)	INSTRUMENTATION LTD. KOTA
		(c)	KHODAY CONTROL SYSTEMS, BANGALORE
		(d)	CHEMIN CONTROLS, PONDICHERRY
4.3	MOSAIC GRID/ MOSAIC TILES & OTHER MOSAIC ITEMS	(a)	SYMO, SWITZERLAND
		(b)	TEW, GERMANY (OLD NAME SUBKLEW)
		(c)	PYROTECH
4.4	LOCAL PANELS / DISTRIBUTION BOARDS	(a)	CONTROL & SCHEMATICS
		(b)	PYROTECH
		(c)	RITTAL
		(d)	L&T
4.5	TERMINAL BLOCKS	(e)	ELMEX
		(f)	PHOENIX
		(g)	WAGO
5.0	<u>ANALYSERS:</u>		
5.1	SWAS ANALYSERS	(a)	POLYMETRON / ZELLWEGGER – ANALYTICALS
		(b)	ABB
		(c)	ORION, USA
		(d)	ROSEMOUNT ANALYTICAL-CHEMPURE,
		(e)	HACH ULTRA FRANCE,
		(f)	HACH USA

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		(g)	YOKOGAWA
		(h)	AMETECH
		(i)	FORBES MARSHALL
		(j)	EMERSON
5.2	SWAS (STEAM AND WATER ANALYSIS SYSTEM) PANELS	(a)	ABB KENT, U.K.
		(b)	ABB LTD. FARIDABAD
		(c)	FORBES MARSHAL
		(d)	EMERSON PROCESS MANAGEMENT INSTRUMENTATION LTD., KOTA
		(e)	YOKOGAWA
5.3	CO ANALYSER (IN SITU TYPE)	(a)	AMETEK, USA / SINGAPORE
		(b)	CODEL INTERNATIONAL LTD. UK
		(c)	LAND COMBUSTION UK
5.4	OXYGEN IN FLUE GAS ANALYSER (ZIRCONIA PROBE TYPE)	(a)	AMETEK, USA / SINGAPORE
		(b)	LAND INSTRUMENTS, UK
		(c)	EMERSON PROCESS MANAGEMENT (I) LTD
		(d)	YOKOGAWA, JAPAN
		(e)	ENOTECH, GERMANY
		(f)	ABB, UK
		(g)	TELEDYNE, USA
		(h)	FUJI (AIC)
5.5	SMOKE DENSITY ANALYSER / PARTICULATE EMISSION ANALYSER / OPACITY ANALYSER	(a)	DURAG, GERMANY
		(b)	CODEL, UK
		(c)	LAND COMBUSTION UK

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		(d)	EMERSON
		(e)	ABB
		(f)	FUJI (AIC)
5.6	NOX / SO2 ANALYSER (IN SITU)	(a)	CODEL, UK
		(b)	FORBES MARSHALL
		(c)	LAND COMBUSTION, UK
5.7	OZONE ANALYSER	(a)	BMT MESSTECHNIK, GMBH
5.8	RESIDUAL OZONE ANALYSER	(a)	ECO SENSORS / KAUFFMANN UMWITTECHNIK .EK
5.9	OZONE LEAK DETECTOR	(a)	OTTPL
6.0	<u>CONTROL VALVES / ACTUATORS / SOLENOID VALVES:</u>		
6.1	ELECTRICAL ACTUATORS FOR REGULATING & OPEN / CLOSE VALVES	(a)	ROTORK CONTROL (INDIA) LTD.,
		(b)	AUMA (INDIA) LTD.,
		(c)	LIMITORQUE INDIA LTD.
6.2	PNEUMATIC ACTUATORS-REGULATING & OPEN / CLOSE	(d)	INSTRUMENTATION LTD., PALGHAT
		(e)	KELTRON CONTROLS, KERALA
6.3	SH/RH SPRAY CONTROL VALVES	(a)	MIL CONTROLS LTD.
	SH/RH SPRAY BLOCK VALVES	(b)	INSTRUMENTATION LTD. PALGHAT
	FEED CONTROL VALVES	(c)	FISHER SANMAR LTD.
		(d)	CONTROL COMPONENT INC., USA
		(e)	HORA (HOLTER REGELARMATUREN GMBH & CO.)
6.4	LFO/HFO CONTROL, AND TRIP VALVES, FLOW CONTROL, PRESSURE	(a)	MIL CONTROLS LTD.
		(b)	INSTRUMENTATION LTD. PALGHAT

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	CONTROL, TEMP. CONTROL, AND BURNER TRIP VALVES, BALL VALVES	(c)	FOURESS ENGG (I) LTD, BANGALORE
		(d)	SAMSON CONTROLS , PUNE
6.5	SOOT BLOWER PRESSURE REDUCING VALVE	(a)	MIL CONTROLS LTD.
		(b)	INSTRUMENTATION LTD., PALGHAT
		(c)	FISHER SANMAR LTD.
		(d)	CONTROL COMPONENT INC., USA
		(e)	HORA (HOLTER REGELARMATUREN GMBH & CO.)
6.6	APRDS CONTROL VALVES	(a)	INSTRUMENTATION LTD.
		(b)	CONTROL COMPONENT INC., USA
		(c)	HORA (HOLTER REGELARMATUREN GMBH & CO.)
6.7	CONTROL VALVES- NON CRITICAL	(a)	DEZURIK COPES VULCAN LTD., U.K.
		(b)	CONTROL COMPONENT INC., USA
		(c)	FISHER SANMAR LIMITED
		(d)	INSTRUMENTATION LTD
		(e)	MIL CONTROL LTD.
		(f)	FISHER XOMOS SANMAR LTD.
		(g)	HORA (HOLTER REGELARMATUREN GMBH & CO.)
6.8	SOLENOID VALVE	(a)	ASCO, CHENNAI
		(b)	ROTEX AUTOMATION LTD., GUJRAT
		(c)	AVCON CONTROLS, MUMBAI
6.9	HP/LP BYPASS VALVES	(a)	BOPP & REUTHER SR GMBH CONTROL COMPONENTS INC (CCI)

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6.10	ELECTRO-HYDRAULIC ACTUATOR	(a)	LEONARDO AUTOMATION (INDIA) PVT. LTD.
7.0	<u>ERECTION HARDWARES:</u>		
7.1	LOCAL INSTRUMENT RACK (LIR) AND LOCAL INSTRUMENT ENCLOSURES (LIE)	(a)	PYROTECH, UDAIPUR
		(b)	INSTRUMENTATION LTD., KOTA
		(c)	ELECTRONICS CORPORATION OF INDIA LTD., HYDERABAD
		(d)	CHEMIN CONTROLS, PONDICHERRY
		(e)	PRAMMEN INDUSTRIES
7.2	INSTRUMENT VALVES	(a)	EXCEL HYDRO PNEUMATICS PVT. LTD., MUMBAI
		(b)	BHEL
		(c)	METPRESS ENGINEERING WORKS, KOLKATA
		(d)	BALDOTA VALVE & FITTING CO. PVT. LTD., MUMBAI
		(e)	AURA INC., NEW DELHI
		(f)	INSTRUMENTATION LTD. PALGHAT
		(g)	PRECISION ENGG. INDUSTRIES, MUMBAI
		(h)	VIKAS INDUSTRIAL PRODUCTS, NEW DELHI
7.3	VALVE MANIFOLDS	(a)	EXCEL HYDRO PNEUMATICS PVT. LTD., MUMBAI
		(b)	METPRESS ENGINEERING WORKS, KOLKATA

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		(c)	BALDOTA VALVE & FITTING CO. PVT. LTD., MUMBAI
		(d)	AURA INC., NEW DELHI
		(e)	PRECISION ENGG. INDUSTRIES, MUMBAI
		(f)	HP VALVES AND FITTINGS, CHENNAI
7.4	COMPRESSION FITTINGS / SOCKET WELD FITTINGS	(a)	SWAGELOCK, USA
		(b)	ASTEC VALVES & FITTINGS PVT. LTD.
		(c)	MET-LOK HYDRO PNEUMATICS PVT. LTD.
7.5	CONDENSATE POTS	(a)	EXCEL HYDRO-PNEUMATICS PVT. LTD., MUMBAI
		(b)	MICROPRECISION, FARIDABAD
		(c)	INSTRUMENTATION LTD. PALGHAT
		(d)	METPRESS ENGINEERING WORKS, KOLKATA
		(e)	BALDOTA VALVES & FITTINGS CO. PVT. LTD., MUMBAI
		(f)	PRECISION ENGG. INDUSTRIES, MUMBAI
7.6	IMPULSE & SAMPLE PIPINGS	(a)	TPS TECHNITUBE ROHREN WERKE GMBH, GERMANY
		(b)	MAHARASHTRA SEAMLESS LTD.
		(c)	BHEL
		(d)	CHOKSI TUBE COMPANY LTD., INDIA
		(e)	INDIAN SEAMLESS METAL TUBES LTD., INDIA
		(f)	MANNESMANN AG, GERMANY

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		(g) TOUVAY AND CAUVIN GULF EC, DUBAI
		(h) JINDAL SAW PIPES LTD., INDIA
		(i) SUMITOMO CORPORATION, JAPAN / KAWASAKI
		(j) RATNAMANI METALS & TUBES LTD., AHMEDABAD
7.7	JUNCTION BOX (FRP)	(a) DEVI POLYMERS, CHENNAI
		(b) SUCHITRA INDUSTRIES, BANGALORE
		(c) RITTAL
		(d) PYROTECH
		(e) L&T
		(f) HENSEL ELECTRIC INDIA PVT. LTD., SRIPERUMBUDUR
7.8	AIR CYLINDER	(a) VELJAN HYDRAIR, HYDERABAD
		(b) NUCON INDUSTRIES, HYDERABAD
		(c) PRECISION ENGG. (PREAC), BANAGALORE
		(d) ASCO, CHENNAI
8.0	<u>CABLES:</u>	
8.1	CONTROL CABLES	(a) DELTON CABLES, FARIDABAD
		(b) UNIVERSAL CABLES, SATNA
		(c) NICCO CABLE, KOLKATA
		(d) POLYCAB, DAMAN
		(e) GAYOLENE, MUMBAI
		(f) RELIANCE ENGRS, BANGALORE
		(g) CORDS CABLES, RAJASTHAN

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		(h)	PARAMOUNT CABLES, ALWAR
		(i)	THERMOCABLES, BANGALORE,
		(j)	KEI INDUSTRIES LTD., CHENNAI
8.2	INSTRUMENTATION CABLE	(a)	DELTON CABLES, FARIDABAD
		(b)	UNIVERSAL CABLES, SATNA
		(c)	NICCO CABLE, KOLKATA
		(d)	POLYCAB, DAMAN
		(e)	GAYOLENE, MUMBAI
		(f)	RELIANCE ENGRS, BANGALORE
		(g)	CORDS CABLES, RAJASTHAN
		(h)	PARAMOUNT CABLES, ALWAR
		(i)	THERMOCABLES, BANGALORE / HYDERABAD
		(j)	KEI INDUSTRIES LTD., CHENNAI
		(k)	CABLE CORPRN OF (I) LTD., CHENNAI
		(l)	RPG CABLES LTD., CHENNAI
		(m)	FORT GLOSTER INDUSTRIES LTD. KOLKATA
		(n)	DECO CABLES, DELHI
		(o)	KRISHNA CABLES, GWALIOR
		(p)	THERMAPADS (P) LTD
		(q)	ELKAY TELELINKS LTD.
		(r)	INCAB INDUSTRIES LTD
		(s)	TORRENT CABLE LTD.
8.3	COMPENSATING CABLES	(a)	DELTON CABLE

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		(b) TOSHNIWAL, MUMBAI RELIANCE, BANGALORE
		(c) LAPP INDIA, MUMBAI/ BANGALORE
		(d) CORDS CABLES, RAJASTHAN
		(e) PARAMOUNT CABLE
8.4	SPECIAL CABLES (PTFE /FEP INSULATED CABLES)	(a) TOSHNIWAL CABLE
		(b) RELIANCE CABLES
		(c) LAPP INDIA, MUMBAI
		(d) PARAMOUNT CABLES
		(e) FINOLEX, PUNE
8.5	POWER CABLES (LT)	(a) DELTON CABLES, FARIDABAD
		(b) UNIVERSAL CABLES, SATNA
		(c) NICCO CABLE, KOLKATA
		(d) CORDS CABLES, RAJASTHAN
		(e) FORTGLASTER INDUSTRIES
		(f) INCAB, PUNE
		(g) CCIL, BANGALORE
		(h) KEI INDUSTRIES LTD., CHENNAI
		(i) POLYCAB, DAMAN PARAMOUNT CABLES, ALWAR
9.0	<u>UPS / DC SYSTEM:</u>	
9.1	UPS WITH ACDB	(a) HI-REL ELECTRONICS
		(b) EMERSON NETWORK (FORMERLY TATA LIEBERT)
		(c) DB POWER ELECTRONICS
9.2	24 VDC BATTERY CHARGER	(a) CALDYNE, KOLKATA

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	WITH DCDB	(b)	AMARARAJA, TIRUPATI
		(c)	CHHABI ELECTRICALS, JALGAON
		(d)	HBL POWER SYSTEMS, HYDERABAD
		(e)	MASS TECH CONTROLS
9.3	BATTERY (TUBULAR/PLANTE) (TUBULAR) (TUBULAR)	(a)	EXIDE, KOLKATA
		(b)	HBL NIFE, HYDERABAD UNION BATTERY (BUI PUNE)
9.4	BATTERY (NICKEL- CADMIUM)	(a)	HBL POWER SYSTEMS, HYDERABAD
		(b)	AMCO, BANGALORE

Laboratory Instruments:

Bidder shall submit the vendor list with credentials for Mahagenco's approval.

NOTE : The vendors indicated in the above list are Mahgenco's approved vendors, however, the product of above vendors proposed for this project shall meet the requirements stipulated in 'Proven Product' Cl. No. 5.0 of Vol. V, Section I of Tender Specification.

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	TITLE:	SPECIFICATION NO. PE-TS-415-154-A001
	1X660 MW BHUSAWAL TPS	SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION - I A
		REV.NO. 00 DATE: 27.05.2019

ANNEXURE III:

DRAWING DOCUMENTS DISTRIBUTION PROCEDURE

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1.0 <u>GENERAL</u> 1.1 As part of the overall project management activity, the Contractor shall be responsible for proper engineering and co-ordination of activities during various phases of execution of the contract. The Contractor shall identify a person, designated as Project Manager, with whom the Owner, the Consulting Engineer or the Review Consultant shall interact on matters related to engineering as well as execution of the contract. The Project Manager shall be the single-point contact person on behalf of the Contractor and shall be responsible for all engineering co-ordination. The Owner/Consultant/ Review Consultant shall interact with the Project Manager only on all matters of co-ordination between the Owner and the Contractor or on matters involving the Contractor, his manufacturing units and sub-vendors. For the purpose of expediting, the Owner or his representative may sometimes interact with the manufacturing units or sub-vendors of the contractors. However, such interaction will not, under any circumstance, dilute the responsibility of the Contractor to provide a fully engineered and co-ordinated package under this contract. 1.2 On finalization of the contract, a procedure for exchange of engineering information will be mutually agreed and finalized between the Owner and the Contractor. 2.0 <u>DESIGN COORDINATION MEETING</u> The Contractor and his sub-vendors will be called upon to attend design co-ordination meetings with the Engineer, other Contractors and the Consultants of the Owner during the period of execution of contract. The Contractor including his sub-vendors shall attend such meetings at their own cost at Owner's or Consultant's office in Mumbai or at Bhusawal site or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions. 3.0 <u>GUIDELINES FOR ENGINEERING SERVICES</u> 3.1 Prior to commencement of the engineering work as part of design submissions, all aspects of design viz criteria for selection and sizing of all equipment and systems, design margins etc including that for structural steel		

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and civil work shall be outlined and these shall form the basis for the detailed engineering work. 3.2 Engineering work shall be performed on modern and proven concepts and internationally accepted good engineering practices but fully compatible with the Indian environments. Owner shall have the right to review and approve the engineering work by themselves and/or through consultant and ask for any clarifications and changes/modifications to the work performed by Contractor. 3.3 At any stage during the performance of assignment, the Contractor may be required to make certain changes/modification/improvements in design/drawing/other documents which are applicable to any unit of 660 MW individually or severally, which in the opinion of the Owner could result in better improved design, layout, operability, plant availability, maintainability, reliability or economy of the plant and its systems/sub-systems in view of revised and more accurate information/data available at a later date (s) or feedback (s) received during execution/operation of similar units. Such changes/modifications/improvements required could be identified by Owner and/or consultant and mutually discussed. Owner requires the Bidder to incorporate such action in the subject assignment appropriately without any additional cost liability and time implication to the Owner and same shall be within the responsibilities and scope of the Contractor. 3.4 During the course of review of detailed engineering stages, it may be essential in the opinion of Owner to obtain certain classified data for review purposes only. In case Owner so desires, the Bidder shall submit such data to Owner. 3.5 During the course of review of detailed engineering, it may be essential in Owner's opinion to obtain data and information on similar equipment and plants engineered by the Bidder. In case Owner so desires, the Bidder shall submit such data and information to the Owner. 3.6 It is not the intent to give details of every single task covered in the total engineering work to be carried out by Contractor, however, all engineering work required for the satisfactory completion of the plant/systems as		

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specified shall be carried out by the Contractor. Broadly, the following are the minimum requirements in respect of scope of major items of work: 4.6.1 Preparation, updating and finalisation of scheme drawings, control and interlock diagrams, detailed and fully dimensioned layout drawings (plant layout and equipment layout detailed plan, elevation and cross-sectional drawings at different elevations/ floor levels) covering all mechanical, electrical, C&I, civil and structural items, equipment, systems and facilities. Drawings and Schedules prepared by the Contractor from time to time, as detailed designs are developed, shall be submitted for Owner's/ Consultant's approval before the work is taken up. Revisions, corrections, additions to drawings and schedules shall not be considered to change the scope of work. 4.6.2 Preparation of detailed technical specifications including data sheets, tender drawings and bill of material for all bought out items and also finalisation of corresponding sub-contractors. 4.6.3 Review of sub-contractor's data, drawings, design calculations, schedules, bill of materials, instruction manuals etc. for all equipment, before forwarding them to Owner /Consultant for approval. 4.6.4 Preparation of civil construction drawings for all equipment showing foundation details and full details regarding equipment loads, floor openings, details of embedments etc required for preparation of civil construction drawings and also as referred at relevant sections of Scope, Terminal Points & Exclusions. These documents shall be preceded by appropriate design calculations, static and dynamic analysis, as necessary. 4.6.5 Preparation and finalisation of process piping and instrumentation diagrams and schematics, complete in all respects for all systems/packages of the power plant. 4.6.6 Preparation of consolidated schedules and bills of materials, including line numbers, tag numbers, source of supply, service conditions, specifications, materials, types and connections details, quantities for items of the plant including dampers, steam traps, strainers, instrumentations, ducting. 4.6.7 Sizing of all piping and equipment as per the stipulated design criteria, carrying out the flexibility analysis/dynamic analysis as necessary, hangers & support engineering.		

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4.6.8	Final revision of all documents including preparation and compilation of Instruction Manuals for installation, commissioning, operation and maintenance for all equipment and systems. Refer clause 5.0 for the specific requirement in this regard.	
4.6.9	Certification and submission of final as-built drawings for all areas.	
4.6.10	Preparation and compilation of all drawings, schedules and instructions which may be required at site, whether separately mentioned or not.	
4.6.11	All erection and assembly drawings which may be required at site.	
4.6.12	For all bought out item packages, the Contractor shall provide complete material/ component list along with detail specification, drawings, component part number etc during detail engineering stage prior to final approval. Such approved drawing / document shall be made available at site in adequate number prior to commencement of work. Moreover, such document/drawing shall be provided in soft form (CD).	
4.6.13	Preparation of necessary documentation, design calculations etc required for submission to statutory authorities like IBR, Chief Electric Inspector etc.	
4.0	<u>OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS</u>	
4.1	The Contractor shall provide all necessary maintenance manuals and operating instructions at least six (6) months before the time of commissioning and before taking over of the plant and equipment. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hard copies.	
4.2	The information provided, which shall be contained in loose leaf stiff backed covers, shall include :	
4.2.1	A complete inventory of all main items of plant, with identification details.	
4.2.2	Service manuals for all plant and equipment giving full descriptions of the main items and auxiliary items such as power packs, hydraulic equipment, actuators, lubricating pumps etc.	

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4.2.3 A separate electrical manual covering items such as switchgear, cabling, instrumentation, controls, cabling layouts and wiring diagrams. 4.2.4 A schedule of recommendations for routine maintenance of all electrical and mechanical equipment, recommended inspection point, information on detection, cause and rectifications of troubles & faults. 4.2.5 A lubrication schedule with all necessary drawings, diagrams to identify the lubrication points. 4.2.6 Manufacturer's literature. 4.3 The instruction manual shall be subject to the approval of Owner. 4.4 The contractor shall submit the complete equipment list. The list shall be updated every three (3) months. 5.0 <u>PLANT HANDBOOK</u> The Contractor shall submit to the Engineer, a preliminary plant handbook preferably in A-4 size sheets which shall contain the design and performance data of various plant, equipment and systems, covering the complete project including single line flow diagrams, within twenty four (24) months from the date of his acceptance of the Letter of Award. The final plant handbook complete in all respects shall be submitted by the Contractor six (6) months before start-up and commissioning activities. The plant handbook shall be submitted in the form of two (2) soft copy in CD/DVD (one to Owner and one to Consultant) and twenty five (25) hard copies in decent bound forms. 6.0 <u>CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE</u> 6.1 Within fifteen (15) days of issue of Letter of Award (LOA) by the Owner, the Contractor shall furnish a schedule of drawings and design document to be submitted by him to the Owner/Engineer indicating dates against each document. The documents shall be divided into two categories:		

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(a) for approval and (b) for information/further engineering and co-ordination by the Owner. This document submission schedule shall require approval by the Owner/Engineer. 6.2 All contract documents shall be marked, without fail, with the name of the Owner, the Project, the specification title and number and the unit designation. All dimensions shall be in metric units. All notes, markings etc. shall be in English. 6.3 Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval/information of the Owner/Engineer. 6.4 Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Consultant: 6.4.1 List of sub-vendors (from Owner only) 6.4.2 System scheme and instrumentation diagrams 6.4.3 Design basis justifying selection of equipment & process parameters where not specified in the Contract 6.4.4 Equipment data sheets and general arrangement drawings 6.4.5 Predicted performance curves of equipment** 6.4.6 Materials of construction 6.4.7 Layout drawings		

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6.4.8	Operation logic diagrams	
6.4.9	Typical control circuit	
6.4.10	Drawings of Instrumentation and Control	
6.4.11	Any deviation from contract (by Owner)	
	** For all critical equipments (boiler and turbine auxiliaries etc), submission of this data shall be mandatory for approval of equipment data sheets / GA drawings.	
6.5	Unless specified otherwise, the following categories of documents/ drawings would be treated for information/further engineering by the Owner/Engineer. The Contractor shall, however, incorporate all additional information and clarifications in these documents/ drawings as and when desired by the Owner/Engineer.	
6.5.1	Equipment foundation drawings	
6.5.2	Equipment cross-section drawings, product literature etc which are of proprietary nature	
6.5.3	Various bills of quantity, schedules etc	
6.5.4	Piping fabrication drawings, isometrics etc	
6.5.5	Panel wiring diagrams	
6.5.6	Instruction/Operation manuals	
6.5.7	Service manuals and troubleshooting guide for C & I system including field instruments	
6.5.8	Cable schedule and interconnection chart	
6.5.9	Drive/feeder wise control scheme showing all external interfaces.	

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In essence, the Contractor is solely responsible for corrections and adequacy of design & engineering for documents under this category. 6.6 Upon review, the Owner/Engineer shall put his remarks and one of the following action stamps on the drawing/document: 6.6.1 Approved 6.6.2 Approved except as noted, forward final drawing 6.6.3 Approved except as noted, resubmission required 6.6.4 Disapproved 6.6.5 For information/reference only For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner / Engineer. For action stamp in category (b), further review by Owner / Engineer would not be necessary provided the Contractor agrees & incorporates the minor comments made on the document. Except for action stamp under category (c) & (d), the Contractor can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/Engineer. The Owner/Engineer may accord approval in category (c) or (d) in more than one submission of a document till he is satisfied that the intent of the specification has been fully complied with. The Contractor shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds. Approval of contract documents by the Owner/Engineer shall not relieve the Contractor of his responsibility for any errors and fulfillment of contract requirements. The Contractor's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Owner/Engineer.		

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6.7	Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.	
6.8	For review by the Consulting Engineer, the Contractor shall furnish three (3) prints of each drawing. Two (2) prints of such submission shall also be sent to the Owner. After review, one (1) stamped print will be returned to the Contractor. Upon action under category (a) or (c), the Contractor shall directly distribute the documents to the various offices of the Owner and other agencies in number of copies as specified in the contract document. Such distribution copies shall be marked with the reference and date of the letter by which the Owner/Engineer has accorded his final approval. Penal action shall be taken against the Contractor for any unauthorised revision in the drawings so distributed from the drawings approved by the Owner/Engineer. The contractor shall furnish three (3) CD's of all as built/final drawings for Owner / Consultant site.	
6.9	In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.	
6.10	For details of documentation for Civil, Structural and Architectural works, Volume VI may be referred.	
7.0	<u>TENDER STAGE DOCUMENT SUBMISSION</u>	
8.1	The Bidder shall submit along with his bid all documents/drawings as requested in respective specifications. The documents shall include but not be limited to the following:	
8.1.1	All Bid proposal sheets duly filled up. (The data mentioned in Bid proposal sheets is minimum required only. The Bidder shall submit the additional data asked for at any later stage).	
8.1.2	Detailed experience list and financial resources of the prime bidder, his collaborators/ associates in this bid as well as the sub-vendors proposed.	
8.1.3	Scheme drawings indicating scope of supply and service as offered by the Bidder indicating clearly exclusions, if any.	

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8.1.4	List of terminal points of the package offered together with quality and quantity of various input (i.e. water, air, electricity etc.) as required from the Owner at such interfaces.	
8.1.5	Equipment GA, Layout, Design Calculations, interlock and other write-up, catalogues/ literature etc as required for clear understanding of the bid submitted.	
8.1.6	L-1 network indicating target dates for intermediate milestones and final commissioning of equipment supplied. This network shall be supplemented by a detailed write-up on proposal procedure of project implementation, deployment schedule for Key personnel with their bio-data, schedule of construction machinery etc.	
8.1.7	List of suppliers for all bought out items.	

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Note:

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

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ANNEXURE IV: PAINTING SPECIFICATION

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15.0 <u>PAINTING</u> 15.1 <u>GENERAL</u> All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. Surfaces not easily accessible after shop assembly shall be treated before-hand and protected for life of the equipment. Surfaces to be finish painted after installation shall be shop painted with at least two (2) coats of primer. Steel surfaces, which are not to be painted, shall be coated with suitable rust preventive compound subject to the approval of the Owner. All paints shall be used in accordance with the manufacturer's instructions. No thinners or other substance shall be added to the coating material without the approval of the Engineer. The quality and vendor of the paints shall require approval of the Owner. All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects. All primers shall be well marked into the surface, particularly in areas where pitting is evident, and the first priming coat shall be applied as soon as possible after cleaning, within four hours maximum. The paint shall be applied by brush, roller or airless spray, according to the manufacturer's instructions. Spray painting shall be carried out by operators trained and thoroughly experienced in the use of the equipment. If the drying interval between successive coats, which should not exceed one week, has been so long as to endanger the adhesion of the following coat, the paint already applied shall be lightly rubbed down with fine abrasive paper before putting on the next coat. Paint spraying on large surfaces shall not normally be done indoors, except with the approval of the Engineer. Spray guns shall not be used outdoors in		

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windy weather or near unprotected surfaces of a contrasting colour and under no circumstances shall spray guns be used where spray may be carried into or onto exposed electrical equipment. Paint containers shall not be opened until required and the paint shall be mechanically mixed thoroughly before use, and agitated occasionally during use. Electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil resistant enamel. The interior of all panels' cabinets and enclosures shall be finished with gloss white enamel. The Contractor shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory surfaces of each item of equipment. The touch-up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished. The Contractor shall select shop primer for steel and iron surfaces, which will have a continuous operating temperature below 35°C, in accordance to the relevant standard. Special high temperature primer shall be used on surface exposed to operating temperature above 35°C. The Owner/Engineer shall submit the colour scheme during execution of contract for approval.		
15.2	<u>PREPARATION</u> Oil and grease shall be removed from the surface by washing with a suitable detergent, rinsing with clean water, and drying. Surfaces to be shot blasted shall be cleaned to Swedish Standard SA 2.5 or equivalent, and all dust remaining after cleaning shall be removed. The priming coat shall be applied without delay.	
15.3	<u>DAMAGED PAINTWORK</u> Any damaged paintwork shall be made good as follows:	

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15.3.1The damaged area, together with an area extending 25 mm around its boundary, shall be cleaned down to bare metal. 15.3.2A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50 mm around the perimeter of the original damage. 15.3.3The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming 15.4 <u>PAINTING SYSTEMS</u> The requirements for the Dry Film Thickness (DFT) of paint and the materials to be used shall be as stated below, unless otherwise specified elsewhere in this specification. 15.4.1 Surfaces subject to Weathering All surfaces shall have a minimum of four coats of paint made up as follows: (a)Primer coat : 35 micron DFT (b)Tie coat : 35 micron DFT (c)Finishing coat (Two Nos.) : 35 micron DFT per coat (d)The total minimum DFT : 140 micron 15.4.2 Surfaces Inside Buildings All surfaces shall have a minimum of three coats of paint made up as follows: (a)Primer coat : 35 micron DFT (b)Tie coat : 35 micron DFT (c)Finishing coat (Two Nos.) : 25 micron DFT per coat (d)The total minimum DFT : 120 micron		

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The Contractor shall select the type and colour of primer & finish coat after approval by the Owner. For detail painting on building & structural steel elements, please refer Volume VI / A & B of this specification. 16.0 <u>COLOUR CO-ORDINATION & FINISH</u> 16.1 Exterior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and with the surrounding landscape. 16.2 Interior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and which will be conducive to; the comfort, well-being and high productivity of the operators. Operating plant and services provided shall be colour coded for ease of identification. 16.3 All finishes shall be durable and as far as possible maintenance free. Finishes shall be easily cleaned. 16.4 Final colours and finishes shall be to the Approval of the Engineer.		

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ANNEXURE V: MANDATORY SPARES LIST


TITLE:

TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM
1X660 MW BHUSAWAL TPS U#6

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SECTION-C1

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ANNEXURE-V

LIST OF MANDATORY SPARES FOR CHEMICAL DOSING SYSTEM			
SL. NO.	DESCRIPTION	QTY	UNIT OF MEASUREMENT
1	LP CHEMICAL DOSING SYSTEM	1	
1.1	HYDRAZINE DOSING SYSTEM		
1.1.1	Dosing pumps and drives	1	Lot (One (1) of each type and size)
1.1.2	Agitators	1	Lot (One (1) of each type and size)
1.1.3	Reducing gear assembly	1	Lot (One (1) of each type and size)
1.1.4	Strainer	1	Lot (One (1) of each type and size)
1.1.5	Valves	1	Lot (One (1) of each type and size)
1.2	AMMONIA DOSING SYSTEM		
1.2.1	Dosing pumps and drives	1	Lot (One (1) of each type and size)
1.2.2	Agitators	1	Lot (One (1) of each type and size)
1.2.3	Reducing gear assembly	1	Lot (One (1) of each type and size)
1.2.4	Strainer	1	Lot (One (1) of each type and size)
1.2.5	Valves	1	Lot (One (1) of each type and size)
1.3	Resin	1	One complete fill of each type for one vessel
2	LOW PRESSURE PIPING SYSTEM	1	
2.1	Valves	1	Lot (5% of the total population of each type, Size and class or minimum Two (2) of each type, size and class whichever is higher)
2.2	Valves including control valves	1	Lot (5% of the total population or minimum Two (2) of each type, material, size & Class, whichever is more)
	Note: Complete valve along with actuator and all other accessories which are the part of original supply shall be also be supplied		
3	415 V MOTORS	1	Lot consisting of following:
3.1	Terminal plates for motors upto 30kw for each rating	1	Lot (1 no. For each type & rating of Motor)
3.2	Terminal plates for motors above 30kw for each rating	1	Lot (1 no. For each type & rating of Motor)
3.3	Heaters	1	Lot (1 set For each type & rating of Motor)
3.4	Greasing arrangements	1	Lot (1 set For each type & rating of Motor)
3.5	Motor of each type and rating	1	Lot (10% of the installed quantity or minimum 1 number whichever is higher)
3.6	Bearings (DE and NDE)	1	Lot (1 set For each type & rating of Motor)
3.7	End shield cover driving and non-driving end	1	Lot (1 set For each type & rating of Motor)
3.8	Cooling fan	1	Lot (1 set For each type & rating of Motor)
3.9	Motor terminal block	1	Lot (1 set For each type & rating of Motor)
3.10	Complete set of coupling	1	Lot (1 set For each type & rating of Motor)
4	MEASURING INSTRUMENTS		


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4.1	ELECTRONIC TRANSMITTERS	1	Lot consisting of following:
4.1.1	Transmitters of all types, ranges and model no. (for the measurement of Pressure, differential pressure flow, level etc.)	1	Lot (10% or 2 no. of each type and model, whichever is more)
4.1.2	Electronic cards / PCB's for each type and model and model of transmitters	1	Lot (10% or 5 nos. of each type, whichever is more)
4.2	TEMPERATURE ELEMENTS	1	Lot
4.3	INDICATORS/RECORDERS	1	Lot
4.3.1	Digital Indicators of each model, type & range (including relevant digital indicators of electrical system)	1	Lot (10 % or 2 nos. min. whichever is more)
4.3.2	Vertical Indicators of each type & model	1	Lot (5% or 1 no. of each model whichever is more)
4.4	Level transmitters (displacer type)		
4.4.1	Electronic cards / PCB's of level transmitters	1	Lot (10% of total quantity used or 1 for each type/rating whichever is more)
4.4.2	Level transmitters	1	Lot (10% of total quantity used or 1 for each type/rating whichever is more)
4.5	SWITCHES		
4.5.1	Switches (Pressure, DP, Level, Flow, Temperature etc.)	1	Lot (10% of each type of total nos. used in the system or minimum 1 no. of each type, model & range whichever is more)
4.6	Rotameter	1	Lot (10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range whichever is more)
4.7	SOLENOID VALVE		
4.7.1	Assembly (Solenoid Valve)	1	Lot (10% of total quantity used or minimum 2 no. of each type whichever is more)
4.7.2	Coil	1	Lot (10% of total quantity used or 5 no. whichever is more)
4.8	E/P Converter	1	Lot (10% of each type of total nos. used in the system or minimum 2 no. of each type, model & range whichever is more)
5	PROCESS CONNECTION PIPING (For impulse piping/tubing, sampling piping/tubing and air supply piping as applicable)	1	Lot consists of following
5.1	Valves of all types and models	1	Lot (10 % or 2 no. of each type, class, size and model whichever is more)
5.2	2 way, 3 way, 5 way valve manifolds	1	Lot (10 % or 2 no. of each type, class, size and model whichever is more)
5.3	Fittings	1	Lot (10 nos. of each type)
5.4	Purge meters	1	Lot (10% of each model or 2 Nos. whichever is more)
5.5	Filter regulators	1	Lot (10% of each model or 2 Nos. whichever is more)
5.6	Impulse pipe & tubing of all type	1	Lot (20 mtrs each type & size)
5.7	Impulse line root valve	1	Lot (10% of total quantity used or 4 no. whichever is more for each type and rating of each size)
5.8	SS tube	1	Lot (40 mtrs of each type/size)


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5.9	Fitting for SS tube	1	Lot (40 nos. of each type/size)
6	INSTRUMENTATION CABLE, INTERNAL WIRING AND ELECTRICAL FIELD	1	Lot consists of following
6.1	Pre fabricated cable of each type	1	Lot (10% of installed quantity)
6.2	Pre fabricated cable connector	1	Lot (10% or 1 no. of each type and model, whichever is more)
6.3	Other cables		Lot (10% of each type, pair and size of actual installed quantity)
7.0	ELECTRICAL ACTUATORS	1	Lot consists of following
7.1	Actuators	1	Lot (10% or 1 no. of each type, model and rating, whichever is more.)
7.2	Power unit for modulating actuator	1	Lot (10% or 2 nos. of each type, whichever is more.)
7.3	DC-DC unit/power pack units	1	Lot (10% or 2 nos. of each type, whichever is more.)
7.4	Electronic cards	1	Lot (10% or 2 nos. of each type, whichever is more.)
7.5	Brake assembly	1	Lot (10% or 2 nos. of each type, whichever is more.)
7.6	Brake calls	1	Lot (10% or 2 nos. of each type, whichever is more.)
7.7	Position feedback transmitters	1	Lot (10% or 2 nos. of each type, whichever is more.)
7.8	Contra! unit	1	Lot (10% or 2 nos. of each type, whichever is more.)
7.9	Torque and limit switch assembly of each unit	1	Lot (10% or 2 nos. of each type, whichever is more.)
7.10	O-ring	1	Lot (1 set of each size)
7.11	Motor	1	Lot (1 no. of each type & rating)
7.12	Auxiliary contact	1	Lot (10% of total quantity used or 2 nos. whichever is more for each type and rating of each size)
7.13	Seal kit	1	Lot (1 set of each type & size)
8	Pressure Gauge, Pressure Switch, Temperature Gauge, Temperature Switch, Isolating Valve, Solenoid Valve, Rota Meter etc.	1	Lot (10% of total quantity of each item and type/rating used in the system or minimum 1 (one) no. whichever is higher.)
9	Annunciation System	1	
9.1	Each type of PCB	1	Lot (1 (one) No. each)
9.2	lamp Box with Facia & Lamps (LED type)	5	5 (five) Nos.
9.3	Hooter	1	1(one) No.
10	Auxiliary/Power Contact of, Push Button, Indicating Lamp, Fuse etc. for Chiller Unit	1	Lot (10% of total quantity of each type of items used in the system or minimum 2(two) nos. minimum 2(two) nos. whichever is more.)

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The vendor warrants:

1. That all spares supplied will be new and in accordance with the contract document and will be free from defects in design, material and workmanship and shall further guarantee as under:
2. In case of any failure in the original component/ equipment due to faulty designs, materials and workmanship, the corresponding spare parts if any, supplied will be replaced without any extra cost to the BHEL and customer unless a joint examination and analysis by BHEL and/ or customer of such spare parts prove that the defect found in the original part that failed can safely be assured not to be present in spare parts.
3. The long term availability of spares to the BHEL and the customer for the full life of the equipment covered under the contract and that before going out of production of spare parts of the equipment covered under the contract, vendor and his sub-vendors shall give the BHEL and the customer at least 24 (Twenty Four) months advance notice so that the latter may order his bulk requirements of spares, if he so desires. The same provision will also be applicable to the sub-vendors. Further, in case of discontinuance of manufacture of any spares by the vendors or his sub-vendors the vendors and his sub-vendors, will provide the BHEL and the customer, 2 (two) years in advance, with full manufacturing drawings, material specifications and technical information required by the BHEL and the customer for the purpose of manufacture of such items and also the right to manufacture such spares for their own requirements.
4. Further in case of discontinuance of supply of spares by the vendors or his sub-vendors, the vendor will provide the BHEL and the customer with full information for replacement of such spares with other equivalent makes, if so required by the BHEL and the customer.
5. Notwithstanding the above, the vendor shall be responsible for supply of spares for the lifetime of the package at reasonable prices. The prices of all future requirements of spares shall be derived from the corresponding ex-works price at which the orders for such spares have been placed by the BHEL and the customer as a part of the mandatory or long term or any other kind of spares. The base indices for calculating ex-works price shall be commissioning of last equipment under main contract.
 - i) In case of emergency requirements of spares, the vendor would make every effort to expedite the manufacture and delivery of such spares on the basis of mutually agreed time schedule.
 - ii) In case the vendor fails to supply the mandatory or long term or any other kind of spares on the terms stipulated above, the BHEL and the customer shall be entitled to purchase the same from the alternate sources at the risk and the cost of the vendor and recover from the vendor, the excess amount paid by the BHEL and the customer over the rates as per the contract. In the event of such risk purchase by the BHEL or the customer, the purchases will be as per the works and procurement policy of the BHEL and the customer prevalent at the time of such purchases and BHEL & the customer at his option may include a representative from the vendor in finalizing the purchases.
 - iii) It is expressly understood that the final settlement between the parties in terms of relevant clauses of the tender document shall not relieve the vendor of any of his obligations under the provision of long term availability of spares and such provisions shall continue to be enforced till the expiry of 30 (thirty) years period reckoned from the scheduled date of completion of trial operation of the last equipment unless otherwise discharged expressly in writing by the BHEL or the customer.

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ANNEXURE VI:

LIST OF ERECTION & COMMISSIONING SPARES

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LIST OF COMMISSIONING SPARES

SL. NO.	ITEM DESCRIPTION	Quantity per skid (No.)	Total Nos.
1.0	HYDRAZINE DOSING SYSTEM		
1.1	Oil Seals for drive end.	4	8
1.2	Gaskets for drive end	4	8
1.3	Guide ring for plunger.	4	8
1.4	Teflon rings for valve/s.	8	16
1.5	Level gauge glass	2	4
1.6	Back up fuse	3	6
1.7	Pilot lamp	2	4
1.8	Push Button	2	4
1.9	Control fuse	2	4
1.10	Bulb for Annunciation	4	8
2.0	AMMONIA DOSING SYSTEM		
2.1	Oil Seals for drive end.	4	8
2.2	Gaskets for drive end	4	8
2.3	Guide ring for plunger.	4	8
2.4	Teflon rings for valves.	8	16
2.5	Level gauge glass	2	4
2.6	Back up fuse	3	6
2.7	Pilot lamp	2	4
2.8	Push Button	2	4
2.9	Control fuse	2	4
2.10	Bulb for Annunciation	4	8
3.0	NaOH DOSING SYSTEM		
3.1	Oil Seals for drive end.	4	8
3.2	Gaskets for drive end	4	8
3.3	Guide ring for plunger.	4	8
3.4	Teflon rings for valve/s.	8	16
3.5	Level gauge glass	2	4
3.6	Back up fuse	3	6
3.7	Pilot lamp	2	4
3.8	Push Button	2	4
3.9	Control fuse	2	4
3.10	Bulb for Annunciation	4	8

Notes: -

- Any other commissioning spare/ special tools and tackles required for the commissioning of the bidder's chemical dosing skids shall be in bidder's scope and same shall be supplied by bidder as part of his base offer and the same shall be mentioned specifically by the bidder in the un-priced schedule.
- All the commissioning spares provided shall be strictly of the same make and specification of the items it shall replace and shall be perfectly interchangeable.
- All the commissioning spares shall be separately packed and properly marked for easy identification at site.

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ANNEXURE VII

DRAWING / DOCUMENTS SUBMISSION SCHEDULE

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DRAWING/ DOCUMENTS SUBMISSION SCHEDULE

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

Bidder to further note that drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. Engineering meeting shall be held fortnightly, for which the bidder shall depute his concerned engineer along with project manager to BHEL PEM office or at customer office. The meeting can also be held at site.

List and schedule of drawings/documents to be submitted after award of contract:

S. No.	Drawing/ document No.	Drawing/ document Title	No. of weeks for drawing/ document submission after placing LOI/ PO
1.	PE-V0-415-154-A001	P&I DIAGRAM FOR CHEMICAL DOSING SYSTEM	2
2.	PE-V0-415-154-A002	TECHNICAL DATA SHEET-CHEMICAL DOSING SYSTEM	4
3.	PE-V0-415-154-A003	GA DRAWING & FOUNDATION DETAILS	2
4.	PE-V0-415-154-A004	LOCAL CONTROL PANEL (INCLUDING WIRING DIAGRAM, LOGIC DIAGRAM AND FIELD TERMINATION DETAILS) - CDS	4
5.	PE-V0-415-154-A005	QAP FOR CHEMICAL DOSING SYSTEM	2
6.	PE-V0-415-154-A006	O&M MANUAL FOR CHEMICAL DOSING SYSTEM	16

NOTES:

- Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
- In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion. However, in case changes are necessitated due to any constraints at customer end, delay in review/ approval of such revised drawing beyond one month will be to customer's account.
- 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

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- b) Internet speed – 2 mbps (Minimum preferred)
- c) Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- d) Vendor's internal proxy setting should not block DMS application's link
(<http://124.124.36.198/wrenchwebaccess/login.aspx>)
- e) 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.
- f) For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>

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ANNEXURE VIII:

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

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**ANNEXURE-VIII
FORMAT FOR OPERATION AND MAINTENANCE MANUAL**

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

Check List for Operation & Maintenance Manual

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

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

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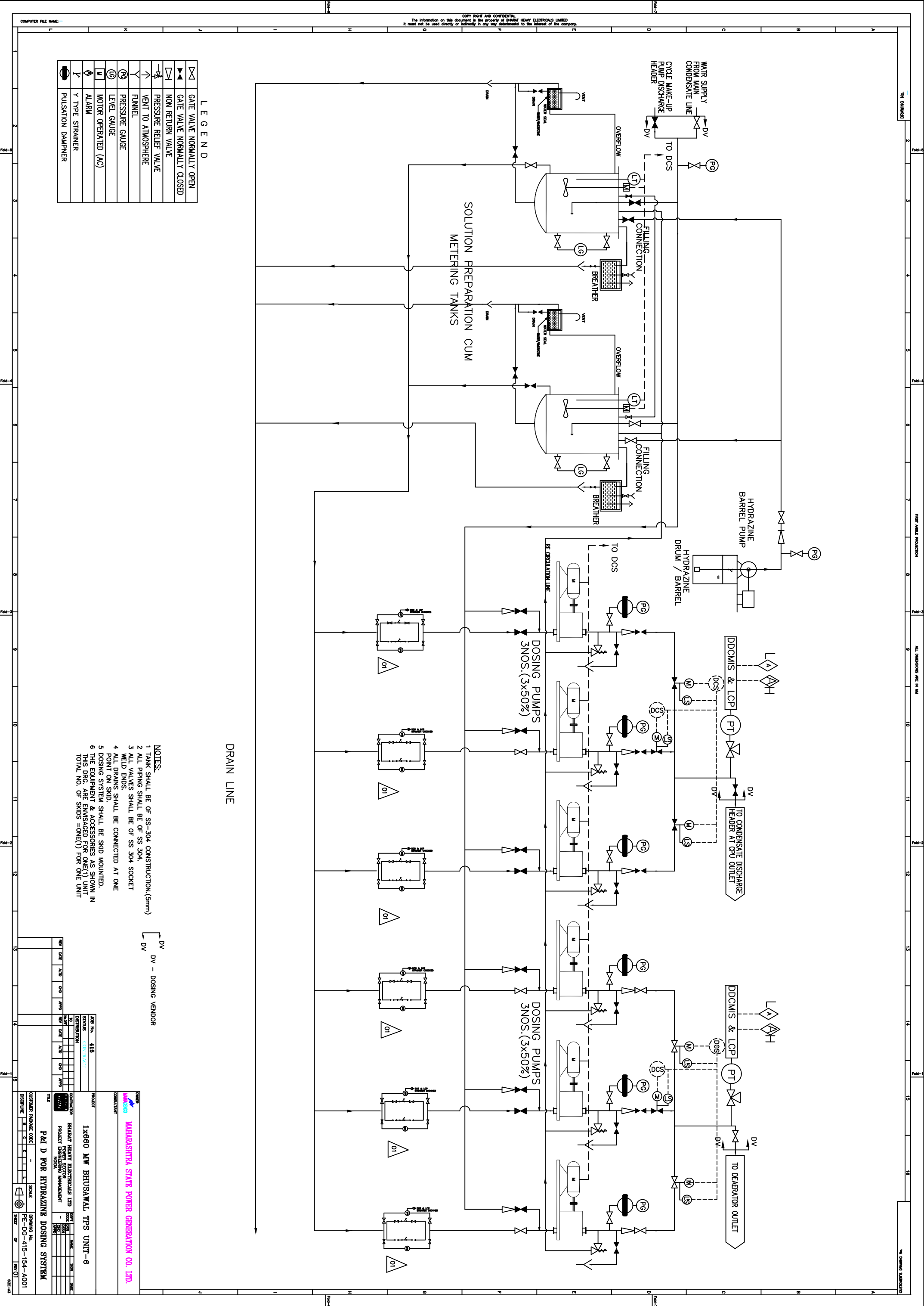
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/ user/ operator				
5.1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5.2	Start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

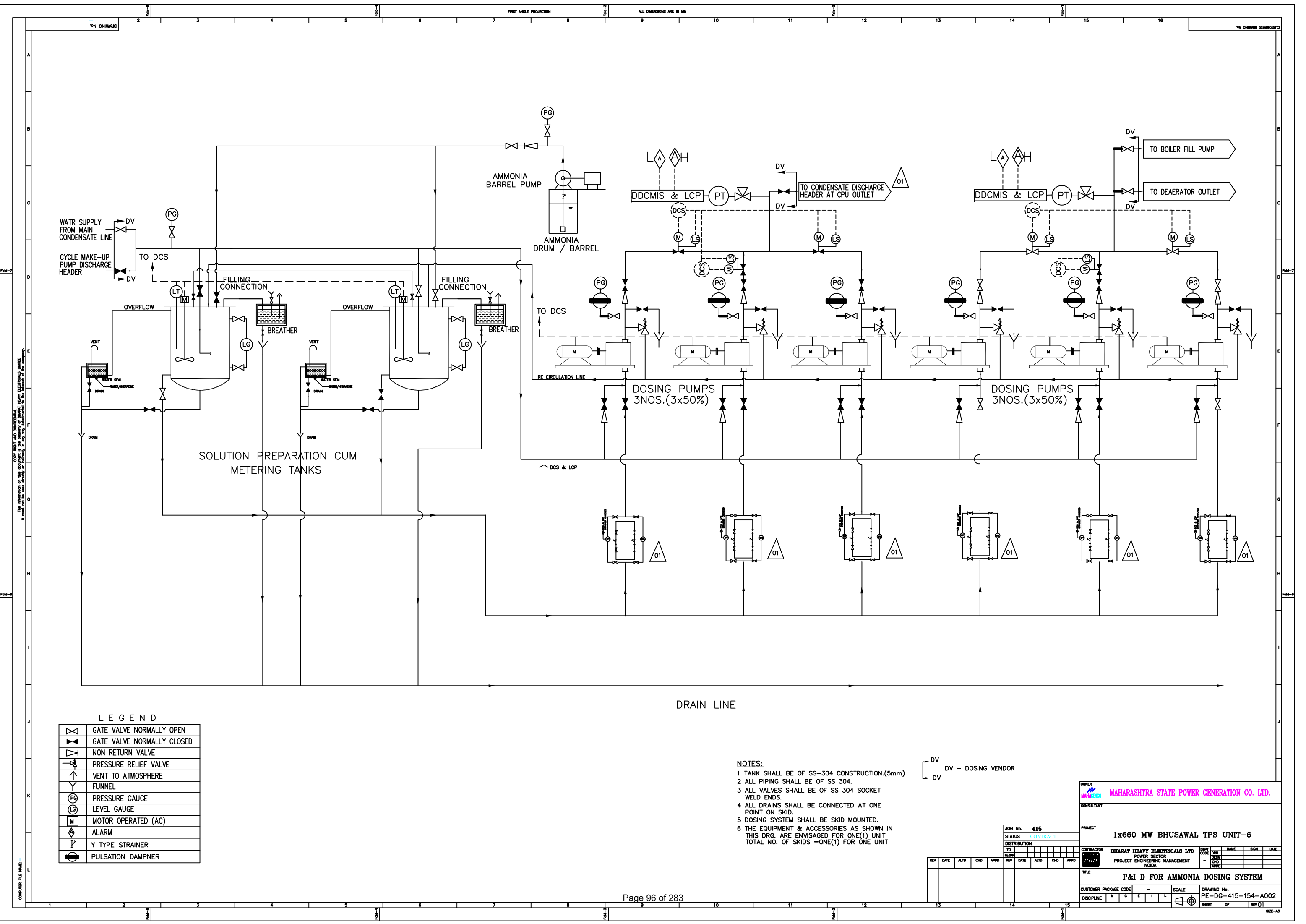
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	Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	Statutory and other specific requirements considerations.				
8.0	List of reference documents				
9.0	Binding as per requirement				

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P&IDs FOR CHEMICAL DOSING SYSTEM





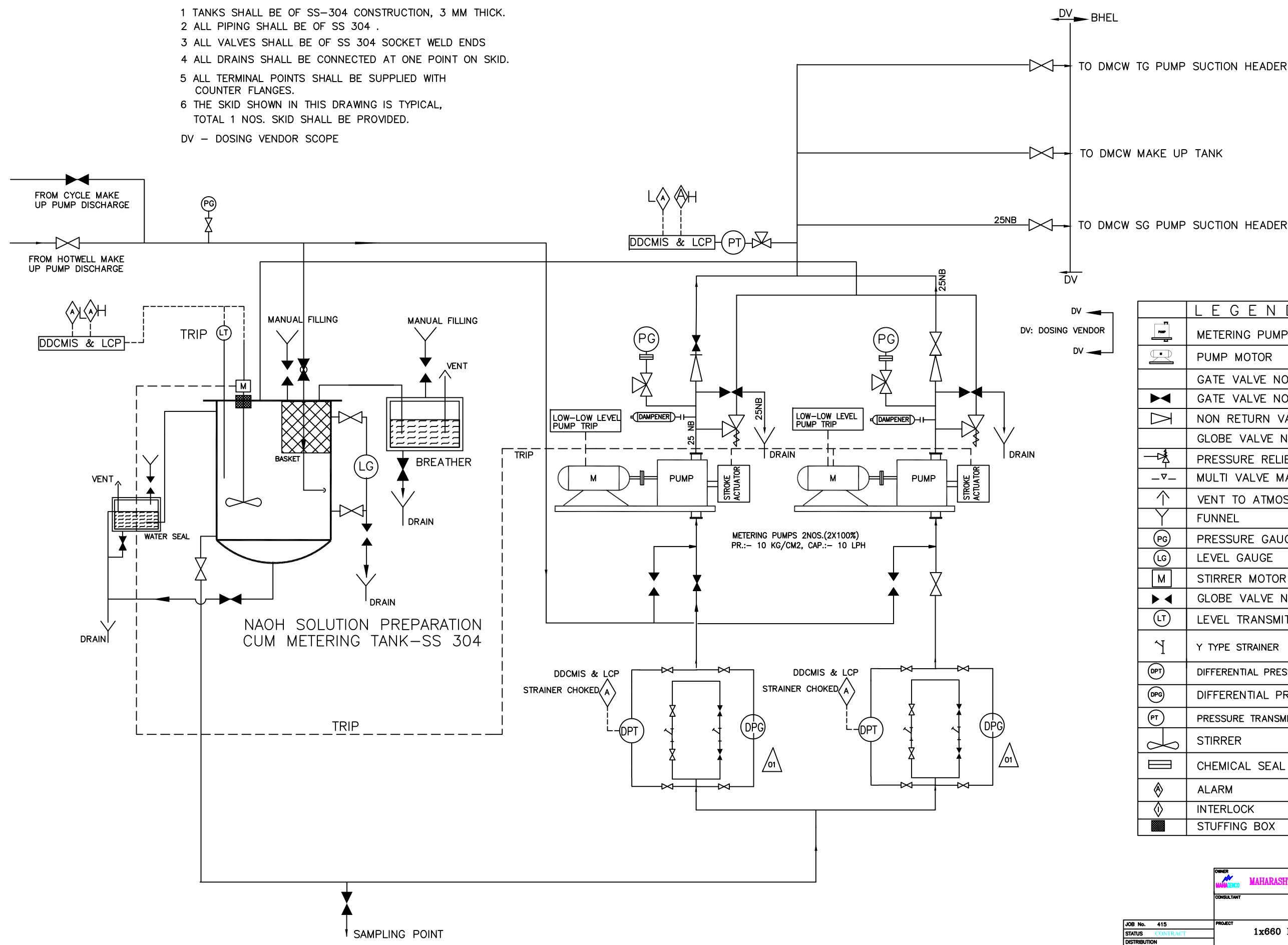
LEGEND	
	GATE VALVE NORMALLY OPEN
	GATE VALVE NORMALLY CLOSED
	NON RETURN VALVE
	PRESSURE RELIEF VALVE
	VENT TO ATMOSPHERE
	FUNNEL
	PRESSURE GAUGE
	LEVEL GAUGE
	MOTOR OPERATED (AC)
	ALARM
	Y TYPE STRAINER
	PULSATION DAMPNER

NOTES:
1 TANK SHALL BE OF SS-304 CONSTRUCTION.(5mm)
2 ALL PIPING SHALL BE OF SS 304.
3 ALL VALVES SHALL BE OF SS 304 SOCKET WELD ENDS.
4 ALL DRAINS SHALL BE CONNECTED AT ONE POINT ON SKID.
5 DOSING SYSTEM SHALL BE SKID MOUNTED.
6 THE EQUIPMENT & ACCESSORIES AS SHOWN IN THIS DRG. ARE ENVISAGED FOR ONE(1) UNIT
TOTAL NO. OF SKIDS =ONE(1) FOR ONE UNIT

DV - DOSING VENDOR

JOB No. 415		PROJECT 1x660 MW BHUSAWAL TPS UNIT-6	
STATUS CONTRACT		CONTRACTOR BHARAT HEAVY ELECTRICALS LTD	
DISTRIBUTION		DEPT POWER SECTOR	
TO		PROJECT ENGINEERING MANAGEMENT	
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- NOTES: -
- 1 TANKS SHALL BE OF SS-304 CONSTRUCTION, 3 MM THICK.
 - 2 ALL PIPING SHALL BE OF SS 304 .
 - 3 ALL VALVES SHALL BE OF SS 304 SOCKET WELD ENDS
 - 4 ALL DRAINS SHALL BE CONNECTED AT ONE POINT ON SKID.
 - 5 ALL TERMINAL POINTS SHALL BE SUPPLIED WITH COUNTER FLANGES.
 - 6 THE SKID SHOWN IN THIS DRAWING IS TYPICAL, TOTAL 1 NOS. SKID SHALL BE PROVIDED.
- DV - DOSING VENDOR SCOPE



LEGEND	
	METERING PUMP
	PUMP MOTOR
	GATE VALVE NORMALLY OPEN
	GATE VALVE NORMALLY CLOSED
	NON RETURN VALVE
	GLOBE VALVE NORMALLY OPEN
	PRESSURE RELIEF VALVE
	MULTI VALVE MANIFOLD
	VENT TO ATMOSPHERE
	FUNNEL
	PRESSURE GAUGE
	LEVEL GAUGE
	STIRRER MOTOR
	GLOBE VALVE NORMALLY CLOSED
	LEVEL TRANSMITTER
	Y TYPE STRAINER
	DIFFERENTIAL PRESSURE TRANSMITTER
	DIFFERENTIAL PRESSURE GAUGE
	PRESSURE TRANSMITTER
	STIRRER
	CHEMICAL SEAL DIAPHRAGM
	ALARM
	INTERLOCK
	STUFFING BOX

OWNER

MAHARASHTRA STATE POWER GENERATION CO. LTD.

CONSULTANT

JOB No. 415

STATUS CONTRACT

PROJECT

1x660 MW BHUSAWAL TPS UNIT-6

CONTRACTOR

BHARAT HEAVY ELECTRICALS LTD

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

DISCIPLINE

M C E I L

DEPT

CODE

FORM

NAME

SIGN

DATE

DESIGN

APPROVAL

DATE

TITLE

P&I D FOR NaOH DOSING SYSTEM

CUSTOMER PACKAGE CODE

SCALE

DRAWING No.

PE-DG-415-154-A003

DISCIPLINE

SHEET 1 OF 1

REV 01

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	TITLE:	SPECIFICATION NO. PE-TS-415-154-A001
	1X660 MW BHUSAWAL TPS	SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION - I A
		REV.NO. 00 DATE: 27.05.2019

DATASHEET - A

	TITLE:	SPECIFICATION NO. PE-TS-415-154-A001
	1X660 MW BHUSAWAL TPS	SECTION I
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION - I A
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DATASHEET – A

S. NO	DESCRIPTION	HYDRAZINE DOSING	AMMONIA DOSING	NaOH DOSING
1.0	Total skid(s) for station	One (1)	One (1)	One (1)
2.0	Solution Preparation cum Metering Tank			
2.1	No. of tanks per Skid	Two	Two	One
2.2	Capacity in litres	1500	1500	1200
2.3	Type	Vertical cylindrical, Bottom Dished end.	Vertical cylindrical, Bottom Dished end.	Vertical cylindrical, Bottom Dished end.
2.4	Material of the tank	SS-304	SS-304	SS-304
2.5	Thickness	3 mm	3 mm	3 mm
2.6	Motorised Stirrer	Propeller type with slow speed reduction gear unit		
2.7	Dissolving basket	NA	NA	Provided(50Mesh BS)
2.8	MOC -Dissolving basket	NA	NA	SS 316
2.9	MOC of stirrer	SS 316	SS 316	SS 316
3.0	Pump:			
3.1	Metering Pumps			
3.1.1	Medium to be handled	Hydrazine solution	Ammonia solution	NaOH solution
3.1.2	Type of pump	-----Positive displacement (Plunger type) metering pump-----		
3.1.3	Make of pump	As per approved sub vendor list during detailed engineering		
3.1.4	Nos. of pump-motor assembly	Six (3×50% + 3×50%)	Six (3×50% + 3×50%)	Two (2×100%)
3.1.5	Capacity	0-50 LPH	0-100 LPH	0-10 LPH
3.1.6	Discharge pressure	45 Kg/Cm ² (g)	45 Kg/Cm ² (g)	10 Kg/Cm ² (g)
3.1.7	All Wetted parts of pumps	SS-316	SS-316	SS-316
3.1.8	Applicable standard	API 675	API 675	API 675
3.1.9	Type of stroke control	Local manual & automatic		
3.1.10	Connection at suction, Position	1” ANSI B16.5 #150, bottom		
3.1.11	Connection at discharge, Position	1” ANSI B16.5 #300, top		
3.2	Dispensing Pumps			
3.2.1	Medium to be handled	Hydrazine solution	Ammonia solution	NaOH solution
3.2.2	Type of pump	Positive displacement metering pump		NA
3.2.3	Make of pump	As per approved sub vendor list during detailed engineering		NA
3.2.4	Nos. of pump-motor assembly	One (1x100%)	One (1x100%)	NA
3.2.5	Capacity	0-10 LPH	0-10 LPH	NA
3.2.6	Discharge pressure	10 Kg/Cm ² (g)	10 Kg/Cm ² (g)	NA
4.0	Strainers:			

	TITLE: 1X660 MW BHUSAWAL TPS	SPECIFICATION NO. PE-TS-415-154-A001
		SECTION I
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4.1	No. of strainers	12	12	04
4.2	Type	Y type	Y type	Y type
4.3	Material of screen	SS-304	SS-304	SS-304
4.4	Mesh Size	50 (BS)	50 (BS)	50 (BS)
5.0	Main, Drain & Overflow Piping:			
5.1	Material	ASTM A 312 GR TP 304 SCH 40	ASTM A 312 GR TP 304 SCH 40	ASTM A 312 GR TP 304 SCH 40
5.2	Diameter	25 NB	25 NB	25 NB
6.0	Sampling & Vent Pipe:			
6.1	Material	ASTM A 312 GR TP 304 SCH 40	ASTM A 312 GR TP 304 SCH 40	ASTM A 312 GR TP 304 SCH 40
6.2	Diameter	15 NB	15 NB	15 NB
7.0	Main Drain Header:			
7.1	Material	ASTM A 312 GR TP 304 SCH 40	ASTM A 312 GR TP 304 SCH 40	ASTM A 312 GR TP 304 SCH 40
7.2	Diameter	40 NB	40 NB	40 NB
8.0	Valves:			
8.1.00	Gate & Globe valves	The following parameters are applicable for all three systems.		
8.1.01	Body, Bonnet, Stem	ASTM A182 Gr. TP 304. Material for Stem shall be SS 316.		
8.1.02	Design standard	ANSI B 16.34/API 602 for gate valves, BS 5352 for globe valve		
8.1.03	Test standard	API 598		
8.1.04	Size	As per P&ID		
8.1.05	End Connections	SW ANSI B 16.11		
8.1.06	Rating	-----Class ASA 800-----		
8.1.07	Valve operation	Manual		
8.2.00	Check valves/ NRV			
8.2.01	Body, cover, disc/piston	ASTM A182 Gr. TP 304	ASTM A182 Gr. TP 304	ASTM A182 Gr. TP 304
8.2.02	Design standard	ANSI B 16.34/API 602	ANSI B 16.34/API 602	ANSI B 16.34/API 602
8.2.03	Test standard	API 598/MSS-SP-61	API 598/ MSS-SP-61	API 598/ MSS-SP-61
8.2.04	Size	25 NB	25 NB	25 NB
8.2.05	End Connections	SW ANSI B 16.11	SW ANSI B 16.11	SW ANSI B 16.11
8.2.06	Rating	-----Class ASA 800-----		
8.2.07	Valve operation	Manual	Manual	Manual
8.3.00	Pressure relief valve (PRV)			
8.3.01	Body, bonnet, disc, nozzle	ASTM A182 Gr. TP 316	ASTM A182 Gr. TP 316	ASTM A182 Gr. TP 316
8.3.02	Valve discharges to	Mixing/storage Tank	Mixing/storage Tank	Mixing/storage Tank
8.3.03	Back pressure	Constant	Constant	Constant
8.3.04	Set pressure	50 Kg/Cm ²	50 Kg/Cm ²	12 Kg/Cm ²
8.3.05	Inlet Connections	25 NB, Flanged, ANSI B16.5, 300#	25 NB, Flanged, ANSI B16.5, 300#	25 NB, Flanged, ANSI B16.5, 300#
8.3.06	Outlet Connections	25 NB, Flanged, ANSI B16.5, 150#	25 NB, Flanged, ANSI B16.5, 150#	25 NB, Flanged, ANSI B16.5, 150#

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9.0	Fittings	Forged steel to A182 F304, Dimension to ANSI B 16.11 socket weld ends.		
10.0	Flanges (pump suction / pump discharge)	-----ANSI B 16.5 CL 150 / ANSI B 16.5 CL 300 -----		
11.0	Structural steel	IS 2062	IS 2062	IS 2062
12.0	Hand pump	One (1) no., Wetted Part MOC: SS-304	One (1) no., Wetted Part MOC: SS-304	NA
13.0	Step ladder with platform	IS 2062	IS 2062	IS 2062
14.0	Nut & Bolt	ASTM A-193 Gr B7 and ASTM A-194 Gr. 2H respectively.	ASTM A-193 Gr B7 and ASTM A-194 Gr. 2H respectively.	ASTM A-193 Gr B7 and ASTM A-194 Gr. 2H respectively.



TITLE:

1X660 MW BHUSAVAL TPS

**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM**

SPECIFICATION NO. PE-TS-415-154-A001

SECTION I

SUB-SECTION - IB

REV.NO. 00 DATE : 27.05.2019

SECTION I-B: SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)



**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM
(ELECTRICAL PORTION)**

SPECIFICATION NO.
SECTION-C
REV 00 DATE 25.02.19
PAGE 1 OF 1

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER/ PURCHASER

- 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.
- 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.
- k) Technical requirements shall be as per specifications listed in Clause 4.1, 4.2, 4.3, 4.4 & 4.5 below.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

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

- a) A copy of this sheet "Electrical Equipment Specification for DOSING SYSTEM and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
- b) Electrical load requirement in the load data format.

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

4.0 LIST OF ENCLOSURES

- 4.1 Electrical scope between BHEL & vendor (Annexure-A).
- 4.2 Technical specification for Motors DG/BSL U-6/2011/T-1
- 4.3 Data Sheet- A along with Annexure-I.
- 4.4 Conduits and pipes specification & Constructional details of cables.
- 4.5 Quality Plan
- 4.6 Load data format (Annexure-B).

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

PACKAGE : CHEMICAL DOSING SYSTEM

SCOPE OF VENDOR: SUPPLY

PROJECT : 1 X 660 MW BHUSAWAL TPP

ANNEXURE-A

<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 AC (3 phase 4 wire) 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	Any special type of cable like compensating, co-axial, prefab, MICC & fibre optical	Vendor	Vendor*	Within the skid
7	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.
8	Motors with base frame and fixing hardware for motors.	Vendor	Vendor*	Makes shall be subject to customer/ BHEL approval at contract stage.

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR FOR SKID MOUNTED SYSTEM (FOR EPC PROJECTS)**PACKAGE : CHEMICAL DOSING SYSTEM****SCOPE OF VENDOR: SUPPLY****PROJECT : 1 X 660 MW BHUSAVAL TPP****ANNEXURE-A**

9	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.
10	Below grade grounding	BHEL	BHEL	
11	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.
12	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.

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1.0 SCOPE

- 1.1 This section covers the general requirements of the drive motors for power station auxiliary equipment.
- 1.2 Motors shall be furnished in accordance with both this general specification and the accompanying driven equipment specification.
- 1.3 In case of any discrepancy, the driven equipment specification shall govern etc.

2.0 STANDARDS

- 2.1 All motors shall conform to the latest applicable IS, IEC and CBIP Standards/ Publications except when otherwise stated herein or in the driven equipment specification.
- 2.2 Major standards, which shall be followed, are listed below other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed
 - (a) IS-325
 - (b) IS-12615
 - (c) IEC-34

3.0 SERVICE CONDITIONS

- 3.1 The motors will be installed in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash canopy to be provided to all outdoor install motors.
- 3.2 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the annexure to this specification.

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3.3	For motor installed outdoor and exposed to direct sunrays, the effect of solar heat shall be considered in the determination of the design ambient temperature	
4.0	<u>TYPE AND RATING</u>	
4.1	<u>A.C. MOTORS</u>	
4.1.1	Motors shall be general purpose, constant speed, squirrel cage, three phase, induction type.	
4.1.2	All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity.	
4.1.3	The motor name-plate rating at 50°C shall have at least 10% margin over the input power requirement of the driven HT equipment at rated duty point unless stated otherwise in driven equipment specification or in general electrical specification.	
4.1.4	The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service.	
4.1.5	All LT motors used in this project are proposed to be energy efficient type suitable for EFF1 efficiency rating.	
4.1.6	The motor name plate rating shall have at least 10% margin over the input power requirement of the HT driven equipment and 15% for LT driven equipments at rated duty point.	
4.1.7	Motors located in hazardous area shall be flame proof type.	
4.2	<u>D.C. MOTORS</u>	
4.2.1	D.C. Motor provided for emergency service shall be shunt/compound wound type.	
4.2.2	Motor shall be sized for operation with fixed resistance starter for maximum reliability.	

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4.2.3 Starter panel complete with all accessories shall be included in the scope of supply. 4.3 For equipment installed outdoor and exposed to direct sun rays, the effect of solar heat shall be considered in determining the design ambient temperature. 5.0 <u>PERFORMANCE</u> 5.1 <u>RUNNING REQUIREMENTS</u> 5.1.1 Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given in the annexure. 5.1.2 The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals. 5.1.3 The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage. 5.1.4 Motor shall not be stalled if the supply voltage drops to 70% of the rated voltage for 2 seconds duration. 5.2 <u>STARTING REQUIREMENTS</u> Motor shall be designed for direct online starting at full voltage. Starting current shall not exceed 6 times full load current for all auxiliaries except boiler feed pump where the starting current shall be limited to 4.5 times. No further tolerances are applicable on starting current specified above for HT motors 5.2.1 The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage 5.2.2 Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminal except BFP motor. In case of BFP motor, it shall		

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be 75% rated voltage. Minimum starting requirement for mill motor (double cage) shall be 85% rated voltage at motor terminals. 5.2.3 Motor shall be capable of three equally spread starts per hour, two starts in quick succession from cold condition and one restart from hot condition. Cranking motor shall be capable of six equally spread starts per hour, three starts in quick succession from cold condition and one restart from hot condition. The coal conveyor and crusher motors shall be suitable for 3 consecutive hot starts with maximum 20 starts per day. Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction. 5.2.4 HT pump motors shall be suitable to start with forward rotation. 5.2.5 The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage 5.3 <u>STRESS DURING BUS TRANSFER.</u> 5.3.1 The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage. 5.3.2 The motor shall be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics. 5.4 <u>LOCKED ROTOR WITHSTAND TIME</u> 5.4.1 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time.		

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5.4.2	Starting time mentioned above is at minimum permissible voltage of 80% rated voltage.	
5.4.3	Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilizing motor rated capacity	
6.0	<u>SPECIFIC REQUIREMENTS</u>	
6.1	<u>ENCLOSURE</u>	
6.1.1	All indoor motor enclosures shall conform to the degree of protection IP-55 unless otherwise specified and outdoor motor enclosure shall confirm to degree of IPW-55. Motor for outdoor or semi-outdoor service shall be of weather-proof construction.	
6.1.2	For hazardous area approved type of increased safety enclosure shall be furnished.	
6.2	<u>COOLING</u>	
6.2.1	The motor shall be self ventilated type, either totally enclosed fan cooled (TEFC) or closed air circuit air- cooled (CACA).	
6.2.2	In case water cooling is required for very large motors, prior approval of the customer is to be obtained before proceeding ahead with design & manufacture.	
6.3	<u>WINDING AND INSULATION</u>	
6.3.1	All insulated winding shall be of copper.	
6.3.2	All motors shall have class F insulation but limited to class B temperature rise.	
6.3.3	Windings shall be impregnated to make them non-hygroscopic and oil resistant.	

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6.4 TROPICAL PROTECTION

6.4.1 All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion.

6.4.2 All fittings and hardware shall be corrosion resistant.

6.5 BEARINGS

6.5.1 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application.

6.5.2 Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred.

6.5.3 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.

6.5.4 Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves.

6.5.5 Grease lubricated bearings shall be prelubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication.

6.5.6 Oiled bearing shall have an integral self cooled oil reservoir with oil ring inspection ports, oil sight glass with oil level marked for standstill and running conditions and oil fill and drain plugs.

6.5.7 Forced lubricated or water cooled bearing shall not be used without prior approval of Owner.

6.5.8 Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent.

6.5.9 Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.

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6.6 6.6.1 6.6.2 6.7 6.7.1 6.7.2 6.7.3 6.7.4 6.7.5 6.7.6 6.7.7 6.7.8 6.7.9 6.7.10	<u>NOISE & VIBRATION</u> The noise level shall be as per statutory acceptance (IS/IEC). The peak amplitude of the vibration shall be within IS/IEC specified limits. <u>MOTOR TERMINAL BOX</u> Motor terminal box shall be phase segregated (PSTB) type and located in accordance with Indian Standards clearing the motor base- plate/ foundation. Terminal box shall be capable of being turned 360 Deg. in steps of 180 Deg. For HT motors and 90 Deg. for LT motors unless otherwise approved. The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor. The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables. Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame. The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor. The terminal box shall be capable of withstanding maximum system fault current for duration of 0.25 sec. For 11kV and 3.3kV motor, the terminal box shall be phase-segregated type. The neutral leads shall be brought out in a separate terminal box (not necessarily phase segregated type) with shorting links for star connection. Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used. The gland plate for single core cable shall be non-magnetic type.	

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6.7.11 Due to any reason, if the terminal box is found to be not suitable for the approved cable size for either HT/LT motors, then the bidder shall arrange necessary adopter box to facilitate the termination of cables. The adopter box shall be of the same short circuit rating and specifications as the main terminal box. The adopter box shall be located as near as possible to the main terminal box. The interconnecting cabling between adopter box and main terminal box along with providing suitable cable glands and termination kits as applicable shall also be done by the bidder. 6.8 <u>GROUNDING</u> 6.8.1 The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GS bolts and washer 6.8.2 The grounding connection shall be suitable for accommodation of ground conductors as follows : <table> <tr> <td>Motor above 90 kW</td> <td>:</td> <td>75 x 10 mm GS Flat</td> </tr> <tr> <td>Motor above 30 kW up to 90 kW</td> <td>:</td> <td>50 x 6 mm GS Flat</td> </tr> <tr> <td>Motor above 5 kW up to 30 kW</td> <td>:</td> <td>25 x 6 mm GS Flat</td> </tr> <tr> <td>Motor up to 5 kW</td> <td>:</td> <td>8 SWG GS Wire</td> </tr> </table> 6.8.3 The cable terminal box shall have a separate grounding pad 6.9 <u>RATING PLATE</u> In addition to the minimum information required by IS, the following information shall be shown on motor rating plate: (a) Temperature rise in Deg.C under rated condition and method of measurement. (b) Degree of protection.			Motor above 90 kW	:	75 x 10 mm GS Flat	Motor above 30 kW up to 90 kW	:	50 x 6 mm GS Flat	Motor above 5 kW up to 30 kW	:	25 x 6 mm GS Flat	Motor up to 5 kW	:	8 SWG GS Wire
Motor above 90 kW	:	75 x 10 mm GS Flat												
Motor above 30 kW up to 90 kW	:	50 x 6 mm GS Flat												
Motor above 5 kW up to 30 kW	:	25 x 6 mm GS Flat												
Motor up to 5 kW	:	8 SWG GS Wire												

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(c) Bearing identification no. and recommended lubricant. (d) Location of insulated bearings. 6.10 <u>CONSTRUCTION</u> 6.10.1 Stator Core The Stator Core Lamination shall be made of high-grade silicon/magnetic steel sheet varnished on both sides and pressed to form rigid core. 6.10.2 Rotor The rotor construction shall be such that in case of dislodging of the rotor bar from the end ring, it should not come out and hit the stator core/stator winding and damage. 7.0 <u>ACCESSORIES</u> 7.1 <u>GENERAL</u> Accessories shall be furnished, as listed below, or if otherwise required by driven equipment specification or application 7.2 <u>SPACE HEATER</u> 7.2.1 Motor of rating 30 kW and above shall be provided with space heaters, suitably located for easy removal or replacement. 7.2.2 The space heater shall be rated 240 V, 1 phase 50 Hz and sized to maintain the motor internal temperature above dew point when the motor is idle. 7.3 <u>TEMPERATURE DETECTORS</u> 7.3.1 All 11kV and 3.3kV motors shall be provided with twelve (12) nos. Simplex type winding temperature detectors, four (4) nos. per phase.		

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7.3.2	11kV and 3.3kV motor bearing shall be provided with duplex type temperature detectors.	
7.3.3	The temperature detector mentioned above shall be resistance type, 3 wire, platinum wound, 100 Ohms at 0°C.	
7.3.4	Leads of all simplex type motor winding RTDS and motor bearing RTDS shall be wired up to respective switchgear metering & protection compartment. From which one set of RTDS will be connected to numerical protection relay and another set shall be kept free for DCS connectivity.	
7.3.5	Five numbers of Temperature detectors / thermistors shall be provided for L.T. Motors above 90 kW (3 nos. Winding temperatures & 2 nos. bearing temperatures).	
7.4	<u>INDICATOR/SWITCH</u>	
7.4.1	Dial type local indicator with alarm contacts shall be provided for the following :	
	(a) 11kV and 3.3kV motor bearing temperature	
	(b) Hot and cold air temperature of the closed air circuit for CACA and CACW motor	
7.4.2	Flow switches shall be provided for monitoring cooling water flow of CACW motor and oil flow of forced lubrication bearing, if used.	
7.4.3	Alarm switch contact rating shall be minimum 0.5 A at 220V D.C. and 5A at 240V A.C.	
7.5	<u>CURRENT TRANSFORMER FOR DIFFERENTIAL PROTECTION</u>	
7.5.1	Motor 1000 KW and above shall be provided with three differential current transformers mounted over the neutral leads within the enclosure. Loose 3 nos. CT for mounting on switchgear side shall be in bidder's scope.	

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7.5.2	The arrangement shall be such as to permit easy access for C.T. testing and replacement. Current transformer characteristics shall match Owner's requirements to be intimated later.	
7.6	<u>ACCESSORY TERMINAL BOX</u>	
7.6.1	All accessory equipment such as space heater, temperature detector, current transformers etc., shall be wired to and terminated in terminal boxes, separate from and independent of motor (power) terminal box.	
7.6.2	Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit cable connections.	
7.7	<u>DRAIN PLUG</u>	
	Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.	
7.8	<u>LIFTING PROVISIONS</u>	
	Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.	
7.9	<u>DOWEL PINS</u>	
	The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment.	
7.10	<u>PAINTING</u>	
	Motor including fan shall be painted with corrosion proof paints of colour shade (RAL-7032).	
8.0	<u>TESTS</u>	
8.1	<u>ROUTINE AND TYPE TEST:</u>	

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Tests are to be conducted for HT and LT motors 60kW and above in presence of Mahagenco representative and contractor as per IS: 325 and required copies of test certificates are to be furnished for approval and despatch clearance. In addition, following tests shall have to be carried out on the motors in presence of MAHAGENCO representative & contractor on LT & HT motors. For Motors below 60kW type and routine test conducted as per IS325 shall be witnessed by contractor and test certificate shall be submitted for review of Mahagenco & Dispatch clearance

8.1.1 FOR HT MOTORS:

(a) Impulse test by 1.2 / 50 micro sec. On sample coil of Stator winding insulation as type test as per IEC-671/IS 14422,1995 test voltages as under

Voltage rating of motor	Impulse Test Voltage
3.3 kV	: 18 kV peak
11 kV	: 49 kV peak

(b) Tan delta, charging current and dielectric loss measurements on each phase of motor stator winding as routine test

(c) Polarization Index Test as per IS:7816 as routine test

(d) Tan delta measurement on coils

(e) Surge withstand test for inter turn insulation.

(f) Test to diagnose rotor bar failure during manufacture.

Tests indicated at (d), (e), (f) shall be carried out during manufacture of the coils and shall be furnished for verification .

8.1.2 FOR HT & LT MOTORS:

(a) Test for suitability of IP55/ IPW– 55 as per IS 4691 as type test. Type test certificate for first numeral shall be acceptable in lieu to test,

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provided the test motor is identical to motor being supplied. Second numeral test shall be carried out on one motor of each type and rating. (b) Fault Withstand Test for main terminal box as type test. Type test certificate shall be acceptable, if the test is conducted on exactly identical terminal box within last three years. (c) Test for noise level as routine test. (d) Test for vibration as routine test. (e) Overspeed test as type test. 8.2 <u>TEST WITNESS:</u> Test shall be performed in presence of Owner/Purchaser's representative so desired by the Owner/Purchaser. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.		

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<u>AC & DC MOTOR</u>				
SR. NO.	ITEM	UNIT		
1.0	<u>AUXILIARY POWER SUPPLY</u>			
1.1	<u>H.T. SUPPLY</u>			
	11kV, 3Ø, 3W, 50 Hz non-effectively earthed		Motors rated 1000 kW and above	
	Fault level 44 kA symm			
	3.3kV, 3Ø, 3W, 50 Hz, non-effectively earthed		Motors above 160 kW and below 1000kW	
	Fault level 40 kA symm			
1.2	<u>L.T. SUPPLY</u>			
	415V, 3Ø, 3W, 50 Hz effectively earthed		Motors below and including 160kW	
	Fault level 50 kA symm			
	240V, 1Ø, 2W, 50 Hz effectively earthed		Lighting, space heating, A.C. control & protective devices	
1.3	<u>D.C. SUPPLY</u>			
	220V, 2W, unearthed		D.C. alarm, control & protective devices	
	Fault level 25* kA.			
	Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation			
2.0	<u>RANGE OF VARIATION</u>			

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SR. NO.	ITEM	UNIT	
2.1	<u>A.C. SUPPLY:</u>		
	Voltage		± 10%
	Frequency		± 5%
	Combined Voltage & frequency		± 10% (absolute sum)
	During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance		
2.2	<u>D.C. SUPPLY</u>		
	Voltage		198 to 240 Volt

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SECTION – 11
ELECTRIC MOTOR ACTUATORS

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1.0 <u>SCOPE</u> 1.1 This Section covers the general requirements of Electric Motor Actuators for valves, dampers and gates. 1.2 All electric motor actuators shall be furnished in accordance with this general specification and the accompanying driven equipment specification. 2.0 <u>STANDARDS</u> 2.1 All electrical equipment shall conform to the latest applicable IS, ANSI and NEMA Standards, except when stated otherwise herein or in driven equipment specification. 2.2 Major standards, which shall be followed, are listed below. Other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed: (a) IS-9334 (b) IS-325 3.0 <u>SERVICE CONDITIONS</u> 3.1 The actuator shall be suitable for operation in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash. 3.2 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the general specification. 4.0 <u>RATING</u> 4.1 For isolating service, the actuator shall be rated for three successive open-close operation of the valve/damper or 15 minutes, whichever is longer. 4.2 For regulating service, the actuator shall be suitably time-rated for the duty cycle involved with necessary number of starts per hour, but in no case less than 150 starts per hour.		

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5.0 PERFORMANCE

The actuator shall meet the following performance requirements:

- 5.1 Open and close the valve completely and make leak-tight valve closure without jamming.
- 5.2 Attain full speed operation before valve load is encountered and impart an unseating blow to start the valve in motion (hammer blow effect).
- 5.3 Operate the valve stem at standard stem speed and shall function against design differential pressure across the valve seat.
- 5.4 The motor reduction gearing shall be sufficient to lock the shaft when the motor is de-energised and prevent drift from torque switch spring pressure.
- 5.5 The entire mechanism shall withstand shock resulting from closing with improper setting of limit switches or from lodging of foreign matter under the valve seat.

6.0 SPECIFIC REQUIREMENT

6.1 CONSTRUCTION

- 6.1.1 The actuator shall essentially comprise the drive motor, torque/ limit switches, gear train, clutch, hand wheel, position indicator/ transmitter, in-built thermostat for over load protection, space heater and internal wiring. Actuator shall be integral type. Integral starter shall have facility to hook-up with Plant DCS for positioning of limit and torque switches.
- 6.1.2 The actuator enclosure shall be totally enclosed, dust tight, weather-proof suitable for outdoor use without necessity of any canopy.
- 6.1.3 All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.
- 6.1.4 The actuator shall be designed for mounting in any position without any lubricant leakage or operating difficulty.

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6.2 <u>MOTOR</u> 6.2.1 The drive motor shall be three phase, squirrel cage, induction machine with minimum class B insulation and IPW-55 enclosure, designed for high torque and reversing service. 6.2.2 The motor shall be designed for full voltage direct on-line start, with starting current limited to 6 times full-load current. 6.2.3 The motor shall be capable of starting at 85 percent of rated voltage and running at 80 percent of rated voltage at rated torque and 85 percent rated voltage at 33 percent excess rated torque for a period of 5 minutes each. 6.2.4 Earthing terminals shall be provided on either side of the motor. 6.3 <u>LIMIT SWITCHES</u> Each actuator shall be provided with following limit switches: 6.3.1 Two (2) torque limit switches, one for each direction of travel, self-locking, adjustable torque type. 6.3.2 Four (4) end-of-travel limit switches, two for each direction of travel. 6.3.3 Two (2) position limit switches, one for each direction of travel, each adjustable at any position from fully open to fully closed positions of the valve/damper. 6.3.4 Each limit switch shall have 2 NO + 2 NC potential free contacts. Contact rating shall be 5A at 240V A.C. or 0.5A at 220V D.C. 6.4 <u>HAND WHEEL</u> Each actuator shall be provided with a hand wheel for emergency manual operation. The hand wheel shall declutch automatically when the motor is energized.		

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6.5 <u>POSITION INDICATOR/TRANSMITTER</u> The actuator shall have: 6.5.1 One (1) built-in local position indicator for 0-100% travel 6.5.2 One (1) position transmitter, potentiometer type, for remote indicator. 6.6 <u>SPACE HEATER</u> A space heater shall be included in the limit switch compartment suitable for 240V, 1 phase, 50 Hz supply. 6.7 <u>WIRING</u> All electrical devices shall be wired up to and terminated in a terminal box. The internal wiring shall be of sufficient size for the power rating involved but in no case less than 1.5 Sq.mm copper. All wiring shall be identified at both ends with ferrules. 6.8 <u>TERMINAL BOX</u> The terminal box shall be weather proof, with removable front cover and cable glands for cable connection. The terminal shall be suitable for connection of 2.5 Sq.mm copper conductor. 7.0 <u>TEST</u> 7.1 The actuator and all components thereof shall be subject to tests as per relevant Standards. In addition, if any special test is called for in equipment specification, the same shall be performed. 7.2 <u>TEST WITNESS:</u> Test shall be performed in presence of Owner/Purchaser's representative so desired by the Owner/Purchaser. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.		

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**GENERAL TECHNICAL REQUIREMENTS
OF
CONDUITS AND PIPES
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1.0 GENERAL

- 1.1 This specification covers the manufacture, inspection & testing at vendor's works and delivery to site of conduits, pipes and their fittings for electrical installation.

2.0 CODES AND STANDARDS

- 2.1 The material, constructional features and various processes involved in manufacture shall comply with currently applicable Indian Standards.
- 2.2 The following Indian Standards shall be applicable, in general. However if Data Sheet A specifies conformance to other international standards, the equivalent IEC/BS/other standards shall be considered.

- a) IS:9537 (All Parts) Conduits for electrical installation.
- b) IS:3480 Flexible steel conduits for electrical wiring.
- c) IS:6946 Flexible non-metallic conduits for electrical installation.
- d) IS:1239 Mild steel tubes, tubulars and other wrought steel fittings.
(for size above 63mm dia of rigid conduits)
- e) IS:2667 Fittings for rigid steel conduits for electrical wiring.
- f) IS:3837 Accessories for rigid steel conduits for electrical wiring.
- g) IS:3419 Fittings for rigid non-metallic conduits.
- h) IS:6005 Code of practice for phosphating iron & steel.
- i) IS:2629 Recommended practice for hot dip galvanizing on iron and steel.
- j) IS:4759 Specification for hot dip zinc coatings on structural steel and allied products.
- k) IS:6745 Methods for determination of mass of zinc coating on zinc coated iron and steel articles.

3.0 DESIGN REQUIREMENTS AND CONSTRUCTIONAL FEATURES

The conduit and conduit accessories shall include conduit plugs & caps, gaskets and box cover etc in addition to any specific requirement given in Data Sheet A. The diameter of conduits and accessories shall be uniform throughout the length.

3.1 Rigid Conduits and Fittings

- 3.1.1 Rigid conduits shall generally conform to the requirements of IS:9537 (Part I & Part II). However conduits above 63mm diameter shall conform to the requirements of IS:1239. Unless specified otherwise in Data Sheet A, all conduits and pipes shall be of medium duty.



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- 3.1.2 The rigid conduits shall be hot dip galvanized inside and outside. Weight of zinc shall be as per IS:4759. Conduits shall be thoroughly cleaned and pretreated, conforming to IS:6005.
- 3.1.3 Conduits shall be supplied in approximate length as specified below
- a) Rigid Conduits 5 metres
 - b) Flexible Conduits 10 - 30 metres
- 3.1.4 Each end of conduit length shall be threaded. The ends of conduits shall be sealed with protective caps to prevent damage to threaded portions and entrance of moisture and foreign material.
- 3.1.5 The inside surface of all conduits shall be smooth and suitable for pulling insulated cables and wires without damage.
- 3.1.6 Conduit fittings shall be made out of tube or cast to the shape as to match with corresponding conduit sizes and meet their purpose without any special adjustment.
- 3.1.7 All fittings shall be screwed type and hot dip galvanized inside and outside.
- 3.2 Flexible Metallic Conduits and Fittings
- 3.2.1 Flexible metallic conduits shall generally conform to the requirements of IS:3480.
- 3.2.2 Flexible conduits shall be made of strip steel which shall be of cold rolled mild steel. The strip shall be of uniform width and thickness throughout.
- 3.2.3 The strip shall be electro galvanized to a minimum thickness of 25 microns as specified in IS:3480. The surface of the strip shall be thoroughly cleaned before application of protective coating. Pretreatment, before galvanization, shall conform to IS:6005.
- 3.2.4 The strip for making flexible conduit shall be wound tightly and so overlapped in subsequent helicals that no openings are seen in normal position.
- 3.2.5 Flexible conduits shall be lead coated for application in high temperature zones, if specifically mentioned in Data Sheet A.
- 3.2.6 The conduit shall have uniform diameter throughout its length. The internal surface of all conduits shall be smooth and suitable for pulling insulated cables and wires without damage.
- 3.3 PVC Conduits
- 3.3.1 PVC conduits shall generally conform to the requirements of IS:9537(Part I & Part III).
- 4.0 INSPECTION
- 4.1 The following stages of manufacture shall be stage inspected by Purchaser or his duly authorized representative.
- 4.1.1 Inspection of manufacturing processes such as shearing, punching, bending, welding, galvanizing etc.
 - 4.1.2 Inspection of packing material and procedure.



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4.1.3 Inspection of finished product.

4.2 The inspection will be carried out as per agreed quality plan.

5.0 TESTING

5.1 Rigid Conduits

- a) Acceptance Tests
 - as per IS:9537 Part 1 & 2 upto 63mm OD
 - as per IS:1239 above 63mm OD
- i) Dimension checks
- ii) Bending test (below 32mm OD)
- iii) Compression test
- b) Special Tests (as acceptance test) as applicable to galvanizing.

5.2 Flexible Steel Conduits

- a) Acceptance Tests
 - as per IS:3480
- i) Dimension checks
- ii) Linear breaking test
- iii) Test for flexibility
- iv) Bend fracture test
- v) crushing test
- b) Special Tests (as acceptance test) as applicable to galvanizing.

5.3 PVC Conduits

- a) Type Tests
 - as per IS : 9537 (Part 1 & 3)
- i) Dimension checks
- ii) Bending test
- iii) Compression test
- iv) Impact test
- v) Collapse test
- vi) Resistance test
- vii) Resistance to burning



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viii) Electrical Characteristics

b) Acceptance tests - as per IS:9537 (Part 1 & 3)

i) Dimension checks

ii) Bending test

iii) Compression test

iv) Collapse test

v) Resistance to burning

vi) Electrical characteristics

5.4 Sampling for the tests shall be done as per applicable standards mentioned above.

5.5 The testing shall be carried out as per agreed quality plan.

6.0 PACKING

6.1 The material shall be packed as per manufacturer's standard. Packing procedure shall be to the purchaser's approval.

7.0 DRAWING, DATA AND DOCUMENTS REQUIRED

7.1 The following information shall be furnished within two weeks of award of contract, for purchaser's approval.

a) Manufacturing drawings/details.

b) Recommended Field quality plan covering site handling, storing, laying etc.

c) Final quality plan.

7.3 The following information shall be furnished after testing and inspection

Type Test, routine test and special test certificates in bound volume in requisite number.



DOCUMENT TITLE

CONDUITS AND PIPES

SPECIFICATION NO. PES-507-27

VOLUME II B

SECTION D

REVISION 0

DATE: 27/10/2010

SHEET 6 OF 6

DATASHEET A

SPECIFIC TECHNICAL REQUIREMENTS

- 1.0 APPLICABLE STANDARDS: IS:9537,IS: 1239, IS:3480
- 2.0 RIGID STEEL CONDUITS & STEEL PIPES
 - a) Material: Cold rolled mild steel to IS:226
 - b) Applicable standard
 - i) Upto 63mm OD: IS:9537 Part I & II
 - ii) Above 63mm OD: IS:1239
 - c) Surface treatment: Hot dip galvanizing inside & outside as per IS:2629
 - d) Wt. of zinc: as per IS 4759
 - e) Duty: Medium
 - f) Fittings: Screw type as per IS:2667
- 3.0 FLEXIBLE CONDUITS:
 - a) Material: Strip steel cold rolled and annealed
 - b) Standard applicable: IS: 3480
 - c) Surface treatment: Electro galvanized as per IS: 3480
 - d) Whether lead coated: YES
 - e) Minimum thickness: 25 microns
of zinc coating
- 4.0 PVC CONDUITS
 - a) Material: PVC
 - b) Applicable standard: IS: 9537 (Part I & III)

	Design Calculations For LT Cable Selection & Sizing	
	1 x 660MW BHUSAWAL T.P.S UNIT-6	

CONSTRUCTIONAL DETAILS OF CABLES SELECTED

(A) LT POWER & CONTROL CABLES

S.NO.	PARTICULARS	DETAILS	
		LT POWER CABLES	LT CONTROL CABLES
1	REFERENCE STANDARD	IS: 7098 -PART -1	IS -1554 PART -1
2	SYSTEM	415 V AC , 240 V AC & 220V DC	220V DC & 110 V AC
3	VOLTAGE GRADE	1.1 KV	1.1 KV
4	CONDUCTOR		
4.1	MATERIAL	STRANDED COMPACTED PLAIN ALUMINIUM CONDUCTOR OF H2 GRADE CLASS 2 / STRANDED HIGH CONDUCTIVITY ANNEALED PLAIN COPPER.	STRANDED, NON COMPACTED, HIGH CONDUCTIVITY ANNEALED PLAIN COPPER
4.2	REFERENCE STANDARD	IS 8130	IS 8130
4.3	SHAPE	CIRCULAR/ SHAPED	CIRCULAR
4.4	MINIMUM SIZE	ALUMINIUM- 16 SQ.MM. COPPER- 2.5 SQ. MM.	2.5 SQ.MM.
4.5	MAXIMUM CONDUCTOR TEMPERATURE WHEN CARRYING CONTINUOUSLY CURRENT	90°C	70°C
4.6	MAXIMUM CONDUCTOR TEMPERATURE AT THE TERMINATION OF SHORT CIRCUIT CURRENT	250°C	160°C
5	NO. OF CORES	1C,2C,3C,3.5C,4C	AS PER CLAUSE 4.2.1
6	INSULATION	EXTRUDED XLPE	EXTRUDED HRPVC, TYPE-C
6.1	REFERENCE STANDARD	IS: 7098 -PART -1	IS -5831 & IS-1554 PART-I
7	CORE IDENTIFICATION	BY COLOR CODING AS PER IS: 7098 - PART -1	i) CONTROL CABLES UPTO 5 CORE- COLOR CODING AS PER IS 1554 (Part-1) (ii) CONTROL CABLES ABOVE 5 CORES- BY NUMBERING AS PER IS 1554 (Part-1). INSULATION TO HAVE BLACK COLOR.
8	INNER SHEATH	EXTRUDED HRPVC FRLS TYPE -ST2 FOR MULTI CORE CABLES. SINGLE CORE SHALL HAVE NO INNER SHEATH.	EXTRUDED HRPVC TYPE -ST2 FRLS FOR MULTI CORE CABLES. SINGLE CORE SHALL HAVE NO INNER SHEATH.
8.1	REFERENCE STANDARD	IS: 5831 & IS-7098 PART-I	IS: 5831 & IS-1554 PART I
9	ARMOUR	NON-MAGNETIC HARD DRAWN ALUMINIUM ROUND WIRE ARMOUR OF H4 GRADE FOR SINGLE CORE CABLES AND GS ROUND STEEL WIRE ARMOUR FOR MULTI- CORE CABLES	GS ROUND STEEL WIRE ARMOUR FOR TWIN & MULTICORE CABLES
9.1	REFERENCE STANDARD	IS:3975 & IS 7098 PART I	IS 3975 & IS-1554 PART I
10	OUTER SHEATH	EXTRUDED FRLSH HRPVC TYPE ST2	EXTRUDED FRLSH HRPVC TYPE ST2
10.1	REFERENCE STANDARD	IS: 5831 & IS-7098 PART-I	IS: 5831
11	MARKING	(i) CABLE SIZE (CROSS SECTION AREA AND NO. OF CORES, VOLTAGE GRADE, WORD 'FRLS', REF. IS, TYPE OF CABLE, TYPE OF INSULATION/ SHEATH, MANUFACTURER'S NAME AND/OR TRADE NAME, YEAR OF MANUFACTURE-AT EVERY 5M (BY EMBOSSING), 'BHEL-PEM' and 'CUSTOMER' Name @5m (by embossing), (ii) PROGRESSIVE SEQUENTIAL MARKING OF LENGTH OF CABLE IN METERS- AT EVERY 1M (BY EMBOSSING/PRINTING)	
12	CABLE DRUMS		
12.1	TYPE OF DRUM	WOODEN (HEAVY CONSTRUCTION) AS PER IS 10418	
12.2	STANDARD DRUM LENGTH	500M FOR LARGER SIZES / 1000M FOR SMALLER SIZES (±) 5% (AS SPECIFIED IN BOQ)	
12.3	PAINTING	ENTIRE SURFACE TO BE PAINTED. ALL FERROUS PARTS USED SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING TO AVOID RUSTING DURING TRANSIT OR STORAGE. WOODEN CABLE DRUMS SHALL BE TREATED BY IMMERSING IN COPPER-NITRATE SOLUTION. DRUM NUMBER SHALL BE INDICATED ON EACH DRUM.	
12.4	OUTERMOST LAYER	TO BE COVERED WITH WATERPROOF POLYETHYLENE	
12.5	CONSTRUCTION	ALL WOODEN PARTS FROM SEASONED WOOD AND FERROUS PARTS SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING. WOODEN DRUM SHALL BE TREATED BY IMMERSING IN COPPER NITRATE SOLUTION.	

	Design Calculations For LT Cable Selection & Sizing	
	1 x 660MW BHUSAWAL T.P.S UNIT-6	

12.6	PARTICULAR INFORMATION ON DRUM	BOTH THE END OF CABLES SHALL BE PROPERLY SEALED WITH HEAT SHRINKABLE SEAL. THE CABLE DRUMS SHALL CARRY THE FOLLOWING DETAILS IN PRINTED FORM: A) MSPGCL B) MANUFACTURER'S NAME OR TRADE MAKE C) TYPE OF CABLE & VOLTAGE GRADE D) YEAR OF MANUFACTURE E) TYPE OF INSULATION E.G. XLPE/HRPVC/IE2 F) NO. OF CORE AND SIZES OF CABLES G) CABLE CODE E.G. FRLS/FS H) SINGLE LENGTH OF CABLE ON DRUM I) DIRECTION OF ROTATION, BY ARROW J) APPROX GROSS MASS
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(B) SCREENED CONTROL CABLES

S.NO.	PARTICULARS	DETAILS
1	VOLTAGE GRADE	1100V
2	TYPE OF CABLES	TYPE F (INDIVIDUAL & OVERALL SCREENED) & TYPE G (OVERALL SCREENED)
3	CODES AND STANDARD	IS-1554 PART-1, IS-5831, IS-8130, IS-694, SEN-4241475, IEC-60332 (I).
3(i)	CONDUCTOR	
(a)	CROSS SECTION AREA	0.5 sq.mm
(b)	CONDUCTOR MATERIAL	STRANDED, TINNED ANNEALED HIGH CONDUCTIVITY COPPER
(c)	CONDUCTOR GRADE	ELECTROLYTIC
(d)	NO. & DIA OF STRANDS	7 X 0.3 mm
(e)	NO. OF PAIRS	0.5 sq.mm. - 2P, 4P, 8P, 12P, 24P
(f)	REFERENCE STANDARD	IS-8130
(ii)	INSULATION	
(a)	MATERIAL	EXTRUDED HR PVC TYPE-C AS PER IS-5831
(b)	THICKNESS IN mm	0.6 (NOMINAL) AS PER IS-694
(c)	VOLUME RESISTIVITY (MIN) IN ohm-cm	i. 1×10^{13} Ohm-cm at 27 deg.C / room temp. (Min). ii. 1×10^{10} Ohm-cm at 85 deg.C (Min.)
(d)	VOLTAGE RATING	1100V
(e)	REFERENCE STANDARD	IS-1554 PART-1 & IS-5831
(f)	OD OF COND. INCLUDING INSULATION	AS PER MANUFACTURER'S CALCULATIONS / STD. PRACTICE
(iii)	PAIRING & TWISTING	
(a)	MAX. LAY OF PAIRS (mm)	60
(b)	CONDUCTOR /PAIR IDENTIFICATION	AS PER ATTACHED ANNEXURE D
4	SHIELDING	
(a)	TYPE OF SHIELDING	AL-MYLAR TAPE
(b)	INDIVIDUAL PAIR SHIELDING	TO BE PROVIDED FOR TYPE-F CABLE ONLY
(c)	OVERALL SHIELDING	TO BE PROVIDED FOR BOTH TYPE-F & TYPE-G CABLES
(d)	MINIMUM THICKNESS OF INDIVIDUAL PAIR SHIELDING	28 MICRONS
(e)	MINIMUM THICKNESS OF OVERALL CABLE ASSEMBLY SHIELDING	60 MICRONS
(f)	SHIELDING COVERAGE	100% WITH AT LEAST 25% OVERLAP
5	DRAIN WIRE (To be provided separately for individual pair shield and overall shield.)	
	Material	Multi stranded Annealed tinned copper drain wire.
	Size (No. of strands/ Dia. of each strand)	0.5 sq. mm. (7/0.3 mm.)
6	FILLERS (if applicable)	
(a)	TYPE	NON -HYGROSCOPIC WITH FRLS PROPERTY (AS REQUIRED FOR MAINTAINING CABLE CIRCULARITY)
7	INNER SHEATH	
(a)	MATERIAL	EXTRUDED HR PVC TYPE ST-2 AS PER IS-5831
(b)	THICKNESS	AS PER IS-1554 PART-1
(c)	Whether FR-LSH Applicable	YES
(d)	COLOUR	BLACK
(e)	REFERENCE STANDARD	IS-1554 PART-1 & IS-5831
8	RIP CORD	NON-METALLIC RIP CORD UNDER THE INNER SHEATH
9	ARMOUR	GALVANISED STEEL ROUND WIRE / STRIP AS PER IS-3975 & IS-1554 PART-1

	Design Calculations For LT Cable Selection & Sizing	
	1 x 660MW BHUSAWAL T.P.S UNIT-6	

10	OUTER SHEATH		
(a)	MATERIAL	EXTRUDED HR PVC TYPE ST-2 AS PER IS-5831	
(b)	THICKNESS	AS PER IS-1554 PART-1	
(c)	Whether FR-LSH Applicable	YES	
(d)	COLOUR	GREY	
(e)	REFERENCE STANDARD	IS-1554 PART-1 & IS-5831	
(f)	MARKING	(i) CABLE SIZE (CROSS SECTION AREA AND NO. OF CORES, VOLTAGE GRADE, WORD 'FRLS', REF. IS, TYPE OF CABLE, TYPE OF INSULATION/ SHEATH, MANUFACTURER'S NAME AND/OR TRADE NAME, YEAR OF MANUFACTURE-AT EVERY 5M (BY EMBOSSING), 'BHEL-PEM' and 'CUSTOMER' Name @5m (by embossing), (ii) PROGRESSIVE SEQUENTIAL MARKING OF LENGTH OF CABLE IN METERS- AT EVERY 1M (BY EMBOSSING/PRINTING)	
11	TECHNICAL PARAMETERS (C & I) AT 20 DEG C	0.5 sqmm (IS & OS) Type F	0.5 sqmm (OS) Type G
(a)	MUTUAL CAPACITANCE (MAX.) AT 0.8 KHz, nF / Km	120	100
(b)	CONDUCTOR LOOP RESISTANCE (MAX.), Ohm / Km	78	78
(c)	INSULATION RESISTANCE (MIN.), M Ohm / Km	100	100
(d)	CROSS TALK ATTENUATION (MIN.) AT 0.8KHz, dB / Km	60	60
(e)	CHARACTERISTIC IMPEDANCE (MAX.) AT 1KHz, Ohm	320	340
(f)	ATTENUATION (MAX.) AT 1KHz, dB / Km	1.2	1.2
12	FR-LSH CHARACTERISTICS		
(b)	SMOKE DENSITY RATING	Max. 60% (As per ASTM D 2843): Area under coverage.	
(c)	ACID GAS EMISSION	Max. 20% by weight (As per IEC-60754-1)	
(d)	OXYGEN INDEX	Min 29 at room temperature (As per ASTM D 2863)	
(e)	TEMPERATURE INDEX	Min. 250 deg.C at oxygen index value of 21 (As per ASTM D 2863)	
13	FLAMMABILITY TEST	(1) AS PER IEC-332-1 (2) Swedish Chimney test SEN-SS-424-1475-F3	
14	TEST VOLTAGE & DURATION (High Voltage Test)		
(a)	Core to core	1.5 kV for 1 minute	
(b)	Core to shield	1 kV for 1 minute	
15	CABLE DRUM DETAILS		
(a)	Material Type	Wooden, as per IS 10418	
(b)	Standard drum length	1000 metres: upto and including 12 Pairs. 500 metres: above 12 pairs.	
(c)	Tolerance on drum length	±5%	
(d)	Painting	ENTIRE SURFACE TO BE PAINTED. ALL FERROUS PARTS USED SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING TO AVOID RUSTING DURING TRANSIT OR STORAGE. WOODEN CABLE DRUMS SHALL BE TREATED BY IMMERSING IN COPPER-NITRATE SOLUTION. DRUM NUMBER SHALL BE INDICATED ON EACH DRUM.	
(e)	Outermost layer	TO BE COVERED WITH WATERPROOF POLYETHYLENE	
(f)	Construction	ALL WOODEN PARTS FROM SEASONED WOOD AND FERROUS PARTS SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING. WOODEN DRUM SHALL BE TREATED BY IMMERSING IN COPPER NITRATE SOLUTION.	

	TITLE LV MOTORS DATA SHEET-A 1X660 MW BHUSAWAL TPP	SPECIFICATION NO.	
		VOLUME	II B
		SECTION	D
		REV NO. 00	DATE 25.02.2019
		SHEET 1	OF 1

1.0	Design ambient temperature	:	50 °C
2.0	Maximum acceptable kW rating of LV motor	:	160KW
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 (+5% and -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 90 kW and upto 160kW	:	50 KA for 1 sec.
	(Breaker controlled)		
	o Below 90 kW	:	50 KA protected by fuse for 0.2 sec
	(SFU + Contactor controlled)		
	f) LV System grounding	:	Effectively grounded
5.0	Class of insulation	:	Class 'F', with temp rise limited to class B.
6.0	Minimum voltage for starting (As percentage of rated voltage)	:	80% of rated voltage
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	:	240 V, 1ϕ , 50 Hz
10.0	Rating up to which Single phase motor	:	Acceptable below 0.20 kW
11.0	Additional tests	:	As per QP and customer motor spec
12.0	Flame-proof motor		
	a) Enclosure suitable (As per IS:2148)	:	As per requirement
	b) Classification of Hazardous area (As per IS: 5572 part-I)	:	As per requirement
13.0	Makes	:	As per ANNEXURE-I
14.0	Paint shade	:	RAL 7032
15.0	Degree of Protection of enclosure (motors):		INDOOR IP-55 OUTDOOR IPW-55
16.0	Energy efficiency	:	IE3 as per IS:12615: 2011

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

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ANNEXURE-I

SUB-VENDOR LIST

The list of approved make of the LT Motors are as mentioned below:

S.No.	LIST OF LT MOTORS
1.	BHARAT BIJLEE LTD.
2.	CROMPTON GREAVES
3.	ASEA BROWN BOVERI
4.	KIRLOSKAR ELECTRIC CO LTD.
5.	NGEF
6.	SIEMENS
7.	MARATHON
8.	GE-POWER
9.	RAJINDRA ELECT INDUSTRIES
10.	LAXMI HYDRAULICS PVT. LTD

However, the final list of makes for the LT Motors is subjected to BHEL/Customer approval, during contract stage, without any commercial implications.

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01		SPECIFICATION TITLE				
				SHEET 1 OF 2		SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)		SECTION VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		TITLE QUALITY PLAN		SPECIFICATION : TITLE :				
				SHEET 2 OF 2		SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)		SECTION VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	
NOTES: 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON 2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. 3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 1 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION : VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVANT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVANT IS/	SUPPLIER'S TC	3	-	2	
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 2 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION : VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 3 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION : VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC. 2. OTHER CHARACTERISTICS	MA MA	VISUAL TEST	100% SAMPLE	- MANUF'S SPEC.	NO VISUAL DEFECTS MANUF'S SPEC.	INSPT. REPORT LOG BOOK AND OR SUPPLIER'S TC	3 3	- -	2 2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND. 2.DIMENSIONS INCLUDING BURS HEIGHT 3. ACCEPTANCE TESTS	MA MA MA	VISUAL MEASUREMENT ELECT. & MECH TESTS	100% SAMPLE -DO-	- MANUFR'S DRG. . MANUF'S SPEC./ RELEVANT IS	NO VISUAL DEFECTS (FREE FROM BURS) MANUFR'S DRG. RELEVANT IS	LOG BOOK -DO- SUPPLIER'S TC	3 3 3	- - -	- 2 2	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
1.9	CONDUCTORS	1. SURFACE FINISH 2.ELECT. PROP. & MECH. PROP	MA MA	VISUAL ELECT. & MECH.TEST	100% SAMPLES	- RELEVANT IS/ BS OR OTHER STANDARDS	FREE FROM VISUAL DEFECTS RELEVANT IS/ BS OR OTHER STANDARDS	LOG BOOK SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3* 3	- -	2* 2	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 4 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION : VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
		1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
		1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		BHEL		PARTICULARS		BIDDER/VENDOR						
		NAME										
		SIGNATURE										
		DATE				BIDDER'S/VENDORS COMPANY SEAL						

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
		SHEET 5 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNES	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ ASTM-E165	MANUF'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC./BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
				SHEET 6 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION : VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	FOR MV MOTOR
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.6	IMPREGNATION	1.VISCOSITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	THREE DIPS TO BE GIVEN
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE									
												BIDDER'S/VENDORS COMPANY SEAL

		QUALITY PLAN SHEET 7 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION : VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	VERIFICATION FOR MV MOTOR ONLY
2.8	BRAZING/COMPRESSION JOINT	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.9	COMPLETE ROTOR ASSEMBLY	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	
2.10	ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1	
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE					BIDDER'S/VENDORS COMPANY SEAL				

		QUALITY PLAN SHEET 8 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP		SPECIFICATION : NUMBER :				
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE				
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION : VOLUME III				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC CLAUSE 8.1.2	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1	1	
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	1*	1	* REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1 ^{\$}	1	^{\$} NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR.
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1 ^{\$}	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY ^{\$} NOTE - 2
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE					BIDDER'S/VENDORS COMPANY SEAL				



		QUALITY PLAN SHEET 9 OF 9		CUSTOMER : MAHAGENCO		PROJECT : 1X660 MW BHUSAWAL TPP TITLE		SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE			
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION : VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P W V		REMARKS
1	2	3	4	5	6	7	8	9	10	11	
NOTES: 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED FOR FIRST NUMERAL OF IP-XX. SECOND NUMERAL TEST SHALL BE CARRIED OUT ON ONE MOTOR OF EACH TYPE & RATING. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY											
BHEL			PARTICULARS			BIDDER/VENDOR					
			NAME								
			SIGNATURE								
			DATE								
										BIDDER'S/VENDORS COMPANY SEAL	



TITLE:

1x660 MW BHUSAWAL TPS

**TECHNICAL SPECIFICATION FOR
CHEMICAL DOSING SYSTEM**

SPECIFICATION NO. PE-TS-415-154-A001

SECTION I

SUB SECTION - IC

REV.NO. 00 DATE: 27.05.2019

SECTION – IC: SPECIFIC TECHNICAL REQUIREMENTS (C&I)

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I SHEET 1 of 18
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
CONTROL AND INSTRUMENTATION SPECIFICATION FOR CHEMICAL DOSING SYSTEM		

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I SHEET 2 of 18
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	

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- A. General & Specific Technical requirement
- B. C&I deliverables list
- C. Specification for Motorized valve actuator
- D. Specification for field instruments
- E. Control panels specification
- F. Applicable codes and standards
- G. Mandatory spares
- H. Drawings

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I SHEET 3 of 18
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
GENERAL & SPECIFIC TECHNICAL REQUIREMENT		

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I SHEET 4 of 18
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
GENERAL REQUIREMENT 1.0 Bidder shall provide complete and independent control & instrumentation system with all accessories, auxiliaries and associated equipments for the safe, efficient and reliable operation of auxiliary systems. 2.0. The quantity of instruments shall be as per tender P &ID, wherever provided, for the respective system as a minimum for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe &reliable operation of plant, bidder shall supply the same without any price implication. 3.0 Measuring instruments/equipment and subsystems offered by the bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Further all the instruments shall be of proven reliability, accuracy, and acceptable international standards and shall be subject to employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specification, ranges, makes/ numbers as approved by the employer' during detail engineering. 4.0 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments; sensors, switches etc for external connection including spare contacts shall be wired out to suitably located junction boxes. 5.0 The customer specification attached as Specific Technical Requirement will supersede the Data sheets, if there is any mismatch. 6.0 All instruments shall be suitable for chemical applications.		

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I SHEET 5 of 18
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	

Specific Technical Requirements (C&I):

1. CONTROL PHILOSOPHY

This control write-up is applicable for the following LP dosing systems:

- i) Hydrazine dosing system.
- ii) Ammonia dosing system.
- iii) NaOH dosing system.

The control of all dosing systems shall be realized in Plant DCS including ON/OFF command of the individual pumps and stirrers. All controls, fault indicators/alarms, interlocks, logics shall be implemented in Plant DCS. Separate local panel shall be provided for each of the above said system.

The starter of all the motors shall be clubbed with main plant MCC. Power to all pumps, agitators etc. shall be fed from MCC. DCS commands shall extend to MCC.

A local panel comprising of 'START' push button, 'STOP' push button along with 'ON/OFF/TRIP' indication, local/ remote indication, stroke position indicator, raise/ lower push button for stroke position and local annunciation shall be provided for local operation. The 'STOP' push button shall be wired directly to MCC whereas 'START' push button shall be routed to DDCMIS.

The ON/OFF operation of all motorized stirrers and pumps shall also be provided in Plant DCS with local ON, OFF facility.

The auto stroke controllers of each pump shall be provided in the local panel. The stroke position & adjustment will be done from Plant DCS & Local panel and the stroke controller shall be suitable for accepting 4-20 mA DC signals. The pumps shall be provided with 24 V DC, 2- wire LVDT Type Position feedback transmitter to generate 4-20 mA DC signals to indicate stroke position in Plant DCS & Local panel.

The Local/ Remote selection switch (soft) shall be provided in Plant DCS and its indication shall be provided in LCP. LCP shall be located on the dosing skid.

1. Following interlocks shall be provided at low-low Level in the preparation cum metering tanks:
 - i) Running Dosing pump shall be tripped.
 - ii) Stirrer motor of the respective tank shall be tripped.
2. Following conditions to be ensured before starting a stirrer:
 - i) Level in the tank adequate.
 - ii) Motor not overload.
3. Following conditions to be ensured before starting a pump:
 - i) Level in the tank adequate.
 - ii) Motor not overload.

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I SHEET 6 of 18
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
iii) Motorized discharge valve of selected pump open. 4. Following shall be provided on LCP: i) ON/ OFF/ Fault- Lamp Indications for all drives (pumps & agitator) ii) Operation 'Local selected' / operation 'Remote selected'- Lamp Indication, common for all drives. iii) Pump- Start/ Stop, Agitator-Start/ Stop & Motorized valve Open/Close –Push Buttons. iv) Auto stroke controller v) Stoke position indicator (may be a part of controller) vi) Local LED based annunciation driven by Plant DCS. 5. Following fault indications with alarm annunciations shall be provided on LCP & in Plant DCS: i) Low level in the preparation cum metering tanks. ii) Low-low level in the preparation cum metering tanks iii) High level in the preparation cum metering tanks. iv) High level in the preparation cum metering tanks. v) Dosing pump tripped. vi) Stirrer motor tripped. vii) Low Level in preparation cum metering tanks. viii) Low –Low Level in preparation cum metering tanks. ix) Running dosing motor & stirrer motor tripped due to low-low level in preparation cum metering tanks. SIGNAL EXCHANGE 1. Following signals shall be wired from Plant DCS to LCP. These shall be 24V DC powered signals. (PF contacts are not used to avoid the higher voltage LCP power supply reaching DDCMIS while contact interrogation). i) Operation local selected ii) Operation remote selected iii) Dosing Pump & stirrer (ON/OFF/FAULT) iv) Process conditions (as per clause 5 above) v) Dosing Pumps stroke length demand signal (4-20 mA). vi) Motorized valve Open/Close 2. Following signals shall be wired from LCP to Plant DCS. Binary signals shall be P.F. contacts. i) All field signals ii) START commands for all drives (pumps & agitator) iii) Dosing Pumps stroke length feedback signal (4-20 mA). iv) Motorized valve Open/Close signal. All the field instruments & stroke actuator shall be terminated at local panel by the vendor, for taking further to Plant DCS.		

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I SHEET 7 of 18
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
Instrument cabling from instruments to LCP and pre-wiring within LCP shall be done by Bidder. 3) All electrical actuators shall be integral type. 4) 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 and repetition of clauses in the specification, the more stringent requirements among them are to be complied with. 5) All the instruments/drives shall be terminated on JBs/Panels in field. JBs/Panels shall be in Bidder's scope. RTD's shall be of duplex type. 6) Scope of Instrumentation cables (Screened Control Cables), Fibre Optic cable & Control cables shall be as per Electrical Cable scope matrix in Electrical portion of specification. Any cable in Bidder's scope shall be as per specification. 7) Bidder to comply with codes and standards as mentioned in the specification. 8) All local gauges, transmitters and switches shall be mounted on suitable enclosures, racks subject to owner's approval. All transmitters shall be HART compatible. 9) Bidder shall ensure supply of spare parts for lifetime of the power plants. 10) Bidder to delegate /depute their persons/experts as per owner/consultants' requirement. 11) Bidder must offer general tools and tackles and special calibration instruments required during start-up, trial run, operation and maintenance of the system. 12) 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. 13) Two nos feeders of 415 V AC shall be provided for LCP of Hydrazine, Ammonia & Sodium hydroxide dosing systems .Necessary power supply for panel, instruments etc and any other supply like 24 V DC, 110 V AC etc. for alarm annunciator, Auto Stroke Controller etc. shall be derived from these two feeders by the bidder. The necessary hardware for the same shall be in Bidder's scope. Suitable Automatic changeover arrangement of the input feeders shall also be provided by the bidder in the LCP. Minimum 20% spare windows to be provided in each LCP. 14) Double root valve shall be provided for all pressure tapplings where the pressure exceeds 40 kg/cm².		

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I SHEET 8 of 18
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
C&I DELIVERABLES LIST		

LIST OF DELIVERABLES OF PEM - C&I DEPARTMENT						
1X660 MW BHUSAWAL TPP						
Sl.No.	DRAWING NO.	DRAWING/DOCUMENT TITLE	CUSTOMER	FROM	USER	REMARKS
INSTRUMENTATION						
1	PE-V9-415-XXX-I901	INSTRUMENT DATA SHEETS	-	VENDOR	C&I	
2	PE-V9-415-XXX-I902	INSTRUMENT SCHEDULE	-	VENDOR	C&I	
3	PE-V9-415-XXX-I903	INSTRUMENT INSTALLATION/ HOOK UP DIAGRAMS	-	VENDOR	C&I	
5	PE-V9-415-XXX-I905	INSTRUMENT QP/CHECK LIST	-	VENDOR	C&I	
LOCAL CONTROL PANEL						
1	PE-V9-415-XXX-I950	LOCAL CONTROL PANEL DATASHEET	A	VENDOR	C&I	
2	PE-V9-415-XXX-I951	WIRING DIAGRAM	-	VENDOR	C&I	
3	PE-V9-415-XXX-I952	PANEL GA DRAWINGS	-	VENDOR	C&I	
8	PE-V9-415-XXX-I956	BILL OF MATERIAL	-	VENDOR	C&I	
13	PE-V9-415-XXX-I957	LOCAL CONTROL PANEL QUALITY PLAN	`	VENDOR	C&I	
14	PE-V9-415-XXX-I958	LOCAL CONTROL PANEL O&M MANUAL	-	VENDOR	C&I	
19	PE-V9-415-XXX-I925	MANDATORY SPARES BILL OF MATERIAL	A	VENDOR	C&I	
	Notes:	415 - Project No.				
		XXX -MAX Package Code				
		\$\$ -Approval by BHEL if Vendor BBU Item. Approval by Customer if Customer BBU Item				

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I SHEET 9 of 18
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
SPECIFICATION FOR MOTORISED VALVE ACTUATOR		

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1.0 <u>SCOPE</u> 1.1 This Section covers the general requirements of Electric Motor Actuators for valves, dampers and gates. 1.2 All electric motor actuators shall be furnished in accordance with this general specification and the accompanying driven equipment specification. 2.0 <u>STANDARDS</u> 2.1 All electrical equipment shall conform to the latest applicable IS, ANSI and NEMA Standards, except when stated otherwise herein or in driven equipment specification. 2.2 Major standards, which shall be followed, are listed below. Other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed: (a) IS-9334 (b) IS-325 3.0 <u>SERVICE CONDITIONS</u> 3.1 The actuator shall be suitable for operation in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash. 3.2 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the general specification. 4.0 <u>RATING</u> 4.1 For isolating service, the actuator shall be rated for three successive open-close operation of the valve/damper or 15 minutes, whichever is longer. 4.2 For regulating service, the actuator shall be suitably time-rated for the duty cycle involved with necessary number of starts per hour, but in no case less than 150 starts per hour.		

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5.0 PERFORMANCE

The actuator shall meet the following performance requirements:

- 5.1 Open and close the valve completely and make leak-tight valve closure without jamming.
- 5.2 Attain full speed operation before valve load is encountered and impart an unseating blow to start the valve in motion (hammer blow effect).
- 5.3 Operate the valve stem at standard stem speed and shall function against design differential pressure across the valve seat.
- 5.4 The motor reduction gearing shall be sufficient to lock the shaft when the motor is de-energised and prevent drift from torque switch spring pressure.
- 5.5 The entire mechanism shall withstand shock resulting from closing with improper setting of limit switches or from lodging of foreign matter under the valve seat.

6.0 SPECIFIC REQUIREMENT

6.1 CONSTRUCTION

- 6.1.1 The actuator shall essentially comprise the drive motor, torque/ limit switches, gear train, clutch, hand wheel, position indicator/ transmitter, in-built thermostat for over load protection, space heater and internal wiring. Actuator shall be integral type. Integral starter shall have facility to hook-up with Plant DCS for positioning of limit and torque switches.
- 6.1.2 The actuator enclosure shall be totally enclosed, dust tight, weather-proof suitable for outdoor use without necessity of any canopy.
- 6.1.3 All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.
- 6.1.4 The actuator shall be designed for mounting in any position without any lubricant leakage or operating difficulty.

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6.2

MOTOR

6.2.1

The drive motor shall be three phase, squirrel cage, induction machine with minimum class B insulation and IPW-55 enclosure, designed for high torque and reversing service.

6.2.2

The motor shall be designed for full voltage direct on-line start, with starting current limited to 6 times full-load current.

6.2.3

The motor shall be capable of starting at 85 percent of rated voltage and running at 80 percent of rated voltage at rated torque and 85 percent rated voltage at 33 percent excess rated torque for a period of 5 minutes each.

6.2.4

Earthing terminals shall be provided on either side of the motor.

6.3

LIMIT SWITCHES

Each actuator shall be provided with following limit switches:

6.3.1

Two (2) torque limit switches, one for each direction of travel, self-locking, adjustable torque type.

6.3.2

Four (4) end-of-travel limit switches, two for each direction of travel.

6.3.3

Two (2) position limit switches, one for each direction of travel, each adjustable at any position from fully open to fully closed positions of the valve/damper.

6.3.4

Each limit switch shall have 2 NO + 2 NC potential free contacts. Contact rating shall be 5A at 240V A.C. or 0.5A at 220V D.C.

6.4

HAND WHEEL

Each actuator shall be provided with a hand wheel for emergency manual operation. The hand wheel shall declutch automatically when the motor is energized.

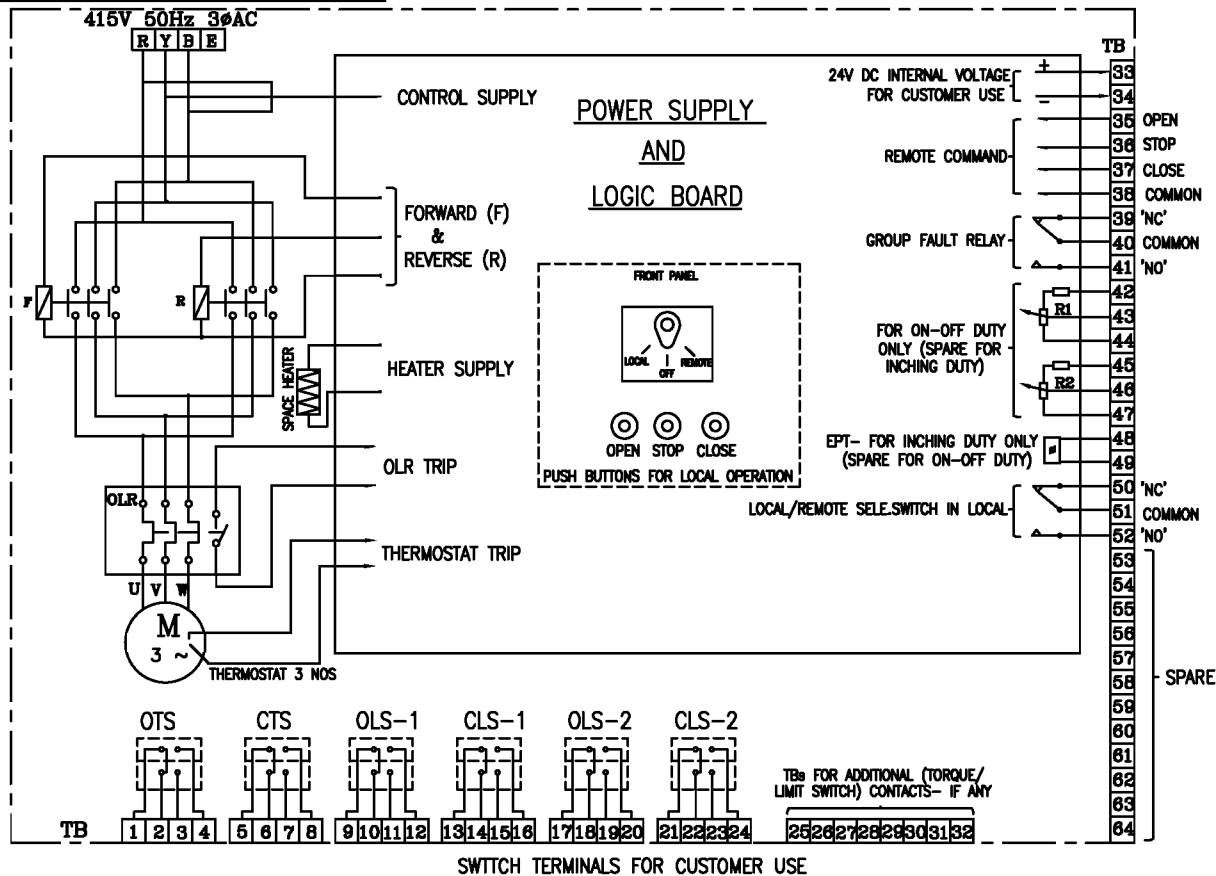
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6.5 <u>POSITION INDICATOR/TRANSMITTER</u> The actuator shall have: 6.5.1 One (1) built-in local position indicator for 0-100% travel 6.5.2 One (1) position transmitter, potentiometer type, for remote indicator. 6.6 <u>SPACE HEATER</u> A space heater shall be included in the limit switch compartment suitable for 240V, 1 phase, 50 Hz supply. 6.7 <u>WIRING</u> All electrical devices shall be wired up to and terminated in a terminal box. The internal wiring shall be of sufficient size for the power rating involved but in no case less than 1.5 Sq.mm copper. All wiring shall be identified at both ends with ferrules. 6.8 <u>TERMINAL BOX</u> The terminal box shall be weather proof, with removable front cover and cable glands for cable connection. The terminal shall be suitable for connection of 2.5 Sq.mm copper conductor. 7.0 <u>TEST</u> 7.1 The actuator and all components thereof shall be subject to tests as per relevant Standards. In addition, if any special test is called for in equipment specification, the same shall be performed. 7.2 <u>TEST WITNESS:</u> Test shall be performed in presence of Owner/Purchaser's representative so desired by the Owner/Purchaser. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.		

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3-V-MISC-24227

DRAWING NO.



CONTACT DEVELOPMENT DIAGRAM

OTS	1-2	OPEN AT OVER TORQUE DURING OPENING TRAVEL				
	3-4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL				
CTS	5-6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL				
	7-8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL				
OLS-1	9-10					
	11-12					
CLS-1	13-14					
	15-16					
OLS-2	17-18					
	19-20					
CLS-2	21-22					
	23-24					
SWITCH	TERMINAL NO.	FULL OPEN	a	INTERMEDIATE	b	FULL CLOSE
		VALVE POSITION				

————— INDICATES CONTACT CLOSED

----- INDICATES CONTACT OPEN

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

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH

VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF 100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	CLS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CTS	#
# - CLS NOT TO BE CONNECTED IN TRIP CIRCUIT				
* - BYPASS OTS FOR INITIAL 5% OF TRAVEL (FOR GATE VALVES ONLY)				

NOTE:-

- ALL TORQUE AND LIMIT SWITCHES (OTS, CTS, OLS1&2, CLS1&2) ARE WITH 2NO+2NC CONTACTS '1NO+1NC' IS TERMINATED IN TBS 1-24, REMAINING CONTACTS ARE FOR INTERNAL USE.
ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25-32
- CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE)
- OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN)
- OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN
- CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE
- EPT - ELECTRONIC POSITION TRANSMITTER (POTENTIOMETRIC TYPE, FOR INCHING DUTY)
- R1-R2-POTENTIOMETER 2 x 100 OHMS (FOR ON-OFF DUTY)
- FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
- M - MOTOR 3 ϕ 415V 50 Hz AC SUPPLY

REV	DATE	ALTERED
		CHD & APPD

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TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS (DRAWN FOR INTERMEDIATE POSITION OF VALVES)				
 365-121 DEPT VL CODE TITLE WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER	NAME N.P.ESWAR SIGN N.P. DATE 07.10.04 NO. OF VAR.	NAME D.DINAKARAN SIGN D.D. DATE 07.10.04 NO. OF VAR.	NAME K.ARUNACHALAM SIGN K.A. DATE 07.10.04 NO. OF VAR.	REFERENCE INFORMATION DRAWING NO. 3-V-MISC-24227 REV 0		
	DRN N.P.ESWAR CHD D.DINAKARAN APPD K.ARUNACHALAM	SCALE WEIGHT (KG). CARD CODE U 01				

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	REV: R0	STEAM GENERATOR AND AUXILIARIES	Page 203 of 223
<u>SR. NO.</u>	<u>DESCRIPTION</u>	<u>UNITS</u>	
	(i) Level Gauge		
	a. Number		One (1)
	b. Type		SS Tube Magnetically coupled. Each gauge not more than 1200mm. Multiple gauges with 300 mm overlap.

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- (a) Each dosing pump shall be provided with diaphragm seal, snubber, glycerine filled type pressure gauge of proper range on discharge piping with isolation valves, fittings etc. Each solution tank shall be provided with stainless tube magnetic type level gauge with colour changing ball or flapper and graduated scale. Level switch shall be provided for low-level alarm and interlock. The chemical feed system shall be operated and adjusted from the local panel and also from the station DCS in unit Control Room.

 - (c) Dosing rate control shall be adjusted from both local and remote automatic & manual from central control room DCS. Required local controller, drive unit as required shall be provided for this purpose. Use of resistance type feedback mechanism for position indication shall be avoided.

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	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 221 of 718
SR. NO.	ITEM	DESCRIPTION	
1.0	<u>FIELD INSTRUMENTS</u>		
	This section provides general hardware guidelines for field instruments and equipment to be supplied under this specification.		
1.1	<u>PRESSURE TRANSMITTER</u>		
1.1.1	Working Principle	SMART, HART Protocol.	
1.1.2	Type	2 – Wire.	
1.1.3	Output Signal	4-20 mA DC.	
1.1.4	Signal Processing	Silicon solid state electronic circuitry.	
1.1.5	Measuring Element	Capsule/Diaphragm.	
1.1.6	Element material	AISI-316 (Stainless Steel) or better.	
1.1.7	Static Pressure	150 % of maximum span continuously, without affecting the calibration.	
1.1.8	Turn-down ratio	100:1	
1.1.9	Span and Zero	Locally adjustable non-interacting. Facility for elevation and suppression by 100% of span.	
1.1.10	Enclosure Class	IP-65.	
1.1.11	Output Indicator	LCD Type.	
1.1.12	Nameplate	Tag number, service engraved in SS tag plate.	
1.1.13	Body	Forged Carbon Steel for air and flue gas application and SS for other	

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REV: R0	CONTROL & INSTRUMENTATION		Page 222 of 718
SR. NO.	ITEM	DESCRIPTION	
		application.	
1.1.14	Operating Voltage	16 - 48 Volts D.C.	
1.1.15	Load	600 Ohms (min.) at 24 Volts D.C.	
1.1.16	Ambient Temperature	0 - 50 °C.	
1.1.17	Performance :		
	(a) Accuracy	± 0.1% of Span or better.	
	(b) Repeatability	± 0.05% of Span or better.	
	(c) Stability	a) +/- 0.1% of calibrated span for 5 year for ranges upto and including 70 Kg/cm ² b) +/- 0.25% of calibrated span for 5 years for ranges more than 70 kg/cm ² (g)	
1.1.18	Sealing/Isolation	Extended diaphragm with 5 meters SS armoured capillary for viscous fluid applications.	
1.1.19	Accessories	(a) Universal mounting bracket suitable for 2" pipe mounting.	
		(b) High tensile carbon steel U- bolts.	
		(c) Siphon for steam and hot water services.	
		(d) ½" NPT 2-valve stainless steel manifold, constructed from SS316 bar stock.	

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REV: R0	CONTROL & INSTRUMENTATION		Page 223 of 718
SR. NO.	ITEM	DESCRIPTION	
		(e) Companion flange with nuts, bolts and gaskets.	
		(f) Hand held configuration kit for calibration of SMART Transmitter.	
		(g) ½" NPT cable gland.	
1.2	<u>DIFFERENTIAL PRESSURE TRANSMITTER/FLOW TRANSMITTER</u>		
1.2.1	Working Principle	SMART, HART Protocol.	
1.2.2	Type	2-Wire.	
1.2.3	Output signal	4-20 mA DC.	
1.2.4	Signal Processing Unit	Silicon solid-state electronic circuitry.	
1.2.5	Measuring element	Capsule/Diaphragm.	
1.2.6	Element material	AISI-316 (Stainless Steel) or better.	
1.2.7	Static Pressure/Overload Pressure	Maximum line (or static) pressure on either side without permanent deformation or loss of accuracy.	
1.2.8	Turn-down ratio	100 : 1 minimum.	
1.2.9	Span and Zero	Locally adjustable, non-interacting.	
1.2.10	Enclosure class	IP-65.	
1.2.11	Zero suppression/elevation	At least 100% of Span.	
1.2.12	Output Indicator	LCD Type.	
1.2.13	Nameplate	Tag number and Service engraved in SS tag plate.	

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REV: R0	CONTROL & INSTRUMENTATION		Page 224 of 718
SR. NO.	ITEM	DESCRIPTION	
1.2.14	Body	Forged Carbon Steel for air and flue gas application and SS for other application.	
1.2.15	Ambient temperature	0 - 50 °C.	
1.2.16	Operating Voltage	16 - 48 Volts DC.	
1.2.17	Load	600 Ohms (min.) at 24 Volts DC.	
1.2.18	Performance:		
	(a) Accuracy	±0.1 % of span or better.	
	(b) Repeatability	± 0.05 % of span or better.	
	(c) Stability	a) +/- 0.1% of calibrated span for 5 year for ranges upto and including 70 Kg/cm ² b) +/- 0.25% of calibrated span for 5 years for ranges more than 70 kg/cm ² (g)	
1.2.19	Sealing / Isolation	Extended diaphragm with 5 meters SS armoured capillary for viscous fluid applications.	
1.2.20	Accessories	(a) Universal mounting bracket suitable for 2" pipe mounting.	
		(b) High tensile carbon steel U-bolts.	
		(c) Siphon for steam and hot water services.	
		(d) Companion flange with nuts, bolts and gaskets.	

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REV: R0	CONTROL & INSTRUMENTATION		Page 225 of 718
SR. NO.	ITEM	DESCRIPTION	
		(e) Hand held configurator kit for calibration of SMART Transmitter	
		(f) ½" NPT cable gland.	
		(g) ½" NPT generally 5-valve stainless steel manifold, constructed from SS316 bar stock. 3 valve manifold for DP application in flue gas and air.	
1.3	<u>DISPLACER TYPE LEVEL TRANSMITTERS</u>		
1.3.1	Type	SMART, HART Protocol.	
1.3.2	Stages of operation	Continuous.	
1.3.3	Material -		
(a)	Displacer	AISI 316 SS.	
(b)	Suspension wire	AISI 316 SS.	
(c)	Torque tube housing	Carbon steel or SS as per application.	
(d)	Torque tube	Inconel.	
(e)	Displacer chamber	CS or SS as per process application.	
(f)	Transmitter Housing	Die cast Aluminium or better.	
1.3.4	Operating Voltage	16-48 Volts D.C.	
1.3.5	Transmission	2-wire.	
1.3.6	Output Signal	4-20 mA DC.	
1.3.7	Signal processing	Solid-state electronic circuitry.	

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SR. NO.	ITEM	DESCRIPTION	
1.3.8	Static / overload pressure	Maximum static pressure without permanent deformation or loss of accuracy.	
1.3.9	Turn-down ratio	10 : 1 or better.	
1.3.10	Zero & Span	Easily accessible (local zero & span adjustment and non-interactive type).	
1.3.11	Enclosure Class	IP-65.	
1.3.12	Output Indicator	LCD type.	
1.3.13	Nameplate	Tag number and Service engraved in stainless steel tag plate.	
1.3.14	Ambient Temperature	0 - 50° C.	
1.3.15	Load Impedance	600 Ohms at 24 Volts (minimum).	
1.3.16	Process Connection	2" Companion flange with nuts, bolts and gaskets.	
1.3.17	Performance -		
	(a) Accuracy	±0.5 % of span or better.	
	(b) Stability	a) +/- 0.1% of calibrated span for 5 year for ranges upto and including 70 Kg/cm ² b) +/- 0.25% of calibrated span for 5 years for ranges more than 70 kg/cm ² (g)	
1.3.18	Accessories	(a) Counter Flange, nuts, bolts, gaskets etc.	

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SR. NO.	ITEM	DESCRIPTION
		(b) Weights for 5 point calibration of instruments.
		(c) Vent and drain plugs.
		(d) Special calibration tool / configuration, if any.
		(e) ½"NPT cable gland.
1.3.19	Preferred Features	(a) Test plug connection and cutout terminals physically separated from other electronics.
		(b) Electronic Damping facility (adjustable).

1.7	<u>PRESSURE GAUGE AND DIFFERENTIAL PRESSURE GAUGE</u>	
1.7.1	Type	Bourdon / Bellows / Diaphragm.
1.7.2	Sensing & Socket	AISI-316 SS.
1.7.3	Movement Material	AISI-304 SS.
1.7.4	Case Material	Stainless steel, IP-65.
1.7.5	Dial Size	Generally 150 mm.
1.7.6	Scale	Black lettering on white in 270 ° arc.

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SR. NO.	ITEM	DESCRIPTION	
1.7.7	Window	Shatterproof glass.	
1.7.8	Range Selection	Normal process pressure: 50~70% of range.	
1.7.9	Over-range Protection	125% of maximum range by internal stop. External stop at zero.	
1.7.10	Adjustment	Micrometer screw for zero. Internal micrometer screw for range.	
1.7.11	Element Connection	Argon welding.	
1.7.12	Process Connection	1/2" NPT(M) Bottom for local, back for panel mounting.	
1.7.13	Performance	Accuracy of ± 1.0 % of span or better.	
1.7.14	Operating ambient	0 - 50 °C.	
1.7.15	Safety Feature	Blow out disc /diaphragm at the back.	
1.7.16	Accessories	(a) Snubbers and Glycerin filled for pulsating fluid applications and at pump discharge.	
		(b) Stainless steel Diaphragm seals for viscous fluids	
		(c) 3-Way SS316 Gauge cock for pressure gauges.	
		(d) 5-valve SS316 manifold from barstock for differential pressure gauge.	
		(e) Siphons for steam and hot water services.	

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SR. NO.	ITEM	DESCRIPTION	
1.7.17	Applicable standard	IS-3624 / 1996.	
1.7.18	Nameplate	Tag number, service engraved in stainless steel tag plate.	
1.8	<u>TEMPERATURE GAUGE</u>		
1.8.1	Type	Mercury or gas filled.	
1.8.2	Sensing Element Material	Bourdon - AISI-316 SS.	
1.8.3	Capillary Armoring	Stainless steel flexible.	
1.8.4	Movement Material	AISI 304 SS.	
1.8.5	Bulb / Stem Diameter	12 mm.	
1.8.6	Bulb / Stem Material	AISI 316.	
1.8.7	Capillary	Stainless Steel.	
1.8.8	Connection to well	½" NPT.	
1.8.9	Case Material	Stainless steel.	
1.8.10	Dial Size	150 mm in general.	
1.8.11	Scale	Black lettering on white in 270 ° arc.	
1.8.12	Mounting	Surface/Panel.	
1.8.13	Over range Protection	125 % of range or more.	
1.8.14	Instrument connection	Bottom for local and back for panel mounting.	
1.8.15	Range	Normal temperature – 50~70% of range.	
1.8.16	Zero adjuster	Micrometer screw adjustable from front.	

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SR. NO.	ITEM	DESCRIPTION	
1.8.17	Window	Shatterproof glass.	
1.8.18	Accuracy	± 1 % or better.	
1.8.19	Enclosure Class	IP-65.	
1.8.20	Capillary	5 meters (local surface)/15.0 meters (local panel) - armoured stainless steel.	
1.8.21	Compensation	Capillary and Case Compensation.	
1.8.22	Accessories	(a) Forged barstock thermowell screwed as per ASME PTC code. Process connection M 33X2 (M). Material of construction of Thermowell: (i) SS 316: In general. (ii) Inconel: For flue gas application. (iii) Tungsten carbide: For coal mill application.	
1.8.23	Nameplate	Tag number, service engraved in stainless steel tag plate.	

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1.10	<u>RESISTANCE TEMPERATURE DETECTOR</u>	
1.10.1	Type	Platinum (Duplex), Ungrounded.
1.10.2	Resistance	100 ohm at 0 °C.
1.10.3	Base	Wound on ceramic (anti-inductive).
1.10.4	Wiring	3 / 4 Wire.

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REV: R0	CONTROL & INSTRUMENTATION		Page 237 of 718
SR. NO.	ITEM	DESCRIPTION	
1.10.5	Protecting Tube		
(a)	O.D.	8 mm.	
(b)	Material	SS-316, Seamless.	
(c)	Filling	Magnesium oxide (Purity above 99.4%).	
1.10.6	Response time	(a) < 20 seconds for measurement.	
		(b) < 10 seconds for control.	
1.10.7	Calibration	DIN 43760.	
1.10.8	Accuracy	± 0.5%.	
1.10.9	Head:		
(a)	Type	IP-65 universal screwed type.	
(b)	Material	Die cast aluminium or better.	
(c)	Terminal blocks	Nickel plated Brass-screw type / silver plated.	
(d)	Cable connection	½" NPT gland and grommet.	
(e)	Others	Terminal head cover with SS chain and suitable gasket. All thermowells in the high velocity steam service shall be checked for Strouhal's frequency limit to arrive at a safe size and design of thermowells.	
1.10.10	Accessories	(a) Adjustable nipple-union-nipple (½" Sch 80 x ½" NPT M) with Thermowell connection.	

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		(b) Compression fittings / unions.	
		(c) Flanges etc. (for flanged connections only)	
		(d) Forged / barstock Thermowell as per ASME PTC code. Process connection M33 x 2 (M). Material of construction of Thermowell: SS 316: In general. Inconel: For flue gas application. Tungsten carbide: For coal mill application.	
1.10.11	Name plate	Tag number, service engraved in stainless steel tag plate	
1.11	<u>PRESSURE SWITCH</u>		
1.11.1	Type	(a) Piston for high pressure application.	
		(b) Bellow / Diaphragm for low pressure application.	
1.11.2	Sensing element material	AISI SS-316. All other wetted part SS316.	
1.11.3	Case Material	Die-cast aluminium alloy, neoprene gasket.	
1.11.4	Setter Scale	Black graduation on white linear scale. Graduation 0-100% with red pointer for set points.	

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1.11.5	Over range	150 % of maximum pressure.	
1.11.6	Adjustments	(a) Internal Set Point.	
		(b) Differential adjustment.	
1.11.7	End Connection	½" NPT (M) bottom connected.	
1.11.8	Switch configuration	Two SPDT.	
1.11.9	Switch Rating	240V, 5A AC / 220V, 0.5A DC.	
1.11.10	Switch Type	Snap acting, hermetically sealed, shock & vibration proof.	
1.11.11	Terminal Block	Suitable for full ring lugs.	
1.11.12	Cable connection	½" NPT conduit connection.	
1.11.13	Enclosure Class	IP-65.	
1.11.14	Performance	(a) Repeat accuracy $\pm 1.0\%$.	
		(b) Accuracy of Setting Indication of $\pm 1.5\%$.	
1.11.15	Ambient temperature	0 – 50 Deg C.	
1.11.16	Nameplate	Tag number, service engraved in SS tag plate.	
1.11.17	Accessories	(a) Remote diaphragm seal with SS-316 capillary for viscous & corrosive application.	
		(b) Siphons for steam and hot water services.	
		(c) Retention ring and screws for surface mounting.	

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		(d) 1/2" NPT 2 Valve SS-316 barstock manifold.	
		(e) ½" NPT cable gland.	
1.12	<u>DIFFERENTIAL PRESSURE SWITCH</u>		
1.12.1	Type	Bellows/Diaphragm/Piston actuated.	
1.12.2	Sensing element material	AISI SS-316. For all other wetted part SS 316.	
1.12.3	Case Material	Die-cast aluminium alloy with neoprene gasket.	
1.12.4	Setter Scale	Black graduation on white scale with 0-100% graduation and provided with red pointer for set point adjustment.	
1.12.5	Over range	Static pressure on any one side, the other side being open to atmosphere.	
1.12.6	Adjustments	(a) Internal set point adjustment.	
		(b) Differential adjustment.	
1.12.7	Process Connection	1/2" NPT (M) bottom / back connected.	
1.12.8	Switch configuration	Two SPDT.	
1.12.9	Switch rating	240V, 5A AC/220V, 0.5A DC.	
1.12.10	Switch type	Snap acting type contacts, shock and vibration proof.	
1.12.11	Terminal Blocks	Suitable for full ring lugs for cable	

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		connection.	
1.12.12	Cable Connection	½" NPT conduit connection or compression gland.	
1.12.13	Performance	(a) Repeat accuracy $\pm 1.0\%$.	
		(b) Accuracy of set point Indication: $\pm 1.5\%$	
1.12.14	Operating Ambient	0 - 50 °C (Maximum Continuous).	
1.12.15	Enclosure	IP-65.	
1.12.16	Accessories	(a) Snubbers for pulsating fluid application.	
		(b) Syphons for steam and hot water services.	
		(c) Retention ring and screws for surface mounting.	
		(d) 1/2" NPT 3-Valve SS-316 manifold constructed from barstock.	
		(e) 1/2" NPT Cable gland.	
1.12.17	Nameplate	Tag number, service engraved in stainless steel tag plate.	
1.12.18	Remote Seal type for special application	(a) Silicone oil/fluorolube filled remote diaphragm seal for dirty/viscous/corrosive fluid.	
		(b) SS armoured capillary at least 3 meters each.	

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		(c) Adapter flanges with nuts, bolts and gaskets for instrument and process side.	
1.13	<u>LEVEL SWITCH</u>		
1.13.1	Type	External cage float operated. Magnetically coupled.	
1.13.2	Float Material	AISI-316 stainless steel or better.	
1.13.3	Other wetted parts	AISI-316 stainless steel or better.	
1.13.4	External Cage	Carbon steel/Stainless steel as per process requirements, welded type/ flanged construction. Cage pressure rating shall equal or exceed the rating of the main vessel.	
1.13.5	External cage mounting	Side-Side.	
1.13.6	External cage connection	25 NB socket welded.	
1.13.7	Switch housing	Epoxy coated die-cast aluminium alloy with neoprene gasket conforming to IP-65.	
1.13.8	Type of switch configuration	2 SPDT (two nos.).	
1.13.9	Contact rating	5A, 240V/AC, 0.25A, 220V DC.	
1.13.10	Accessories	(a) Counter flange, nuts & bolts, suitable gasket etc.	
		(b) Steel globe type drain valve.	
		(c) ½"NPT cable gland.	
		(d) Stainless steel nameplate with	

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		alpha-numeric engraved for service and tag.	
1.13.11	Preferred feature	Switch operating point marked on cage.	
1.13.12	Mounting	On standpipe.	
1.14	<u>CONDUCTIVITY TYPE LEVEL SWITCH</u>		
1.14.1	Type	Conductivity discrimination.	
1.14.2	Application	Drain pots viz. on CRH line.	
1.14.3	Mounting	Flanged – on external cage.	
1.14.4	Probe MOC	Stainless steel with high purity ceramic.	
1.14.5	Probe rating	> Maximum design pressure of vessel.	
1.14.6	Input	Four independent channel with selectable switching threshold for water conductivity.	
1.14.7	Relay Output	Four isolated output relays for Hi, Lo, Hi-Hi, Lo-Lo.	
1.14.8	Contact type & rating	2 SPDT or 1 DPDT @ 5A 30V DC.	
1.14.9	Local Display	Coloured LEDs for Hi, Lo, Hi-Hi, Lo-Lo, Power & fault.	
1.14.10	Power supply	Dual 240V AC, 50 Hz, 1Ph.	
1.14.11	Enclosure	IP-65, corrosion resistant & wall mounting type (Explosion proof for NEC Class-1, Division-1 area).	

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1.14.12	Accessories	(a) PTFE cable from probe to electronics.	
		(b) Mounting accessories.	
		(c) External cage.	
		(d) Washer & gasket.	
1.14.13	Test pressure	(e) Two times rated pressure.	
1.14.14	Cable connection	(f) ½" NPT with cable gland.	

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1.18	<u>GAUGE GLASS</u>	
1.18.1	Type	Reflex.
1.18.2	Glass	Toughened borosilicate Resistant to mechanical and thermal shocks.
1.18.3	Body material	Carbon steel / stainless steel - As per process requirements (Flanged Connection).
1.18.4	Pressure rating	Twice the maximum working pressure.
1.18.5	Temperature rating	As required.
1.18.6	Bolts and nuts	Rust proof alloy steel.
1.18.7	Accessories	Suitable ball check valves of SS-304 /316 body, gaskets, companion flange etc.

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1.26	<u>RADAR TYPE LEVEL MEASUREMENT</u>	
1.26.1	Type	Radar based on Time Domain Reflectometry.
1.26.2	Antenna	Co axial / single rod type guided wave or Horn type as required for the application.
1.26.3	Communication	Two wire 4-20mA DC, HART protocol.
1.26.4	Environmental temperature	0 – 50 °C.
1.26.5	Enclosure	Explosion proof/IP 65 as per application.
1.26.6	Cable Entry	½" NPT.
1.26.7	Calibration	Self calibration with internal reference.
		Zero & Span calibration.
1.26.8	Programming	Handheld programmer & Local keypad.
1.26.9	Process Connection	Flanged /screwed.
1.26.10	Electronic Housing	Epoxy painted Die-Cast aluminium alloy.

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1.26.11	Antenna / Flange assembly	316 SS or Hest alloy. (as required)	
1.26.12	Output Indicator	Digital Integral Display.	
1.26.13	Accuracy	5 mm or 0.1% of probe length.	
1.26.14	Accessories	(a) Programming tool kit.	
		(b) Gasket.	
1.27	<u>ULTRASONIC LEVEL TRANSMITTER</u>		
1.27.1	Principle of operation	Detection of reflected ultrasonic pulse, HART Protocol	
1.27.2	Measuring ranges	Up to 30 meters (typical)	
1.27.3	Signal processing	Microprocessor Controlled Signal Processing	
1.27.4	Operating frequency	10 KHz to 50 KHz (typical)	
1.27.5	Display	Large alpha-numeric back lit LCD/ LED	
1.27.6	Calibration & Configuration	Accessible from front of panel	
1.27.7	Diagnosis	On-line	
1.27.8	Status	For power, Hi/Lo/V. Hi/V. Lo - level indication, fault etc.	
1.27.9	Construction	Plug-on board	
1.27.10	Power supply	240 V AC 50 Hz / 24V DC	
1.27.11	Signal Output	4-20 mA DC - 600 Ohm load.	

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1.27.12	Hysteresis	Fully adjustable preferred	
1.27.13	Output contacts	2 SPDT Potential free changeover contacts @ 240V, 5A AC/220V, 0.5A DC.	
1.27.14	Accuracy & Repeatability	0.25% of span or better	
1.27.15	Resolution	0.1% of span	
1.27.16	Operating Temperature	Transmitter- 50 °C and Sensor – 80 °C	
1.27.17	MOC Sensor	Body- PVC and Face – Polyurethane	
1.27.18	Humidity	1% to 95% non condensing.	
1.27.19	Enclosure	IP-65 Epoxy painted die cast aluminium or Polycarbonate housing.	
1.27.20	Cable connection	3/4" ET	
1.27.21	Mounting	2" for sensor and Transmitter on panel.	
1.27.22	Accessories	Cable gland, prefab cable, mounting accessories.	
1.28	<u>CAPACITANCE TYPE LEVEL SWITCH</u>		
1.28.1	Type	Capacitance type	
1.28.2	Probe	(i) Rod or suspended electrode	
		(ii) Rope type probes may be used only where required probe length is greater than 3 meters.	
1.28.3	Probe Mounting	Stainless steel 1½" ANSI RF Flange / ¾" NPT (M)	

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1.28.4	Material of construction	316 SS	
1.28.5	Insulation	PTFE Part/ Full as per service.	
1.28.6	Enclosure	Powder/Epoxy coated Die cast aluminium with neoprene gasket conforming to IP-65. (Explosion proof for NEC Class-1, Division 1 area).	
1.28.7	Ambient temperature	0-60 °C.	
1.28.8	Mounting	On Tap	
1.28.9	Supply voltage	240V AC, 50Hz /24V DC	
1.28.10	Relay output	2 SPDT	
1.28.11	Contact rating	240V, 5A AC /220V, 0.5A DC.	
1.28.12	Response time	100 mSec or better	
1.28.13	Cable connection	¾" ET	
1.28.14	Accessories	Counter flange, Cable gland, prefab cable and stainless steel name plate engraved with alpha-numeric.	

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1.39	<u>LEVEL GAUGE (FLOAT & TAPE)</u>	
1.39.1	Type	Float and Tape
1.39.2	Float & Tape MOC	AISI 316
1.39.3	Pulley material	Aluminium
1.39.4	Guide wire	SS 316 Stainless steel
1.39.5	Accuracy	± 2 mm
1.39.6	Indication	On circular or vertical dial
1.39.7	Rating	Twice the design pressure

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2.0	<u>CONTROL PANELS/DESK MOUNTED INSTRUMENTS AND ELECTRICAL SYSTEM ACCESSORIES</u>	
2.1	<u>COUPLING RELAY</u>	
2.1.1	Type	Octal base plug-in type/ DIN rail Mounting.
2.1.2	Coil voltage	24 V D.C. in general / other as required.
2.1.3	Contact	2 NO & 2 NC (Minimum).
2.1.4	Contact rating	250 V/5A (A.C)/220V/2A (D.C).
2.1.5	Operating range	70 to 110% of rated voltage.
2.1.6	Insulation	2 kV for 1 minutes between terminal & earth.
2.1.7	Mechanical life	20 million operations.
2.1.8	Coil protection	Diode.
2.1.9	Indication	Coil on LED.

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2.1.10	Enclosure	Transparent cover.	
2.1.11	Connection	Screw terminals.	
2.1.12	Mounting	Projection mounting inside panel / DIN rail mounting.	
2.2	<u>DISTRIBUTION BOARDS</u>		
2.2.1	Type	Fixed, Modular.	
2.2.2	Power distribution	Through MCCB.	
2.2.3	Enclosure	Sheet Steel, IP54.	
2.2.4	Mounting	Free standing (Can be attended from both front & back).	
2.3	<u>RECEIVER RECORDER</u>		
2.3.1	Type	Microprocessor Based continuous video chart type. (Paper less)	
2.3.2	Display type	320 x 240 pixels high resolution coloured LCD graphics.	
2.3.3	Number of pen	2/4 as applicable.	
2.3.4	Input	4-20mA DC/1-5 Volt/ RTD/ Thermocouple.	
2.3.5	Display span rate	1, 5, 10, 20, 30 and 60 min / div. Selectable.	
2.3.6	Digital indication	Measured values with engineering unit.	
2.3.7	Trends	Coloured display on screen.	

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2.3.8	Colour of trends	Selectable.	
2.3.9	Performance		
(a)	Accuracy	$\pm 0.1\%$ of span or better. (Indication & Recording)	
(b)	Updation rate	1 Sec or better.	
2.3.10	Input open circuit	Up/Down Scale. (selectable)	
2.3.11	Reference Junction Compensation	Built-in cold junction compensation for thermocouple inputs.	
2.3.12	Power Supply	240 Volt, 1 Ph, 50 Hz A.C.	
2.3.13	Operating ambient temperature range	0-50 °C. (maximum)	
2.3.14	Face Dimension	144 mm (W) x 144 mm (H).	
2.3.15	Depth	300 mm (typical).	
2.3.16	Construction	Case - drawn steel, Bezel- Polycarbonate.	
2.3.17	Readable distance	3 meters (minimum)	
2.3.18	Mounting	Flush panel.	
2.3.19	Accessories	Engraved phenolic nameplate affixed to front flange to identify each recorder by tag number and each pen by color and measured variable. Shunt resistors, Ethernet port, RS232/422a/ 485 port.	
2.3.20	Features	(i) Hi, Hi-Hi, Lo and Lo-Lo contacts each channel.	

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2.3.21		(ii) 2 MB memory for Data acquisition and 100 MB Zip disk.	
		(iii) 3 ½" Floppy disk.	
		(iv) Computation functions like linear scaling, square root, differential and engineering unit and all other mathematical functions.	
		(v) Memory status display, LCD backlight saver.	
		(vi) Event sampling typically 125, 250, 500 msec.	
2.4	<u>MULTIPOINT RECORDER</u>		
2.4.1	Type	Microprocessor Based continuous video chart type. (Paper less)	
2.4.2	Number of Points	6,12 or 24. (as required)	
2.4.3	Input	4-20 mA/1-5V/Thermocouple/RTD.	
2.4.4	Recording	Channel number or dot with different color for each channel.	
2.4.5	Point Selection	Programmable for any combination of points by selection.	
2.4.6	Readable Distance	3 meters. (minimum)	
2.4.7	Data Display	Channel number, alarm status, measured data and engineering data (or Programming Display) in green LEDs.	

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2.4.8	Face Dimension	(i) 144 x 144 mm (approx.) for 6 point.	
		(ii) 252 x 206 mm (approx.) for 12 point.	
		(iii) 305 x 380 mm (approx.) for 24 point.	
2.4.9	Reference Junction Compensation	Built-in.	
2.4.10	Mounting	Flush Panel.	
2.4.11	Performance		
(a)	Accuracy	± 0.5% of span or better.	
(b)	Ambient Temperature effect	± 0.3% of span for 10 °C variation or better.	
(c)	Supply voltage variation effect	± 0.2% of span for 10% variation in supply voltage or better.	
(d)	Frequency variation effect	± 0.1% of span for 2 Hz variation in frequency or better.	
(e)	Operating Position effect	± 0.1% of span for 0-30 Deg. inclined or better.	
2.4.12	Input Open Circuit	Up/Down Scale.	
2.4.13	Power Supply	240 Volt, 1 Phase, 50 Hz AC.	
2.4.14	Operating Conditions :-		
(a)	Temperature	0-50 °C.	
(b)	Relative Humidity	25%-90%.	

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(c)	Supply Voltage	-15% to +10%.	
2.4.15	Accessories	Engraved phenolic nameplate affixed to front flange to identify each recorder by tag number and each pen by color and measured variable. Shunt resistors, Ethernet port, RS232/422a/485 port.	
2.4.16	Preferred Features	(i) Hi, Hi-Hi, Lo and Lo-Lo contacts for each channel.	
		(ii) 2 MB memory for Data acquisition and 100 MB Zip disk.	
		(iii) 3 ½" Floppy disk.	
		(iv) Computation functions like linear scaling, square root, differential and engineering unit and all other mathematical functions.	
		(v) Memory status display, LCD backlight saver.	
		(vi) Event sampling typically 125, 250, 500msec.	
2.5	<u>BAR GRAPH INDICATOR</u>		
2.5.1	Type	Bar graph.	
2.5.2	Number of channels	One/Two (as required)	
2.5.3	Input	4-20 mA/1-5 V/Thermocouple/RTD.	
2.5.4	Indication	Green LED / LCD.	

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2.5.5	Scale	100 mm vertical one for each channel graduated in engineering unit. (linear scale)	
2.5.6	Readable Distance	3 meters. (minimum)	
2.5.7	Mounting	Flush panel.	
2.5.8	Face Dimension	36(W) x 144(H) mm (approx) / 72 x 144 (H) mm.	
2.5.9	Resolution	1% of scale or better.	
2.5.10	Power Supply	240V, 1 Phase, 50 Hz AC.	
2.5.11	Operating Conditions :-		
(a)	Temperature	0-50 °C.	
(b)	Relative Humidity	5%-95%.	
(c)	Supply Voltage	-15% to +10%.	
2.5.12	Connection between Indicator and Tray	Prefab Cable.	
2.5.13	Accessories	(i) Mounting Tray.	
		(ii) Engraved phenolic nameplate affixed to front flange to identify each indicator by tag number and each point by measured variables.	
2.5.14	Alarm Facility	1 HI and 1 LO for each channel independently adjustable over span. Voltage free outputs.	
2.5.15	Reference Junction Compensation	Built-in cold junction compensation for	

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		thermocouple inputs.	
2.5.16	Feature	(i) Alarm level indication by flashing Cursor.	
		(ii) Green Digital display of parameter value in front panel with a 3.1/2 digit display.	
2.6	<u>VALVE POSITION INDICATOR</u>		
2.6.1	Input	4-20 mA DC/1-5 Volts DC.	
2.6.2	Indication	Pointer and Scale. Moving Coil Meter.	
2.6.3	Readable Distance	3 meters (minimum)	
2.6.4	Pointer Deflection	90 Deg Sector or linear.	
2.6.5	Mounting	Flush Panel (Horizontal/vertical)	
2.6.6	Accuracy	±1% or better.	
2.6.7	Protection Class	IP-42.	
2.6.8	Operating Ambient Temp.	0-50 °C.	
2.6.9	Scale	0-100%.	
2.6.10	Bezel Size	DIN Standard.	
2.7	<u>DIGITAL INDICATOR</u>		
2.7.1	Type	Four and half digit LED seven-segment display with sign.	
2.7.2	Face Dimension	72 x 144 mm / 48 x 96 mm. (as applicable)	
2.7.3	Display Character	13.8 mm, Green. (LED)	

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2.7.4	Accuracy	0.1% of reading, ± 2 digit.	
2.7.5	Input	4-20Ma DC/1-5 V DC/ RTD/ Thermocouple.	
2.7.6	Mounting	Flush Panel.	
2.7.7	Power Supply	240V $\pm 10\%$, 50 ± 2.5 Hz.	
2.7.8	Output Contact	2 nos SPDT, contact rating 5A at 240V AC/ 0.25A at 220V DC.	
2.7.9	Power/Signal Connection	Screwed.	
	Large Display (150x300 mm) indicators shall be provided for MW, MVAR and frequency indications.		
2.8	<u>TOTALIZER / COUNTER</u>		
2.8.1	Type	Electronic.	
2.8.2	Number of digits and digit size	Six, 9 mm high.	
2.8.3	Input	4-20mA DC.	
2.8.4	Reset	Manual.	
2.8.5	Readable distance	3 meters. (minimum)	
2.8.6	Mounting	Flush.	
2.8.7	Performance		
(a)	Accuracy	$\pm 0.5\%$ of span.	
2.8.8	Operating ambient temp.	0 - 50 $^{\circ}\text{C}$.	
2.8.9	Accessories	Engraved phenolic nameplate affixed to front flange to identify tag number and measured variable.	

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SR. NO.	ITEM	DESCRIPTION	
2.8.10	Preferred Features	Power supply on/failure LED visible from front.	
2.9	<u>PUSH BUTTON</u>		
2.9.1	Type	Shrouded square format.	
2.9.2	Face Dimension	32 x 32 mm (maximum)	
2.9.3	Contact Configuration	2 NO + 2 NC.	
2.9.4	Contact Addition	Add-on block up to 4 each with 2 pairs of contacts.	
2.9.5	Contact Material	Hard Silver Alloy.	
2.9.6	Contact Rating	500V / 10 A.	
2.9.7	Utilization Category	AC11 / DC11.	
2.9.8	Insulation Voltage	2 kV for 1 minute between terminals and earth.	
2.9.9	Mechanical Life	1 million operation.	
2.9.10	Construction	Aluminium shrouding with plastic lens.	
2.9.11	Colours	Red, Green, Yellow, Black, etc.	
2.9.12	Connection	Screw terminals.	
2.9.13	Enclosure Class	IP-52.	
2.9.14	Legend	Engraving.	
2.10	<u>ILLUMINATED PUSH BUTTON</u>		
2.10.1	Type	Square format.	
2.10.2	Face Dimension	32 x 32 mm. (maximum)	

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SR. NO.	ITEM	DESCRIPTION	
2.10.3	Contact Configuration	2 NO + 2 NC. (minimum)	
2.10.4	Contact Addition	Add-on-Block up to 4 each with 2 pairs of contacts.	
2.10.5	Contact Material	Hard Silver Alloy.	
2.10.6	Contact Rating	500 V/ 10A.	
2.10.7	Utilization Category	A C11 / DC11.	
2.10.8	Insulation Voltage	2 kV for 1 minute between terminals and earth.	
2.10.9	Mechanical Life	1 Million Operation.	
2.10.10	Lamp	LED with built-in resistors as required.	
2.10.11	Lamp Rating :		
(a)	Voltage	240 V AC.	
(b)	Watt	2 Watt (approx.)	
2.10.12	Lamp and Lens Replacement	From front.	
2.10.13	Construction	Transparent Plastic Lens.	
2.10.14	Colour	Red, Green, Amber, Yellow etc.	
2.10.15	Connection	Screw terminals.	
2.10.16	Enclosure Class	IP-52.	
2.10.17	Legend	Engraving.	
2.11	<u>SELECTOR SWITCH</u>		
2.11.1	Type	2/3/4 position stay put type with rotary lever actuator.	

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SR. NO.	ITEM	DESCRIPTION	
2.11.2	Face Dimension	32 x 32 mm. (maximum)	
2.11.3	Contact Configuration	4 pair of contacts.	
2.11.4	Contact Addition	Add-on-Block up to 4 each with 2 pairs of contact.	
2.11.5	Contact Material	Hard silver Alloy.	
2.11.6	Contact Rating	500 V/10 A.	
2.11.7	Utilization Category	AC11 / DC11.	
2.11.8	Insulation Voltage	2 kV for 1 minute between terminals and earth.	
2.11.9	Mechanical Life	1 million operation.	
2.11.10	Construction	Aluminium shrouding.	
2.11.11	Connection	Screw terminals.	
2.11.12	Enclosure Class	IP-52.	
2.12	<u>INDICATING LAMP</u>		
2.12.1	Type	LED with built-in resistor.	
2.12.2	Face Dimension	32 x 32 mm. (maximum)	
2.12.3	Voltage	240 V AC.	
2.12.4	Watt	2.5 Watt (approximate).	
2.12.5	Lamp and Lens Replacement	From front.	
2.12.6	Construction	Transparent Plastic lens.	
2.12.7	Colour	Red, Green, Amber, Yellow etc.	
2.12.8	Connection	Screw terminals.	

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SR. NO.	ITEM	DESCRIPTION	
2.12.9	Legend	Engraving.	
2.13	<u>INDICATING METERS (A.C)</u>		
2.13.1	Type	Rectifier type.	
2.13.2	Face Dimension	96 x 96 mm.	
2.13.3	Scale	Radial arc of 240 Deg.	
2.13.4	Accuracy	1.5% of full scale. ± 0.5 Hz for frequency meter.	
2.13.5	Input	0-1/0-5A for current measurement, 0-240V, 50 ± 2.5 Hz for voltage/ frequency measurement.	
2.13.6	Zero Adjustment	Screw on meter face.	
2.13.7	Enclosure	Shielded Case.	
2.13.8	Mounting	Flush Panel.	
2.13.9	End Scale Suppression	6 times the measuring range only for motor ammeters.	
2.14	<u>INDICATING METERS (D.C)</u>		
2.14.1	Type	Taut band moving coil.	
2.14.2	Face Dimension	96 x 96 mm.	
2.14.3	Scale	Radial arc of 240 Deg.	
2.14.4	Accuracy	1.5% of full scale.	
2.14.5	Input	0-75 mA for current measurement. Direct reading for voltage measurement.	

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2.14.6	Zero Adjustment	Screw on meter face.	
2.14.7	Enclosure	Shielded case.	
2.14.8	Mounting	Flush Panel.	
2.14.9	End Scale Suppression	2 times the measuring range only for motor ammeters.	
	For electrical system's meter and for synchronization, Bidder shall refer to electrical volume of the specification.		
2.15	<u>AUXILIARY RELAY</u>		
2.15.1	Type	Electromagnetic.	
2.15.2	Coil voltage	240 V A.C / 220V DC. For any other voltage bidder to make his own arrangement.	
2.15.3	Contact Configuration	2 NO & 2 NC (Minimum), additional contacts as per requirement with provision for additional contact block expansion.	
2.15.4	Contact rating	250V/5A. (A.C/D.C.)	
2.15.5	Operating range	80 to 110% of rated voltage.	
2.15.6	Insulation	2 kV for 1 minute between terminals & earth.	
2.15.7	Mechanical life	20 million operations.	
2.15.8	Coil protection	Diode/surge suppressor.	
2.15.9	Connection	Screw terminals.	
2.15.10	Mounting	Projection mounting inside panel.	

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SR. NO.	ITEM	DESCRIPTION
2.16	<u>ELECTRICAL TRANSDUCER</u>	
	Transducers shall be provided for conversion of AC electrical quantities such as voltage, frequency, current and power. Transducer shall be suitable for 220V DC auxiliary supply. Transducers shall be of low burden type having 4 – 20 mA DC linear galvanically isolated output compatible with secondary indicating instrument. Transducer shall be dual channel type. Accuracy class of Transducers shall be as per IS14570:1998 or IEC688 :992.	
2.17	<u>SYNCHROSCOPE</u>	
	Synchroscope shall be designed to provide an illuminate and indication of phase and frequency difference between bus voltage and Generator voltage. It shall denote the actual frequency difference corresponding to the inverse of time taken for one rotation of the illuminated vector spot. The instrument shall be designed for industrial applications, which require precise, reliable and robust instruments for the display range and indication. Synchroscope shall be designed as per the DIN/IEC/BS standards.	
2.18	<u>ANNUNCIATION</u>	
2.18.1	PLC based system alarm annunciation system shall be solid state/ microprocessor based and shall include all required logic sequence. Display part of the system shall have panel mounted facia LED array assemblies, sets of alarm accept, reset, mute and test push buttons and panel mounted audible devices.	
2.18.2	The system shall be immune to variations in the power supply and shall not generate spurious alarm when the system power is switched on (power-on-reset)	
2.18.3	Controller of the PLC/Microprocessor based control system shall be used for configuring the alarm	
2.18.4	10% wired spare channels & facia shall be provided in all cases	

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2.18.5	ANNUNCIATOR LOGIC		
	(a)	The circuit components for individual windows shall be mounted on plug -in circuit cards.	
	(b)	Input shall be provided with contact bounce filtering. The filter shall delay contact inputs for 15 milliseconds to protect against input device bounce and electrical noise on input lines.	
	(c)	Critical alarms shall be hardwired to the input card of annunciator controller.	
2.18.6	<u>OTHER TECHNICAL PARTICULARS</u>		
	(a)	Type of contact	NO or NC configurable
	(b)	Contact interrogation voltage	24 V DC
	(c)	Window drivers.	Electronically short circuit protected, current limiting with automatic recovery
	(d)	Facia dimension	75 mm (W) X 50 mm (H)
	(e)	LED per facia	8 nos./Window
	(f)	Flash rate	Adjustable (slow, fast, intermittent)
	(g)	Inscription Type	Etched on photo film (sandwiched)
	(h)	Inscription letter height	5 mm (min.)
	(i)	No. of row of inscription/ facia	4 (max.)
	(j)	No. of letters/row	14 (max.)

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	(k) Colour of letters	Black (for white windows)
	(l) Facia front cover	Hi-impact polystyrene
	(m) Facia rear plate	Translucent plastic
	(n) Colour of background	Milk white and red for critical / trip.
	(o) Fascia block plate	Cold rolled sheet steel epoxy painted.
	(p) Audible alarm	Cone type speaker
	(q) Tone generator	Electronic with adjustable tone, amplitude and frequency
	(r) Preferred sequence	(i) Ordinary Channel : ISA-S-18.1-1979-R
		(ii) First-up channel : ISA-S-16.1-1979- F3M3
NOTE: 1. Instruments which are open to atmosphere should be covered with proper canopy.		

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4.0 <u>CONTROL DESK / PANELS / RACKS</u> (a) Convenient and logical approach to operational interfaces and aesthetics in the overall view of the panel /desk shall be considered. (b) For items susceptible to vibration, suitable anti-vibration padding shall be provided to prevent damage or malfunction. (c) All items inside the panels/cabinets shall be neatly arranged with easy access/maintenance approach. (d) Incoming power supply feeders shall be duplicated . Alarm shall be provided for failure of a power supply feed. (e) Desk/panel shall be provided with interior illumination, utility receptacles with plug and cooling fan. (f) Panel/Desk shall have gland plate at cable entry to panel. Thickness of gland plate shall not be less than 3 mm. (g) Wire shall be routed/laid through covered trough. (h) Crating of the panels and desks shall be suitable for protection against shock, vibration, inappropriate handling and inclement weather conditions during transportation and warehousing. Mounted equipment shall have adequate protection against damage during handling, transit and storage. Suitable desiccant shall be used inside the packing case. (i) Nameplate (i) Nameplate shall be provided for instrument or device mounted on the panel. (ii) Nameplates for panels shall be provided both in front and rear. (j) All local control panels shall be housed in air condition environment.		

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4.1 <u>CONTROL DESK</u> 4.1.1 Devices mounted on the desk shall be flush type. Devices shall be so mounted that their removal and replacement can be accomplished without interruption of services to others. 4.1.2 Desk shall be ergonomically designed to suit working on a 24 X 7 basis. Aesthetics, ergonomics and illumination shall be considered while positioning of the desk, large video screen and panels in control room. 4.1.3 Control desk shall be free standing floor mounting type of table-top design with compartments for locating the hardware. Desk shall be constructed from aluminum extrusion with high pressure laminate MDF board for work surface of approved colour. Aluminium structure shall be anodized or powder coated paint finish. Thickness of sheet shall not be less than 3 mm. 4.1.4 Monitors with retractable keyboard, emergency push buttons shall be provided on the desk. Desk shall be arranged in arc-like shape without any sharp edges. Edges shall be extruded PVC or rounded post-formed laminate. 4.1.5 Desk shall be of modular, scalable and industrially ruggedized design and shall have Telephones and Intercom connections. 4.1.6 Desk shall have concealed cable trays for wire dressing. 4.1.7 Design shall include Earthing bolts. 4.1.8 Back installed items shall be suitably concealed from front view. 4.2 <u>BACK UP PANEL</u> 4.2.1 Construction shall be from sheet steel of thickness not less than 3 mm. 4.2.2 Electrical upright Panel construction & design shall be similar to back up panel. Control switches, meters, indicators, synchronizer, excitation control switch, annunciation window etc. along with associated mimic diagram, as recommended, shall be provided for manual synchronization of generator.		

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4.2.3 Cabinets/Enclosure/Panels (a) Material of construction : Cold rolled steel sheet. (b) Thickness of Sheet : (i) 2.0 mm for faces supporting instruments / terminals. (c) Construction : Welded throughout as per approved National Standards. (d) Panel height : 2300 mm. (approx) (e) (i) Corners : 7 mm inner radius. (ii) Dimensional : a. In height & length - 3 mm. (iii) Tolerances : b. In height between adjacent sections - 2 mm. : c. Total for a group - 6 mm. (f) Doors : Double, recessed, turned back edges. (i) Thickness of Sheet : 2 mm. (ii) Hinges : Stainless steel. (iii) Door latches : Three point type. (iv) Door gaskets : Neoprene rubber on fixed frame to result dust proof/weatherproof enclosure. (v) Opening of the doors : Outward. (vi) Louvers : With removable wire mesh to ensure dust and vermin proof. (g) Color of interior : Brilliant white. (h) Colour external : RAL 7032.		

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<table border="0"> <tr> <td>(i)</td> <td>Painting</td> <td>: Epoxy powder coated or better.</td> </tr> <tr> <td>(j)</td> <td>Gland plates</td> <td>: Removable 3 mm thick. (bottom)</td> </tr> <tr> <td>(k)</td> <td>Cable entry</td> <td>: Bottom.</td> </tr> <tr> <td>(l)</td> <td>Hardware</td> <td> : (i) Anti vibration pad- 15 mm. : (ii) Predrilled base channel ISMC - 10 or equivalent for all sides. : (iii) Stainless steel buff- finished 2 mm thick kick plate for all sides. : (iv) Stainless steel scratch strips along desk edges fixed with pan-head recessed screws. : (v) Rubber strips to ensure air tightness between kick plate and finished floor. : (vi) Lifting hook / Eye bolt. : (vii) Drawing pocket. : (viii) Door switch, lamps, thermostat, heaters and fans. </td> </tr> <tr> <td>(m)</td> <td>Enclosure Protection</td> <td>: As per environment condition of the area of installation. Refer section-1 of this vol.</td> </tr> </table>			(i)	Painting	: Epoxy powder coated or better.	(j)	Gland plates	: Removable 3 mm thick. (bottom)	(k)	Cable entry	: Bottom.	(l)	Hardware	: (i) Anti vibration pad- 15 mm. : (ii) Predrilled base channel ISMC - 10 or equivalent for all sides. : (iii) Stainless steel buff- finished 2 mm thick kick plate for all sides. : (iv) Stainless steel scratch strips along desk edges fixed with pan-head recessed screws. : (v) Rubber strips to ensure air tightness between kick plate and finished floor. : (vi) Lifting hook / Eye bolt. : (vii) Drawing pocket. : (viii) Door switch, lamps, thermostat, heaters and fans.	(m)	Enclosure Protection	: As per environment condition of the area of installation. Refer section-1 of this vol.
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(m)	Enclosure Protection	: As per environment condition of the area of installation. Refer section-1 of this vol.															
4.3	<u>LOCAL INSTRUMENT RACKS & ENCLOSURE</u>																
4.3.1	General Requirements																
(a)	Devices located in the field shall be grouped and installed in the enclosure (Closed Rack) in outdoor areas such as Boiler area etc. and in Open Type Rack in covered areas such as TG Building.																

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(b) Racks and enclosure shall be factory prefabricated & painted and shall complete with internal piping, tubing, manifold, isolation valves, blowdown valves, integral junction box, illumination etc., (c) No more than six instruments shall be grouped in a single rack/ enclosure. (d) Racks shall be installed above the tapping points for air, flue gas and coal air mixture application whereas for applications such as for water and steam, racks to be installed below the source point. (e) Attention shall be paid in the layout to avoid air traps in liquid piping and water accumulation in air/gas piping. (f) Welding of impulse lines shall comply with the provisions of the latest applicable ANSI Code for Pressure Piping. (g) Instrument piping and tubing shall be hydrostatically tested at one and one-half times the maximum system pressure except for low pressure and vacuum measurement for which the test pressure will be as per piping standard. (h) Service air connection shall be provided for continuous and intermittent purging of impulse pipe in dusty medium. Continuous purging shall be adopted for differential pressure measurement such as flue gas and coal air mixture application. Pressure measurement shall have only intermittent purging whenever required. In case of continuous purging, an air header shall be formed which shall receive service air through isolation valve and air filter regulator. Air shall be fed from the air header to both the impulse pipes near to take off points through isolation valves and flow regulators. Air header shall be constructed from stainless steel. Impulse pipe for such applications shall have a four-way valve. One port of the valve shall have an adaptor to connect flexible stainless steel braided nylon hose to the service air. Rating of the hose shall not be less than 10 Kg/sq.cm. Four way valve shall have two position operations. One position for service and other one for purging. Required pressure gauges shall be provided for monitoring of air pressure. Complete purging arrangement shall be integral to the enclosure and racks.		

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(i) Gate or ball type (full ported) instrument isolation valve and globe type blow down drain valve adequate for duty requirement and for withstanding continuous design pressure and temperature of main process medium shall be provided in the hook up plumbing. For process pressure equal or above 40 kg/ sq.cm single instrument isolation valve and double blowdown valves shall be used before connecting to blowdown header. Whereas for line pressure less than 40 kg/sq.cm, single instrument isolation valve and single blow down valves can be used before connecting to blow down header. Instrument manifolds shall be non integral and shall be installed close to the instrument. (j) Drawing No. PE-189-IN-SK-8004/P0 (Sheets 10) shall be referred for typical arrangement of Local instrument enclosure and rack. 4.3.2 Closed Instrument Rack (a) Enclosure shall be free standing type. Racks shall be adequately reinforced to ensure true surfaces and to provide support. Major load-bearing posts shall be suitably supported by gusset plates or moment members. (b) Enclosure outer shall be constructed from at least 3 mm thick steel plate and epoxy painted to shade gray. Base frame shall be made of ISMC 100 and black color finish. (c) 2" NB galvanized pipes shall be laid horizontally and supported at two end channels to mount transmitters at accessible height. Center posts or any member, which would reduce access, shall be avoided. (d) Double leaf interlocking front opening doors with three point locking shall be provided and shall be arranged for maximum possible access to the interior. Key shall be of identical for all enclosures. (e) Doors shall have concealed quick removal type pinned stainless steel hinges and locking handles. Gaskets shall be used between all mating sections to achieve dust and weather proof enclosure rated for IP-65 including the internal junction box.		

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(f) Removable type bulkhead plates of thickness not less than 6 mm shall be mounted at the racks with suitable high temperature gasket. Impulse lines within the enclosures shall be properly clamped. (g) All internal wirings between the instruments and junction box shall run through flexible conduits. (h) Racks shall have a common blowdown drain header, which will connect individual instrument blowdown line after suitable pressure breaking through regulating globe type blowdown valves. Header shall be of 2" NB ASTM A 106, Sch-80 Gr. C installed at a slope of 1:25 and extended beyond the rack for connection to plant drain header. (i) Each rack shall be provided with one receptacle, light fixtures each at instrument & Junction box compartments with wire guard. 4.3.3 Open Instrument Rack (a) Rack shall be free standing type constructed from 6 mm thick steel channel frame provided with a canopy to protect the instrument from dripping water or falling objects and shall be epoxy painted. Rack Major load-bearing posts shall be suitably supported by gusset plates or moment members. Suitable protective grill shall be welded to the end-posts of the rack to outline a boundary beyond which no mounted equipment shall project. Canopy shall be of CRCA steel sheet of at least 3 mm thickness. Center posts or any member, which would reduce access, shall be avoided. (b) 2" NB galvanized pipes laid horizontally and supported at two end channels shall be employed at working accessible height for mounting of instruments. (c) All internal wirings between the instruments and junction box shall run through flexible conduits. No exposed wirings are admissible. (d) All racks shall have a common blowdown drain header, which will connect individual instrument blowdown line after suitable pressure breaking through regulating globe type blowdown valves. Header		

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shall be of 2" NB ASTM A 106, Sch-80 Gr. C installed at a slope of 1:25 and extended beyond the rack for connection to plant drain header. 4.3.4 Junction Box Junction boxes of metallic construction. (a) Junction box shall be provided at a dry compartment at one side of the enclosure/rack with front opening type door. Junction box shall be of sheet steel construction with thickness not less than 2 mm. Earth stud shall be furnished at rack for safety grounding. (b) Terminals shall be screwless cageclamp type of reputed make and 20% spare terminals shall be furnished in the junction box.		

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11.1.1 Electrical Junction Box (a) Type of Enclosure : Dust tight & weatherproof conforming to IP 65. (b) Material : 3 mm sheet steel (c) Type of Cover : Solid unhinged with retention chain. (d) Paint : External - RAL 7032, Internal – Brilliant White. (e) Mounting : Surface (f) Cable Entry : 3 mm (min) Gland plate (g) Gasket : Neoprene (h) Grounding : Brass earth lug with green screw head External-2 nos , Internal-1no.M6. (i) Number of Drain Holes : Two at bottom capped. (j) Identification : Label for JB and Tags for cable. (k) Accessories : (i) Rail mounted cage clamp type screwless terminals with markers. : (ii) Cable gland : (iii) Ferrules : (iv) Canopy at top 11.1.2 Cable Gland (a) Type : Double compression (b) Entry Thread : NPT		

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(c) Material : Brass (d) Finish : Cadmium Plated (e) Protection : IP 54 or better (f) Accessories : Neoprene gasket, locknuts, reducers etc. 11.1.3 Cable Tray (a) Material : Mild steel, slotted (b) Thickness : not less than 2.0 mm (c) Finish : Hot dip galvanized (d) Perforation : As per MFR standard (e) Cover : Suitable for tray 11.2 <u>PROCESS HOOK UP ACCESSORIES & SPECIFICATION</u> Material and rating of the hook up items shall suit the piping and fluid condition. Hook up materials shall be IBR certified for applicable cases. Bidder shall furnish hook up drawings and the drawings for open racks & closed racks for owner’s approval. 11.2.1 Seamless Stainless Steel Pipe (a) Reference : ASTM A-312 TP 316 (b) Material Grade : TP 316 (c) Type : Seamless /Plain end (d) Size : ½” NB (e) Schedule : 40 (f) Standard Length : 5 meter		

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11.2.2 Stainless Steel Pipe Fittings (a) Reference : ASTM A-182 F 316 / ANSI B16.11 (b) Type : Forged (c) Rating : 3000 lbs / 6000 lbs / 9000 lbs (d) Size : ½" NB (e) End connection : Generally socket weld (f) Type of Fittings : Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc. 11.2.3 Seamless Stainless Steel Tube (a) Reference : ASTM A-213 TP 316 (b) Material Grade : TP 316 (c) Size : ½" OD X 2.1 MM Thick (d) Type : Cold drawn annealed, pickled, passivated, de-scaled, hydraulically cleaned seamless tube. (e) Properties : The tube shall be free from scratches and suitable for bending and capable of being flared by hardened and tapered steel pin. The expanded tube shall show no crack or rupture. Hardness shall be RB 80. (f) Test Pressure : 400 Kg/Sq. cm (minimum) (g) Tolerance : ± 0.13 mm for outside diameter		

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± 15 % for wall thickness. (h) Standard Length : 5 meter (i) Test : Flare, Hardness, Ball and Bubble Test. 11.2.4 Stainless Steel Tube Fittings (a) Reference : ASTM-A-182 (b) Type : Double ferrule double compression. (c) Material : 316 Stainless steel forged. (d) Ferrule : 316 Stainless Steel. (e) Type of Fittings : Male/female connector, elbow, cross /equal tee, straight connector, bulkhead union, ferrule etc. as required to suit installation. (f) Size : To suit SS tubing and NPT end connection. 11.2.5 C.S. Pipe (a) C.S. Pipe : ASTM-A 106 Gr. C (b) Material : Cold drawn seamless black C.S (c) Type : Seamless/Plain ends. (d) Size : ½" NB (e) Schedule : 80, 160, XXS as required. (f) Standard Length : 6 meter		

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11.2.6 C.S. Pipe Fittings (a) Reference : ASTM-A 105/ANSI B16.11 (b) Type : Forged (c) Rating : 3000 lbs/6000 lbs/9000 lbs (d) Size : ½" NB (e) End connection : Generally socket weld. (f) Type of Fittings : Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc. 11.2.7 A.S. Pipe (a) Reference : ASTM-A 335 P22 AS PER ANSI B 36.10 (b) Material : Cold drawn seamless A.S (c) Type : Seamless / Plain ends (d) Size : ½" NB (e) Schedule : XXS (f) Standard Length : 5 meter 11.2.8 A.S. Pipe Fittings (a) Reference : ASTM-A 182 F22 AS PER ANSI B 16.11 (b) Type : Forged (c) Rating : 9000 lbs (d) Size : ½" NB		

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(e) End connection : Generally socket weld (f) Type of Fittings : Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc. 11.2.9 Carbon Steel Globe Valve (a) Reference : ASTM A-105 (b) Type : Globe (c) Construction : Forged Body Cadmium Plated. (d) End Connection : ½" Socket Weld (e) Rating : CL. 800 / CL. 2500 (f) Material : Body - Carbon steel Stem - Hardened Steel Plug - AISI 316 SS Seat- Stainless steel stellited (g) Packing : Teflon / Grafoil as required (h) Yoke : ASTM A105 (i) Handwheel : Carbon steel (j) Design standard : As per ANSI B 16.34		
11.2.10 Stainless Steel Globe Valve (a) Reference : ASTM A-182 F316 (b) Type : Globe (c) Construction : Forged Body (d) End Connection : Socket Weld (e) Proof Pressure : 400 Kg/Cm2 (f) Material : Body - Stainless steel		

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Stem - Hardened Steel Plug - AISI 316 SS Seat- Stainless steel stellited (g) Packing : Teflon as required (h) Yoke : ASTM A182 F316 (i) Handwheel : Carbon steel (j) Design standard : As per ANSI B 16.34 11.2.11 Alloy Steel Globe Valve (a) Reference : ASTM A-182 F22 (b) Type : Globe (c) Construction : Forged Body (d) End Connection : ½" Socket Weld (e) Rating : CL. 2500 (f) Material : Body - Alloy steel Stem - Hardened Steel Plug - AISI 316 SS Seat- Stainless steel stellited (g) Packing : Grafoil as required (h) Yoke : ASTM A182 F22 (i) Handwheel : Carbon steel (j) Design standard : As per ANSI B 16.34 11.2.12 Condensate Pot (a) Reference : ASTM A182 F22 /ASTM A105 (b) Material : Alloy steel/carbon steel as per applicatio		

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(c) Construction : Drilled from bar stock (d) End connection : 3 nos. ½" socket weld end (e) Accessories : Vent valves 11.2.13 Instrument Valve Manifold (f) Type : (i) Two valve manifold : (ii) Five valve manifold (g) Mounting : Remote 2" Pipe Mounting (h) Construction : Single block (bar stock) (i) Material : Forged body and bonnet AISI 316 stainless steel. (j) Ports : 1/2 " NPT (F) (k) Rating : 420 Kg/Sq. cm at ambient (l) Operating Temperature : (-) 30 to (+) 170 Deg C (m) Packing : PTFE Wafer (n) Seat & Stem : AISI 316 SS (o) Plug : AISI 316 SS free to turn on stem/17-4 PH. (p) Handle Bar : AISI 316 SS (q) Connection : Straight (r) Accessories : (i) Plugs for all ports. : (ii) Mounting Bracket , bolts , nuts.		

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11.3	<u>PNEUMATIC HOOK UP ACCESSORIES</u>		
11.3.1	Air Header :		
	(a) Technical Particulars	:	For Panel For Field
	(b) Material of Construction	:	Stainless steel Stainless steel
	(c) Inlet Connection	:	2" NPT (M) 1" NPT (M)
	(d) Header Take-off	:	Stainless steel Stainless steel
	(e) Take off connection	:	1 / 2" NPT (M) 1 / 2" NPT (M)
	(f) Tube Take-off	:	Tube adapter on valve Tube adapter on valve
	(g) Drain	:	SS drain valve at lowest point SS drain valves at lowest poin
11.3.2	Seamless Stainless Steel Tube		
	(a) Reference	ASTM A-269 TP 316	
	(b) Material Grade	TP 316	
	(c) Size	¼" OD X 0.049" wall thickness.	
	(d) Type	Cold drawn annealed, pickled, passivated, de-scaled, ,hydraulically cleaned seamless tube.	
	(e) Properties	The tube shall be free from scratches and suitable for bending and capable of being flared by hardened and tapered steel pin. The expanded tube shall show no crack or rupture. Hardness shall be RB 80.	
	(f) Test Pressure	400 Kg/Sq. cm	

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(g) Tolerance ± 0.13 mm for outside diameter ± 15 % for wall thickness (h) Standard Length 5 meter (i) Test Flare, Hardness, Ball and Bubble Test		

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CHECK LIST FOR PRESSURE SWITCH

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks	
				M	C	B		
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	V	V		
	1.1 MODEL NO/TAG NO							
	1.2 RANGE							
	1.3 END CONN							
	1.4 NO. OF CONTACT							
2	CALIBRATION			P	V	V		
	2.1 REPEATABILITY							
	2.2 SET POINT ADJUSTMENT							
	2.3 DIFFERENTIAL							
3	OVER PR & LEAK TEST				P	V	V	
4	ELECT. INSULATION/HV TEST	ONE			P	V	V	
5	REVIEW OF TC FOR MATERIALS OF	FOR LOT			V	V	V	
	5.1 SENSOR							
	5.2 MOVEMENT							
	5.3 PROCESS CONNECTION							
	5.4 HOUSING							
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST		V	V	V		
7	REVIEW OF TC OF MICROSWITCH	FOR LOT		V	V	V		

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

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to carry out ROUTINE TEST on 100 %.
- Contractor to provide compliance certificate for tests/checks verified by contractor and the same alongwith test certificates to be verified by BHEL



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

CHECK LIST FOR TRANSMITTER

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECKS FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	VISUAL.						
	MODEL/TAG No						
2	PROCESS CONNECTION			P	W	V	
3	ACCURACY			P	W	V	
4	REPEATABILITY			P	W	V	
5	HYSTERESIS			P	W	V	
6	EFFECT OF TEMP VARIATION ON ACCURACY			P	W	V	
7	SPAN / ZERO ADJUSTMENT	ONE / TYPE		P	W	V	
8	EFFECT OF SUPPLY VOLTAGE VARIATION			P	W	V	
9	EFFECT OF LOADING (500 OHM METERS)			P	W	V	
10	HIGH PRESSURE TEST	SEE NOTE-1 BELOW		P	W	V	
11	BURN-IN TEST	ONE / TYPE		P	W	V	
12	DEGREE OF PROTECTION			P	W	V	
13	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		V	V	V	

Legend :

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

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- When material correlation are not available manufacturer's compliance to be provided.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



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

CHECK LIST FOR PRESSURE & DP GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	SENSOR TYPE						
	DIAL SIZE						
	MODEL NO/TAG NO						
	RANGE/SCALE						
	SWITCH CONTACT RATING & NOS.						
	END CONNECTION						
2	CALIBRATION	ONE		P	W	V	
	ACCURACY						
	REPEATABILITY						
	SET POINT ADJUSTMENT						
3	OVER PRESSURE & LEAK TEST	FOR LOT	P	W	V		
4	OPERATION OF PRESSURE. RELIEF DEVICE		P	W	V		
5	REVIEW OF TC FOR		V	V	V		
	MATERIALS OF SENSOR						
	MOVEMENT						
	PROCESS CONNECTION						
	HOUSING						
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST	V	V	V		
7	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW	V	V	V		

Legend :

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

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- When material correlation is not available, MFR's compliance to be provided
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



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

CHECK LIST FOR LEVEL GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS / DRWGS	P	W	V	
	TYPE						
	MODEL/ TAG NO.						
	DAIL SIZE						
	RANGE/SCALE						
	END CONNECTION						
2	DIMENSIONS, PROCESS CONNECTION	ONE / LOT		P	W	V	
3	ACCURACY			P	W	V	
4	MATERIAL TC FOR			P	V	V	
	BODY ISO.						
	VALVE						
	GAUGE GLASS						
5	HYD. TEST	SEE NOTE-1 BELOW		P	W	V	
6	ACCESSORIES AS APPLICABLE			P	W	V	

Legend :

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

Note :

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



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

CHECK LIST FOR ANNUNCIATORS

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	TYPE/ MODEL						
	DIMENSIONS OF HARDWARE						
	MODULARITY						
	SEQUENCE						
	FACIA DETAILS						
2	FUNCTIONAL TEST	100%		P	W	V	
3	IMMUNE TO STEP VARIATIONS IN THE POWER SUPPLY	SEE NOTE-1 BELOW		P	W	V	
4	DEGREE OF PROTECTION FOR ENCLOSURE	TYPE TEST		P	W	V	
5	I/R CHECK	SEE NOTE-1 BELOW		P	W	V	
6	RESPONSE			P	W	V	

Legend :

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

Note :

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

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	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
CONTROL PANELS SPECIFICATION		

7.10 PANELS, CUBICLES AND ENCLOSURES

7.10.1 General

- (a) All panels, cubicles and enclosures shall be furnished complete with integral piping, internal wiring, convenience outlets, internal lighting, grounding, ventilation, space heating, vibration isolating pads and other accessories.

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Unless otherwise specified cable entry for panels/desks/cabinets shall be through bottom via glanding plate. Fireproof seal shall be used to seal the bottom to prevent entry of dust. (b) Panels and cabinets shall be constructed from steel sheet reinforced as required to provide true surface and adequate support for devices mounted thereon. Thickness of the steel plate shall conform to the requirements of UL 50 or equivalent standard. Panels and cabinets shall be of adequate strength to support mounted components during shipment and to support a concentrated load of 100 Kilograms on their top after erection. (c) Panel/cabinet shall have eyebolt on top for lifting. 7.10.2 Surface Preparation and Painting Sheet metal exterior steel surfaces shall be sand blasted, ground smooth and painted as specified below: (a) Suitable filler shall be applied to all pits, blemishes and voids in the surface. The filler shall be sanded so that surfaces are level and flat; corners are smooth and even. Exposed raw metal edges shall be ground burr-free. The entire surface shall be blast clean to remove rust and scale. Oil, grease and salts etc. shall be removed from by one or more solvent cleaning methods prior to blasting. (b) Two spray coats of epoxy primer surface shall be applied to all exterior and interior surfaces, each coat of primer surface shall be of dry film thickness of 1.5 mil. A minimum of two spray coats of final finish colour (Catalyzed epoxy or polyurethane) shall be applied to all surface of dry film thickness 2.0 Mil. The finish colours for exterior and interior surfaces shall conform to the following shades: (i) Exterior – RAL 7032. (ii) Interior - Brilliant White.		

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(c) 7.10.3 Paint films, which show sags, cheeks, blisters, teardrops, fat edges or other painting imperfections shall not be acceptable. Wiring Wiring within the panels shall conform to NEC standards and shall be factory installed and tested at the works. All interior wiring shall be installed neatly. Features shall not be limited to the following: (a) All spare contacts of relays, switches and push buttons shall be wired up to the terminal blocks. (b) Each wire shall be identified at both ends with wire designation as per approved wiring diagram. Heat shrinkable type ferrules with indelible computerized print shall be used with cross- identification. (c) Wire termination shall be made with insulated sleeve and crimping type lugs. All external connections shall be made with one wire per terminal. Wire shall not be spliced or tapped between terminals. Open-ended terminal lugs shall not be used. (d) Internal wiring should be terminated uniformly on one side of the terminal block leaving the other side available for termination of outgoing cables. (e) Thermocouple lead wires, analyzer measuring lead wires, or any other lead wires carrying measuring signal of the order of low milli volt or micro volt shall be electrically and physically isolated from other AC and DC wiring. (f) All low-level signal cables shall be separately bundled from control cable. (g) Wires shall be dressed and run in troughs with clamp-on type covers. Wirings shall be neatly bunched in groups by non-metallic cleats or bands. Each group shall be adequately supported along its run to prevent sagging or strain on termination. (h) Shield wires shall be terminated on separately.		

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(i) Common connections shall be limited to two wires per terminal. (j) Wiring to door mounted devices shall be provided with multi-strand wires of (49 strands minimum) adequate loop lengths of hinge-wire so that multiple door openings will not cause fatigue to the conductor. (k) Wiring shall be arranged to enable instruments or devices to be removed and/or serviced without disturbing the wiring. No wire shall be routed across the face or rear of any device in a manner, which will impede the opening of covers or obstruct access to leads, terminals or devices. (l) Panel internal wiring shall follow distinct colour-coding to segregate different voltage levels viz. 24V DC, 48V, 110V AC, 240V AC, 220V DC etc. (m) Panels/cabinets /desks shall be provided with removable gasketed cable gland plates and cable glands. Split type grommets shall be used for prefab cables. (n) Wire shall be multistranded annealed flexible high purity copper conductor with heat resistant FRLS PVC insulation and shall pass vertical flame test per IPCEAS-1981. (o) Wire sizes used for internal wiring shall not be lower than the followings: (i) Control wiring : 1.5 Sq.mm (switches, pushbuttons etc.) (ii) Power supply/receptacle : 2.5 sq. mm or higher as /illumination wiring per load/ (iii) 4-20mA DC current : 0.5 Sq. mm and low voltage signal upto 24V DC		

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(p) Identification of conductors shall be done by insulation color-coding identified on drawings or by printed wiring lists. 7.10.4 Grounding (a) System cabinet AC and DC ground shall be electrically isolated from each other and also electrically isolated from the Instrumentation signal ground. All the above ground shall be individually connected to the single point on the ground pit. Dedicated redundant earth pit shall be provided which shall be away from the HV equipment. This earth pit shall not be shared with other electrical equipment ground and shall also be insulated from other electrical system ground to ensure single point grounding of the system. Grounding resistance shall be better than 1.0 ohm. IEEE guideline shall be followed while designing the grounding system. (b) Panels and cabinets shall be provided with a continuous tinned copper ground bus bar of minimum 25 mm x 6 mm cross section, extending along the entire length of the panel/desk/cabinet assembly. The ground bus shall be bolted to the panel structure and effectively ground the entire structure. (c) The panel/desk/enclosure /JB ground shall have two (2) bolt drilling with GI bolts and nuts at each end to connect to GI/ copper flat ground riser by means of insulated copper ground cable of required cross section with lug. (d) Circuits requiring grounding shall be individually and directly connected to the panel ground bus. (e) For electronic system cabinets, the electronic system ground bus shall be similar but insulated from the cabinet and shall be separately connected to the system ground. Signal cable shields shall be grounded at the panel end only and shall not be left open. The ground in between panels of a shipping section shall be firmly looped.		

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(f) Electrical meters, relays, transmitters and switching devices, operating at a voltage less than 50V may be grounded through the steel structure. 7.10.5 Panel/Cabinet/ Desk/Enclosures Environmental Protections (a) Panels, cabinets, desks, distribution boxes, junction boxes, terminal boxes and all other field mounted equipment / enclosures shall suit the environmental condition of the area and shall not be inferior than the requirement indicated in the following table: <table border="1"> <thead> <tr> <th>SR. NO.</th><th>LOCATION</th><th>ENCLOSURE TYPE</th></tr> </thead> <tbody> <tr> <td>(i)</td><td>Indoor type non- ventilated enclosure in non-hazardous area</td><td>IP-54.</td></tr> <tr> <td>(ii)</td><td>Indoor type ventilated enclosure in non-hazardous area</td><td>IP -42.</td></tr> <tr> <td>(iii)</td><td>Enclosure in Air conditioned area</td><td>IP-22 with suitable canopy at top to prevent ingress of dripping water.</td></tr> <tr> <td>(iv)</td><td>Outdoor type in non-hazardous areas</td><td>IP-55.</td></tr> <tr> <td>(v)</td><td>Outdoor in hazardous areas</td><td>As per requirements of the NEC Code for the location.</td></tr> </tbody> </table> 7.10.6 Terminal Blocks (a) Terminals shall be chromated galvanized DIN rail mounted screw less cage clamp type. Terminals shall have screwed connection for conductor cross-section above 2.5 mm². Terminal blocks shall conform to IEC 947-7-1.			SR. NO.	LOCATION	ENCLOSURE TYPE	(i)	Indoor type non- ventilated enclosure in non-hazardous area	IP-54.	(ii)	Indoor type ventilated enclosure in non-hazardous area	IP -42.	(iii)	Enclosure in Air conditioned area	IP-22 with suitable canopy at top to prevent ingress of dripping water.	(iv)	Outdoor type in non-hazardous areas	IP-55.	(v)	Outdoor in hazardous areas	As per requirements of the NEC Code for the location.
SR. NO.	LOCATION	ENCLOSURE TYPE																		
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CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: V
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(b) The characteristics of the terminal blocks shall be as follows: (i) High contact force, independent of conductor cross-section and large contact surface area. (ii) Self-loosening protection. (iii) Resistant to thermal aging and vibration. (iv) Low and constant voltage drop. (c) Tension spring shall be made of high quality, non-rusting, acid-resistant steel. The current bar shall be of tin-lead plated copper or brass. (d) Terminals shall be of non flammable suitable thermoplastic material such as polyamide. (e) Terminal blocks shall be mounted vertically in panels and cubicles with clearance for at least 100 mm between two sets and between wall and terminal block. (f) Terminal blocks shall be provided with white marking strips/self-adhesive marker cards. Power terminals shall have protection covers. (g) At least 20 percent spare unwired terminals shall be provided for all panels/cabinets /desks /junction box etc. This shall be in addition to 20% spare wired terminals of spare IO channels and 10% wired spare modules. (h) Bottom of the terminal block shall be at least 200 mm above the cable gland plate for bottom entry type panels. (i) For extending 24 V DC supply to panels, the size of the terminals shall be decided based on voltage drop and not based on current. (j) Other requirements of the terminal blocks are as follows:		

CONSULTANT : PROCON ENGINEERS

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(i) The last block in a rail-mounted assembly shall be closed with an end plate and end bracket. (ii) For visual and electrical separation of terminal groups, partition plates shall be provided, which can be push fitted after forming an assembly. (iii) Design shall permit testing of incoming and outgoing signals by using suitable test plug and socket without disconnecting the cable connections. (iv) It shall be possible to use jumper plugs through the test plug socket to connect adjacent terminals. (v) Where more than one connection to a terminal block is required, two tier terminals shall be used. (vi) Terminal blocks shall be of different colours depending on voltage levels. 7.10.7 Nameplates and Labels (a) Each item shall have permanently attached to it, in a prominent position, a rating plate of non-corrosive material upon which is to be engraved the manufacturer's name, equipment, type/model number, range, serial number, together with details of the loading conditions under which the item of plant in question has been designed to operate. (b) Such nameplates or labels are to be of white non-hygroscopic material with engraved black lettering, or alternatively of transparent plastic material with suitably colour lettering engraved on the back. (c) The nameplates shall be held by self-tapping screws. The size of nameplate shall be approximately 20 mm x 75 mm for equipment and 40 mm x 150 mm for the panels.		

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: V
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(d) Items of plant such as valves, which are subject to handling, are to be provided with an engraved chromium plated nameplate or label with engraving filled with enamel, suitably mounted or affixed with strong rustproof chain

(e) All such nameplates, instruction plates, lubrication charts etc. shall be with English inscriptions. exemption

8.0 METERING BASES AND CHART UNITS

The following system of units shall be followed for various displays and scales unless otherwise mentioned:

(a)	Pressure	:	Kg/cm ² .
(b)	Differential Pressure	:	mm of H ₂ O column/Kg/cm ² .
(c)	Draught	:	mm of H ₂ O column.
(d)	Vacuum	:	Kg/cm ² (abs)/mm of Hg column.
(e)	Temperature	:	Degree Celsius (°C).
(f)	Flow (Steam, Water)	:	Tonnes/hr, M ³ /Hr.
(g)	Flow (Oil)	:	M ³ /Hr, Litter/Hr.
(h)	Flow Air	:	Tonnes/hr/M ³ /Hr.
(i)	Density	:	gms/c.c.
(j)	Level	:	mm/%.
(k)	Conductivity	:	Siemens/cm.
(l)	Gas Analyzer	:	Percentage by weight or as specified in respective case.
(m)	Dissolved Oxygen/Silica /Sodium	:	ppm /ppb.

CONSULTANT : PROCON ENGINEERS



SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A	
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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 3.0 mm for load bearing sections (Mounted with instruments)
2.0 mm for doors and Not less than 2.0 mm for others
 - Panel Height: Not less than 2365 mm (Refer data sheet-A (No. PES-145A-DS1-0)
 - 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.



SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A	
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- 3.1.7 The class of protection shall be in accordance with IP-55 unless otherwise specified in the data sheet – A (No. PES-145-54A-DS1-0).
- 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 as given in data sheet-A (No. PES-145A-DS1-0). 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 as given in data sheet-A (No. PES-145A-DS1-0) 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 as specified in data sheet-A (No. PES-145A-DS1-0) 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 as called for in the data sheet-A (No. PES-145-54A-DS1-0). 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

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 no. PES-145A-DS1-0
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 No. PES-145A-DS2-0
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



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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.

8.0 APPLICABLE DATA SHEET FORMS

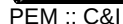
This document shall be read with one or more of the following data sheet forms :

- Data sheet A&B for Local Panels : Data sheet no. PES-145A-DS1-0
- Data sheet C for Local Panels : Data sheet no. PES-145A-DS2-0

बीएचएल PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL						STD QUALITY PLAN NO.: PE-QP-999-145-1056					
								VOLUME		IIB			
								SECTION		D			
								REV. NO.		01		DATE: 22-02-2008	
								SHEET		1		OF 7	
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks	
									P	W	V		
1.0	INCOMING Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	3	---	2		
		2. Bend Test	CR	Mech. test	Sample	IS:1079 IS:513	IS:1079 IS:513	Log Book	2	---	---		
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---		
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---	---		
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---	---		
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	1		
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	IS:2062	IS:2062	Log Book	2	---	---		
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---		
		3. Straightness	MA	Measurement	100%	Factory Std.	Factory Std.	Log Book	2	---	---		
		4. Mill marking	MA	Visual	100%	IS:2062	IS:2062	Log Book	2	---	1		
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---		
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---		
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics ^s P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. 1 - BHEL 2 - Vendor 3 - Sub-vendor													

 PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL						STD QUALITY PLAN NO.: PE-QP-999-145-I056				
								VOLUME IIB				
								SECTION D				
								REV. NO. 01 DATE: 22-02-2008				
								SHEET 2 OF 7				
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks
									P	W	V	
		3. Conductor a) Resistance b) Size c) Sheet colour	MA MA MA	Electrical Measurement Visual	100% 100% 100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---	
		4. Type / Routine Test Certificates	MA	Verification	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	3	---	2	
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc.	1. Verification at make and Type 2. Verification of Test Certificates 3. Operation / Functional check 4. I.R. 5. H.V. 6. Calibration 7. Pick up / Drop off Voltage	CR CR CR MA MA MA MA	Visual Scrutiny of Type / Routine T.Cs. Electrical Electrical Electrical Electrical	Sample 100% Sample+ 100% 100% 100% 100% 100%	BHEL Spec. and BOM Relevant IS Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue	BHEL Spec. and BOM Relevant IS Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue	Log Book Log Book Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2 2 2	--- --- --- --- --- --- ---	--- --- --- --- --- 1 ---	+ for relay & contactors only @ for all components except relays & contactors.
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics ^s P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. 1 - BHEL 2 - Vendor 3 - Sub-vendor												

 PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL						STD QUALITY PLAN NO.: PE-QP-999-145-I056					
								VOLUME		IIB			
								SECTION		D			
								REV. NO.		01		DATE: 22-02-2008	
								SHEET		3		OF 7	
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks	
									P	W	V		
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---		
		2. Surface defects	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---		
		3. IR / HV on Terminal Blocks	MA	Electrical	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---		
6.0	IN PROCESS Blanking / Bending / Forming	1. Dimensions	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---		
		2. Surface defects after bending	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	---		
7.0	Nibbling / Punching	1. Cutout Sizes	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---		
		2. Deburring	MA	Visual	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---		
8.0	ASSEMBLY Frame Assembly & Sheet fixing	1. Dimensions	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2		
		2. Alignment	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2		
		3. Welding Quality	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2		
		4. Surface defects	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2		
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics ^s P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. 1 - BHEL 2 - Vendor 3 - Sub-vendor													



STD QUALITY PLAN NO.: PE-OP-999-145-I056

IIB

D

01

DATE: 22-02-2008

4

OF

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks
									P	W	V	
9.0	Pre-treatment and Painting	1. Pretreatment Process	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		2. Process parameters like bath temp. concentration etc.	MA	Measurement	Periodic	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		3. Dipping / Removal Time	MA	Measurement	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		4. Surface quality after every dip	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		5. Primer after phosphating	MA	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		6. Putty Application & Rubbing after primer	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		7. Paint first coat	MA	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		8. Putty Application and Rubbing after first coat of paint	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1	

LEGEND: * CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

\$ P - Agency Performing the Test.
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V - Agency Verifying the Test.

- 1 - BHEL
- 2 - Vendor
- 3 - Sub-vendor

 PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL						STD QUALITY PLAN NO.: PE-QP-999-145-I056				
								VOLUME IIB				
								SECTION D				
								REV. NO. 01 DATE: 22-02-2008				
								SHEET 5 OF 7				
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks
									P	W	V	
10.	Panel Wiring	1. Wiring Layout	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		2. Wiring Termination (Crimped Lugs)	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		3. Ferrule numbers	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		4. Colour of wiring	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
		5. Size of Conductor	MA	Measurement	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
11.	Component Mounting	1. Correct components	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
		2. Fixing	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
12.	FINAL Final Inspection	1. Workmanship	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.
		2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		3. Components identification Marking / Name plates	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	

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^s P - Agency Performing the Test.
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3 - Sub-vendor

बी एच ई एल BHEL PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL						STD QUALITY PLAN NO.: PE-QP-999-145-I056					
								VOLUME		IIB			
								SECTION		D			
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								SHEET		6		OF 7	
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks	
									P	W	V		
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.	
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1		
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1		
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1		
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1		
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1		
		11. Wire Termination	MA	Pulling manually	Sample	-----	Firm termination	Inspection Report	2	1	1		
		12. Continuity	MA	Electrical	100%	-----	Continuity OK	Inspection Report	2	1	1		

LEGEND: *			CR	- Critical characteristics	^s	P	- Agency Performing the Test.	1	- BHEL
			MA	- Major characteristics		W	- Agency Witnessing the Test.	2	- Vendor
			MI	- Minor characteristics		V	- Agency Verifying the Test.	3	- Sub-vendor

 PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL						STD QUALITY PLAN NO.: PE-QP-999-145-I056				
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								SHEET 7 OF 7				
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks
									P	W	V	
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	Type Test Certificate	3	---	1	
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant IS.	BHEL approved spec., drg., BOM & relevant IS.	Test Report	2	1	1	
15	FUNCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		2. Instrument Calibration	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant IS.	BHEL approved spec/drg & relevant IS.	Inspection Report	2	1	1	

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^s P - Agency Performing the Test.
 W - Agency Witnessing the Test.
 V - Agency Verifying the Test.

1 - BHEL
 2 - Vendor
 3 - Sub-vendor



DATA SHEET FOR LOCAL PANELS

SPECIFICATION NO.: PES-145-054A

VOLUME

SECTION

REV. NO. 01

DATE: 24.01.2019

SHEET 1 OF 2

TAG No. Qty.....

Data Sheet No.: PES-145A-DS1-0

Data Sheet A & B

DATA SHEET-A FOR LOCAL PANEL
(TO BE FILLED BY PURCHASER)DATA SHEET-B
(TO BE FILLED-UP BY
BIDDER)

GENERAL	MANUFACTURER		
	CONSTRUCTION		☐ FOLDED ☐ WELDED (As per requirement EDN)
	ENCLOSURE SHEET THICKNESS	FRONT	☒ 3.0 mm (FOR FACES SUPPORTING INSTRUMENTS/TERMINALS)
		OTHER	☒ 2.0 mm (FOR OTHER SIDES AND TOP)
		DOOR	☒ 2.0 mm
		HEIGHT	☐ 2365 mm for stand alone panels. (THIS SHALL BE DECIDED BY BHEL DURING DETAILED ENGG.)
	OTHER	☐	
TECHNICAL	INPUT POWER SUPPLY *		☐ 240V 50 Hz AC ☐ 220V DC ☐ 415V 3 PHASE 3W ☐ 415V 3 PHASE 4W
	NO. OF FEEDERS		☐ ONE ☒ TWO
	CONTROL SUPPLY		☐ 110V AC ☐ 220V AC ☐ 220V DC ☐ Other. (As per requirement)
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		_____ NOS. (AS REQUIRED)
	PAINT TYPE		☐ EPOXY ENAMEL ☒ EPOXY POWDER COATED OR BETTER (THIS SHALL BE DECIDED BY BHEL DURING DETAILED ENGG.)
	PANEL COLOUR (EXTERNAL)		☐ LIGHT GREY (Shade 631 IS-5) ☐ OPALINE GREEN (Shade 275) . ☒ RAL 7032 (THIS SHALL BE DECIDED BY BHEL DURING DETAILED ENGG.)
	FINISH (EXTERNAL)		☐ MATT ☐ GLOSSY ☐ SEMI GLOSSY
	PANEL COLOUR (INTERNAL)		☐ WHITE ☐ CREAM ☐ OFF WHITE ☒ BRILLIANT WHITE
	FINISH (INTERNAL)		☐ MATT ☐ GLOSSY ☐ SEMI GLOSSY
	CLASS OF PROTECTION		☐ IP-42 (FOR INDOOR SERVICE) ☒ IP-55 (FOR OUTDOOR SERVICE) ☐ ANY OTHER
	CONTROL HARDWARE		☒ RELAY BASED
	FOUNDATION ARRANGEMENT		☐ FOUNDATION BOLTS ☐ ANCHOR FASTENERS
	WEIGHT OF PANEL (Kg.)		
	PANEL TYPE		☐ PRESSURISED ☐ UNPRESSURISED As per Requirement
	CABLE GLAND		☐ DOUBLE COMPRESSION
AMMETER (TYPE OF INPUT) *		☐ 1 Amp CT ☐ 4-20 mA	



DATA SHEET FOR LOCAL PANELS

SPECIFICATION NO.: PES-145-054A

VOLUME

SECTION

REV. NO. 01

DATE: 22.03.2011

SHEET 2 OF 2

TAG No. Qty.....

Data Sheet No.: PES-145A-DS1-0

Data Sheet C

DATA SHEET-C FOR LOCAL PANEL
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

GENERAL	MANUFACTURER			
	CONSTRUCTION		☐ FOLDED ☐ WELDED (As per requirement EDN)	
	ENCLOSURE SHEET THICKNESS	FRONT		
		OTHER		
		DOOR		
		HEIGHT		
	OTHER			
TECHNICAL	INPUT POWER SUPPLY			
	NO. OF FEEDERS			
	CONTROL SUPPLY			
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)			
	PAINT TYPE			
	PANEL COLOUR (EXTERNAL)			
	FINISH (EXTERNAL)			
	PANEL COLOUR (INTERNAL)			
	FINISH (INTERNAL)			
	CLASS OF PROTECTION			
	CONTROL HARDWARE			
	FOUNDATION ARRANGEMENT			
	WEIGHT OF PANEL (Kg.)			
	PANEL TYPE			
	CABLE GLAND			
	AMMETER (TYPE OF INPUT)			
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL NAME: SIGNATURE: DATE:
	Shiv Kumar	Anisha B Singhal	Anisha B Singhal	

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I SHEET 15 of 18
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
APPLICABLE CODES AND STANDARDS		

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1	Section – 1
REV: R0	CONTROL & INSTRUMENTATION	Page 38 of 718
6.2.1 Temperature Measurement (a) Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974). (b) Temperature Measurement - Thermocouples - ANSI - MC 96.1 - 1982. (c) Temperature Measurement by electrical resistance thermometers - IS: 2806. (d) Thermometer-element-Platinum resistance - IS: 2848 / DIN 43760. 6.2.2 Pressure Measurement (a) Instrument and apparatus for pressure measurement - ASME PTC 19.2 (1964). (b) Bourdon tube pressure and vacuum gauges - IS: 3624/1996. 6.2.3 Flow Measurement (a) Instruments and apparatus for flow measurement - ASME PTC 19.5 (1972) Interim supplement, Part-II. (b) Measurements of fluid flow in closed conduit - BS 1042. 6.2.4 Electronic Measuring Instruments and Control Hardware (a) Automatic null balancing electrical measuring instruments -ANSI C 39.4 (Rev. 1973), IS 9319. (b) Safety requirements for electrical and electronic measuring and controlling instrumentation - ANSI C 39.5/1974. (c) Compatibility of analog signals for electronic industrial process instruments - ISA-S 50.1: ANSI MC 12.1/1975. (d) Dynamic response testing of process control instrumentation - ANSI MC 4.1 (1975) - ISA -S26 (1968).		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1	Section – 1
REV: R0	CONTROL & INSTRUMENTATION	Page 39 of 718
(e) Surge withstand capability (SWC) tests - ANSI C 37.90A (1989), IEC-255.4. (f) Printed circuit boards - IPC TM-650, IEC 326C. (g) General requirements and tests for printed wiring boards - IS-7405 (Part-I)/1973. (h) Edge socket connectors - IEC 130-11. (i) Requirements and methods of testing of wire wrap terminations- DIN 41611 Part-2. (j) Dimensions of attachment plugs and receptacles- ANSI C73-1973. (Supplement ANSI C73a – 1980. 6.2.5 Instrument Switches and Contacts (a) Contact Rating - AC services NEMA ICS Part-2 125, A-600. (b) Contact Rating - DC services NEMA ICS Part-2 125, N-600. 6.2.6 Enclosures (a) Enclosures for Industrial Controls and Systems–NEMA ICS-6-110.15 through 110.22. (b) Racks, panels and associated equipment -EIA: RS-310-B-1983 (ANSI C83.9 - 1972). 6.2.7 Apparatus, Enclosures and Installation Practices in Hazardous Area (a) Classification of hazardous area - NEMA Article 500, Volume-6, 1978. (b) Electrical Instruments in hazardous dust locations - ISA-RP 12.11. (c) Intrinsically safe apparatus - NFPA Article 493 Volume-4 1978.		

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1	Section – I
REV: R0	CONTROL & INSTRUMENTATION	Page 40 of 718
(d) Purged and pressurized enclosure for electrical equipment in hazardous location - NFPA Article 496 Volume-4, 1978.		
6.2.8	Sampling System	
(a) Stainless Steel material of tubing and valves, for sampling system - ASTM A 269-79 GRTO-316.		
(b) Submerged helical coil heat exchangers for sample coolers - ASTM D11-98.		
6.2.9	Annunciator	
(a) Specifications and guides for the use of general-purpose annunciators - ISA RP 18.1.		
(b) Surge withstand capability tests -ANSI C37.90 a -1971 and IEEE Standard 472-1974.		
6.2.10	Interlocks, Protections	
(a) Relays and relay system associated with electric power apparatus - IEEE Standards 3.13.		
(b) Surge withstand capability tests - ANSI C37.90 a - 1971 and IEEE Standard 472-1974.		
(c) General requirements and tests for switching devices for control and auxiliary circuits including contactor relays - IS-6875 (Part-I)/ 1973.		
(d) Turbine water damage prevention - ASME-TDP-1-1980.		
(e) Boiler safety interlocks - NFPA Section 85B, 85D, 85E, 85F, 85G.		
6.2.11	UPS System	
(a) Practice and requirements for semi-conductor power rectifiers - ANSI C34.2.		

CONSULTANT : PROCON ENGINEERS

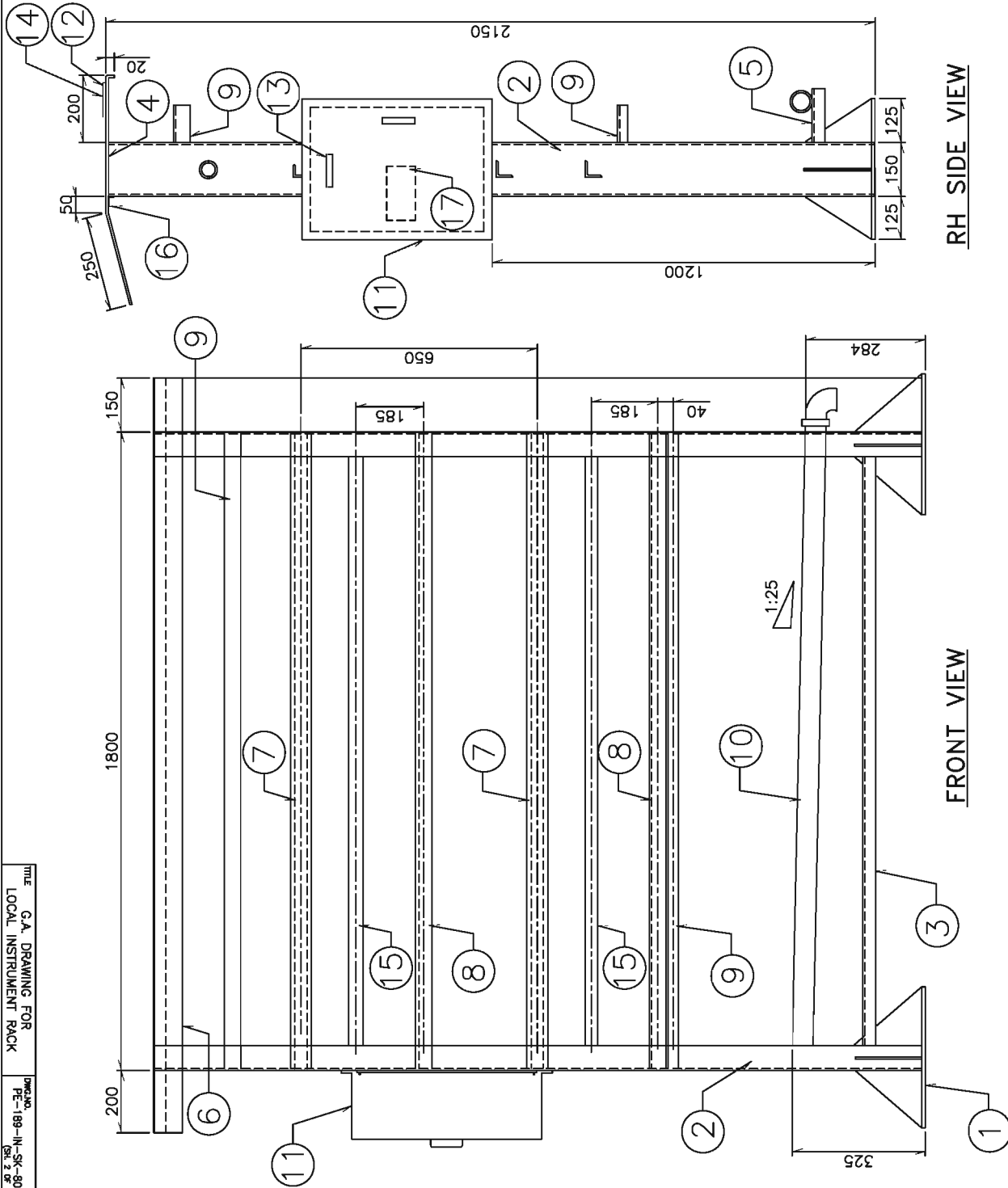
	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1	Section – I
REV: R0	CONTROL & INSTRUMENTATION	Page 41 of 718
(b) Relays and relay systems associated with electrical power apparatus IEEE Standard - 3.13. (c) Surge withstand capability tests - ANSI C 70.90 A/1971, IEC-255.4. (d) Recommended practice for sizing large lead storage batteries for generating stations and sub-stations - -IEEE-485. (e) Battery: IEEE Std. 1106/IS, 10918, BS 6920-II: 1984, IS 1652, IEC 896-1987. (f) For Lead acid plante type battery selection & sizing : IEEE Std. 485:1997 6.2.12 Control Valves (a) Control valve sizing (Incompressible fluids) - ISA-S39.2 / 1972. (b) Control valve sizing (Compressible fluids) - ISA-S39.4 / 1972. (c) Control Valve seat leakage – ANSI / FCI 70.2. (d) Face to face dimensions of Control Valves - ANSI B16.10. (e) Control Valve Capacity Test Procedure – ISA – S75.02. 6.2.13 Instrument Tubing (a) Seamless Carbon Steel Pipe - ASTM-A-106. (b) Forged carbon steel fittings - ASTM-A-105. (c) Dimensions of fittings - ANSI-B16.11. (d) Code for pressure piping, welding, hydrostatic testing - ANSI-B 31.1. (e) Nomenclature for instrument tube fittings - ISA-RP 42.1 / 1982. (f) Seamless Stainless Steel Tube ASTM A-213 TP 316 / ASTM A-269 TP 316.		

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 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1	Section – 1
REV: R0	CONTROL & INSTRUMENTATION	Page 42 of 718
(g) Seamless Alloy Steel Pipe ASTM A 335 P22. (h) Seamless Stainless Steel Pipe ASTM A-312 TP 316. 6.2.14 Cables (a) Thermocouple extension wires/cables - ANSI MC96.1. (b) Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy-IPCEA S-61-402. (c) Guide for design and installation of cable system in power generating station (insulation, jacket materials) -IEEE Standard 422. (d) Requirements of vertical tray flame test - IEEE 383. (e) Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B33. 6.2.15 Electronic Cards, Subassemblies and Components (a) Unpackaged. (i) Vibration : IEC-68.2.6 (ii) Shock : IEC-68.2.27 (iii) Drop & Topple : IEC-68.2.31 (b) Packaged Vibration, Drop & Static Compression – NSTA. (c) Electromagnetic Compatibility (i) Electrical Fast Transient : IEC-801.4 (ii) Surge Withstand : IEC-255.4		

CONSULTANT : PROCON ENGINEERS

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I SHEET 18 of 18
	SPECIFIC TECHNICAL REQUIREMENTS (C&I)	
DRAWINGS		



LEGEND:

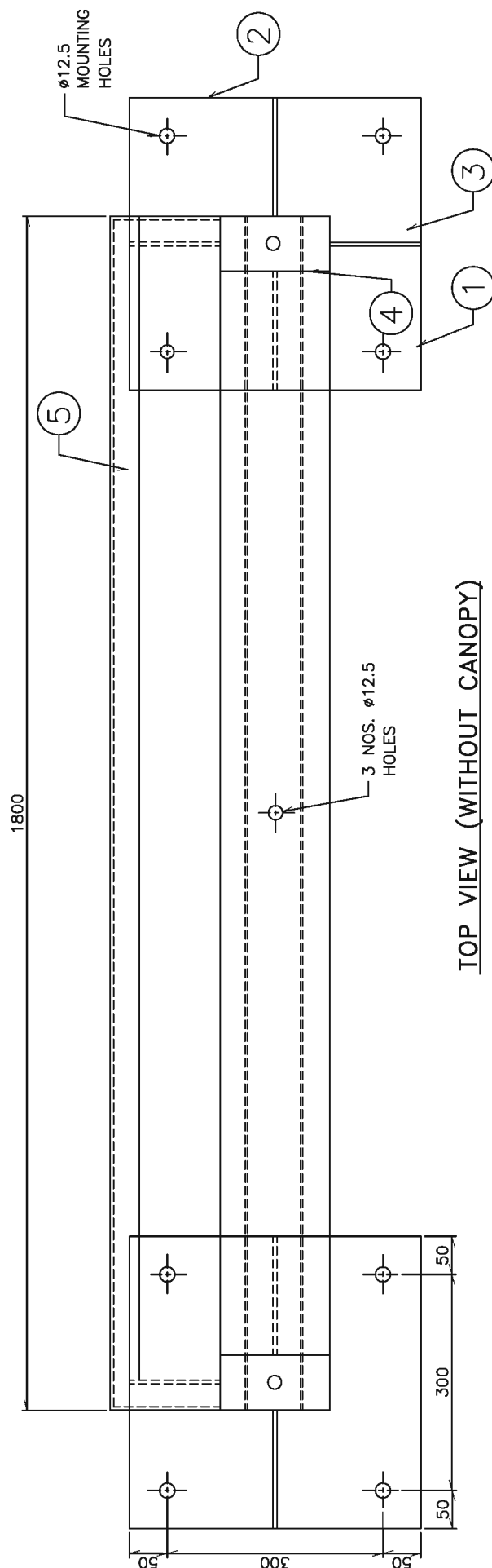
ITEM NO.	DESCRIPTION
1.	M.S. PLATE 400 x 400 x 10
2.	ISMC 150 x 75 x 6
3.	ISMC 75 x 40 x 5
4.	CANOPY MOUNTING PLATE 5mm THICK.
5.	BRACKET FOR DRAIN PIPE.
6.	CANOPY ASSEMBLY 3.0mm THICK CRCA SHEET.
7.	GI PIPE 2" NB CLASS B FOR TRANSMITTER MOUNTING.
8.	M.S. ANGLE 40 x 40 x 5
9.	BRACKET FOR IMPULSE PIPE SUPPORT.
10.	DRAIN PIPE MATERIAL ASTM A106 GR. 'C' SIZE 2" NB SCH 80.
11.	JUNCTION BOX SIZE: 480(H) x 360(W) x 180(D).
12.	BULKHEAD M.S. PLATE 5mm THICK.
13.	COMPACT FLUORESCENT LAMP FOR RACK ILLUMINATION.
14.	XLPE GASKET IN BETWEEN BULKHEAD PLATE & CANOPY MOUNTING PLATE.
15.	PVC CABLE TRAY/ FLEXIBLE CONDUIT FOR CABLE
16.	C' CHANNEL FOR LIGHT FITTING.
17.	TAG PLATE.

NOTES:

1. POWER SOCKET & TB SHALL BE PROVIDED IN JB.
2. COLOR: RAL 7032. OVERALL THICKNESS > 100 MICRONS.
3. TAG PLATE SHALL BE PROVIDED FOR EACH INSTRUMENT.
4. 20% TERMINALS SHALL BE PROVIDED AS SPARE.
5. ANTIVIBRATION PAD & FOUNDATION BOLTS SHALL BE PROVIDED.
6. DIMENSIONS SHOWN ARE TENTATIVE AND SHALL BE FINALIZED AT DETAILING.
7. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.

FOR BID PURPOSE ONLY

ISSUE	REVISIONS	BY	CLEARED	APPD	DATE	FOR RD ISSUE ONLY				MAHARASHTRA STATE POWER GENERATION CO.LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT G.A. DRAWING FOR LOCAL INSTRUMENT RACK	PROCON ENGINEERS (DIVISION OF NADARO CONSULTING ENGINEERS PVT.LTD.) SCALE ~ DATE (RD ISSUE) 23-08-2011 DWG. NO. PE-189-IN-SK-8004(SH. 2 of 10) PO							
						DEPT	SIGNATURE	DATE	DATE		DATE	DATE	DATE	DATE				
						CHEM												
						CIVIL												
						ELEC												
						MECH												

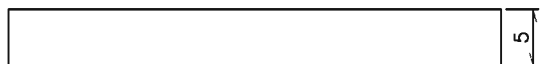


NOTES:

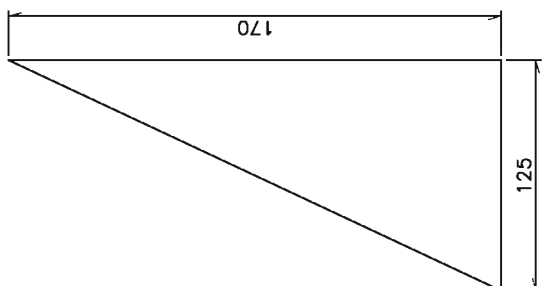
1. M.S. PLATE 400 x 400 x 10.
2. RIB M.S. PLATE 162.5 x 170 x 5 THICK.
3. RIB M.S. PLATE 125 x 170 x 5 THICK.
4. RIB M.S. PLATE 134 x 165 x 5 THICK.
(CANOPY MOUNTING PLATE SUPPORT)
5. BRACKET FOR IMPULSE PIPE SUPPORT.
6. ALL DIMENSIONS ARE IN mm
UNLESS OTHERWISE SPECIFIED.

FOR BID PURPOSE ONLY

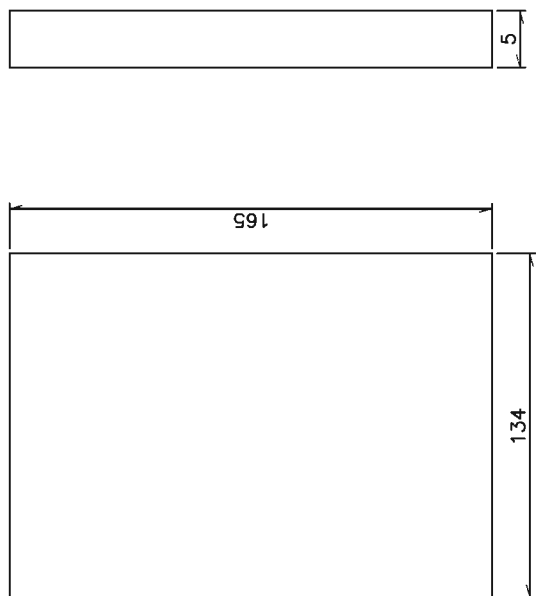
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DETAIL OF-2



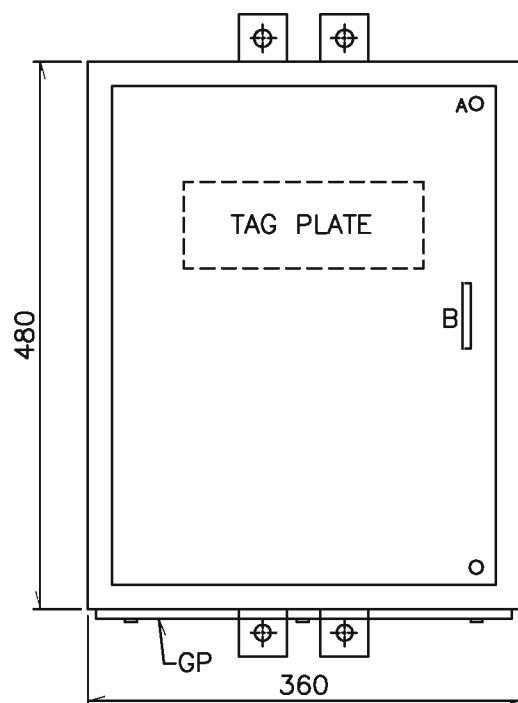
DETAIL OF-3



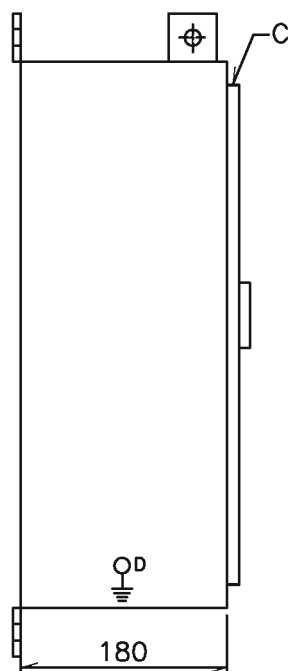
1. RIB M.S. PLATE 162.5 x 170 x 5 THICK.
2. RIB M.S. PLATE 125 x 170 x 5 THICK.
3. RIB M.S. PLATE 134 x 165 x 5 THICK.
4. ALL DIMENSIONS ARE IN mm
UNLESS OTHERWISE SPECIFIED.

DO NOT SCALE

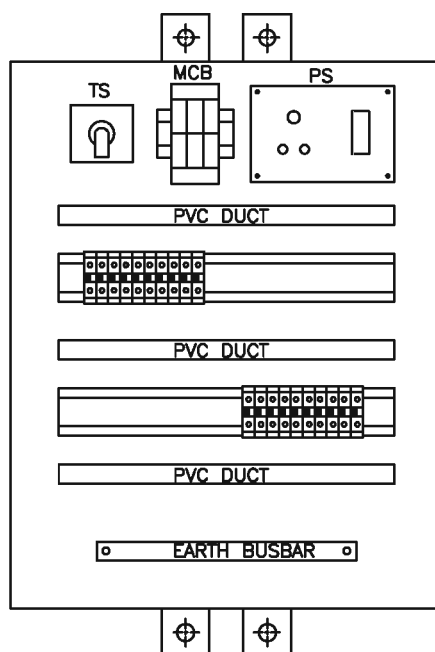
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FRONT VIEW



SIDE VIEW



LEGEND:

- A – DOOR LOCK
- B – DOOR HANDLE
- C – HINGES
- D – EARTH STUD
- GP – GLAND PLATE
- PS – POWER SOCKET
- TS – TOGGLE SWITCH
- TBS – TERMINAL BLOCKS

INTERNAL FRONT VIEW

NOTES:

1. JB WILL BE MADE OUT OF 2.0 mm CRCA SHEET.
2. PROTECTION CLASS IP-65.
3. COLOR: EXT.-RAL 7032, INT.-BRILLIANT WHITE.
4. NUTS FOR MOUNTING THE JUNCTION BOX SHALL BE PROVIDED.
5. 3 mm THICK CRCA GLAND PLATE (GP) AT BOTTOM SHALL BE PROVIDED.
6. SCREWLESS CAGE CLAMP TERMINALS SHALL BE USED.
7. EARTH BUS BAR SHALL BE OF 25x6 TINNED COPPER.
8. INSTRUMENT TAG VIS-A-VIS SERVICE AND TERMINAL DETAILS SHALL BE PRINTED ON PHENOLIC BOARD MOUNTED ON BACK SIDE OF DOOR.
9. COLOR CODE FOR POWER SUPPLY:
PHASE-RED, NEUTRAL-BLACK & EARTH – GREEN.
10. CABLE FOR PANEL LIGHTING SHALL BE 1.5 SQ.mm, 1100V GRADE.
11. SIGNAL WIRING SHALL BE 4Px0.5 SQ.mm TINNED COPPER, TWISTED PAIR, OVERALL SHIELDED 500V GRADE, FRLS PVC.
12. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED.

FOR BID PURPOSE ONLY

ISSUE	BY	CH	DATE

PROCON ENGINEERS
(DIVISION OF NIMOTO CONSULTING ENGINEERS PVT. LTD.)

CLIENT : MAHARASHTRA STATE POWER GENERATION CO.LTD.
PROJECT : BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT

DO NOT SCALE

DATE : 23-08-2011

G.A. OF JB LOCAL INSTRUMENT RACK

SCALE ~ APPROVED

DIV INST.
DR P.N.Z.
CH D.J.P.

DWG.NO.PE-189-IN-SK-8004 (SHEET 5 OF 10) PO

TYPICAL INSTRUMENT INSTALLATION DIAGRAM

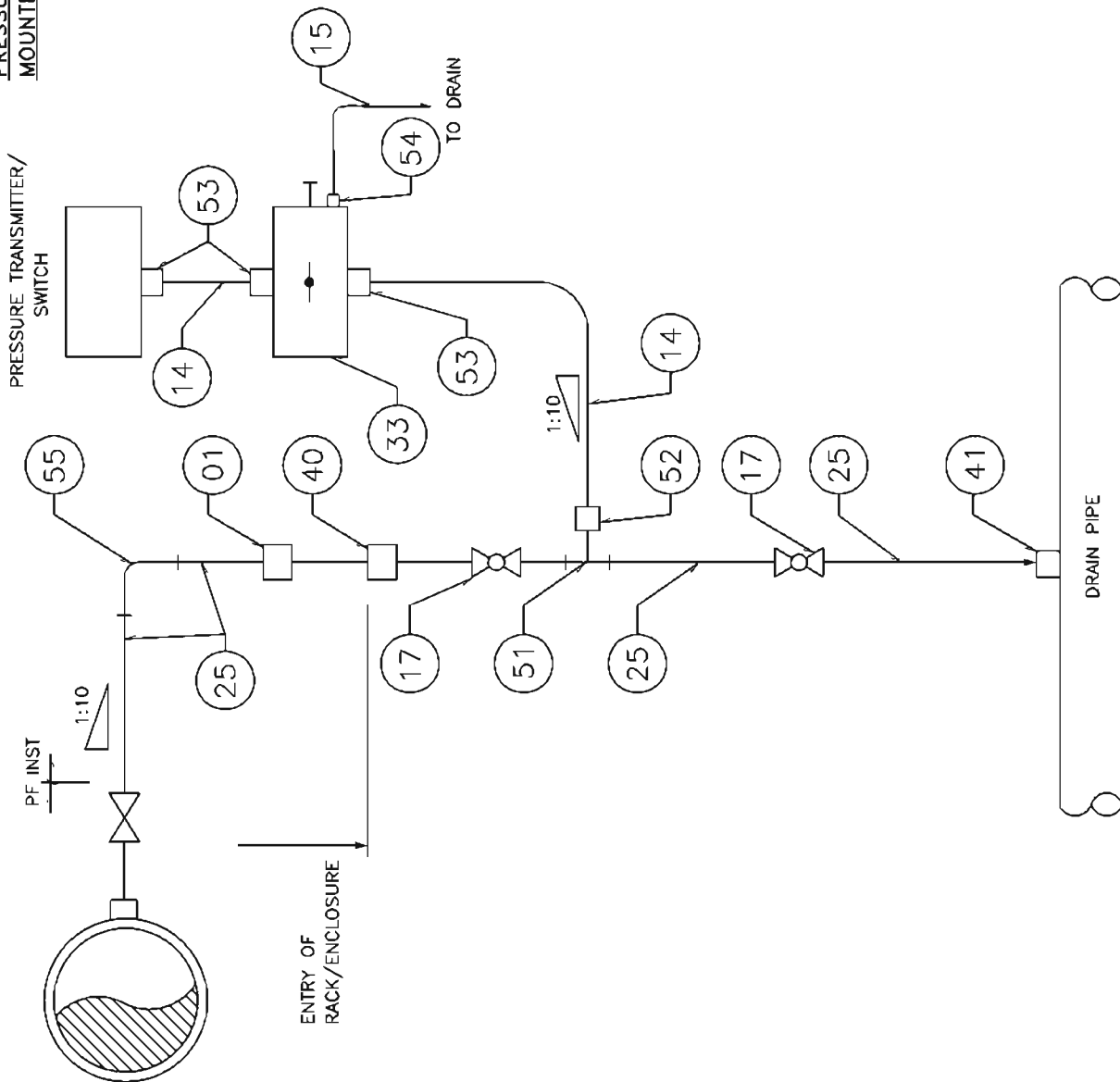
				FOR BID PURPOSE ONLY	
				DO NOT SCALE	DATE : 23-08-2011
ISSUE	BY	CH	DATE	TYPICAL INSTRUMENT INSTALLATION DIAGRAM	
				PROCON ENGINEERS (DIVISION OF NIMOTO CONSULTING ENGINEERS PVT. LTD.) CLIENT : MAHARASHTRA STATE POWER GENERATION CO.LTD. PROJECT : BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT	
				SCALE ~	APPROVED
				DIV INST.	
				DR P.N.Z.	
				CH D.J.P.	DWG.NO.PE-189-IN-SK-8003 (SH. 1 of 20) PO

NOTES:

1. PROVISION OF SINGLE OR DOUBLE ROOT VALVE AND DRAIN VALVE SHALL BE IN ACCORDANCE WITH THE PRESSURE/ TEMPERATURE REQUIREMENT. FOR LINE PRESSURE EQUAL TO OR GREATER THAN 40 KG/SQ. CM. 2 NOS ROOT VALVE AND 2 NOS DRAIN VALVE SHALL BE REQUIRED.
2. MATERIAL, SIZE AND RATING OF THE PROCESS HOOK UP ITEMS SHOWN IN THE DRAWING ARE INDICATIVE ONLY. ACTUAL REQUIREMENT SHALL BE AS PER PROCESS CONDITION AND SPECIFICATION OF CONTROL & INSTRUMENTATION.
3. DRAIN PIPE IN RACK AND ENCLOSURE SHALL BE 2" NB SCH 80.

				FOR BID PURPOSE ONLY	
				DO NOT SCALE	DATE : 23-08-2011
ISSUE	BY	CH	DATE	TYPICAL INSTRUMENT INSTALLATION DIAGRAM	
				PROCON ENGINEERS (DIVISION OF NIMOTO CONSULTING ENGINEERS PVT. LTD.) CLIENT : MAHARASHTRA STATE POWER GENERATION CO.LTD. PROJECT : BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT	
				SCALE ~ DIV INST. DR P.N.Z. CH D.J.P.	APPROVED DWG.NO. PE-189-IN-SK-8003 (Sht. 2 of 20) PD

PRESSURE TRANSMITTER/PRESSURE SWITCH
 MOUNTED BELOW SOURCE POINT

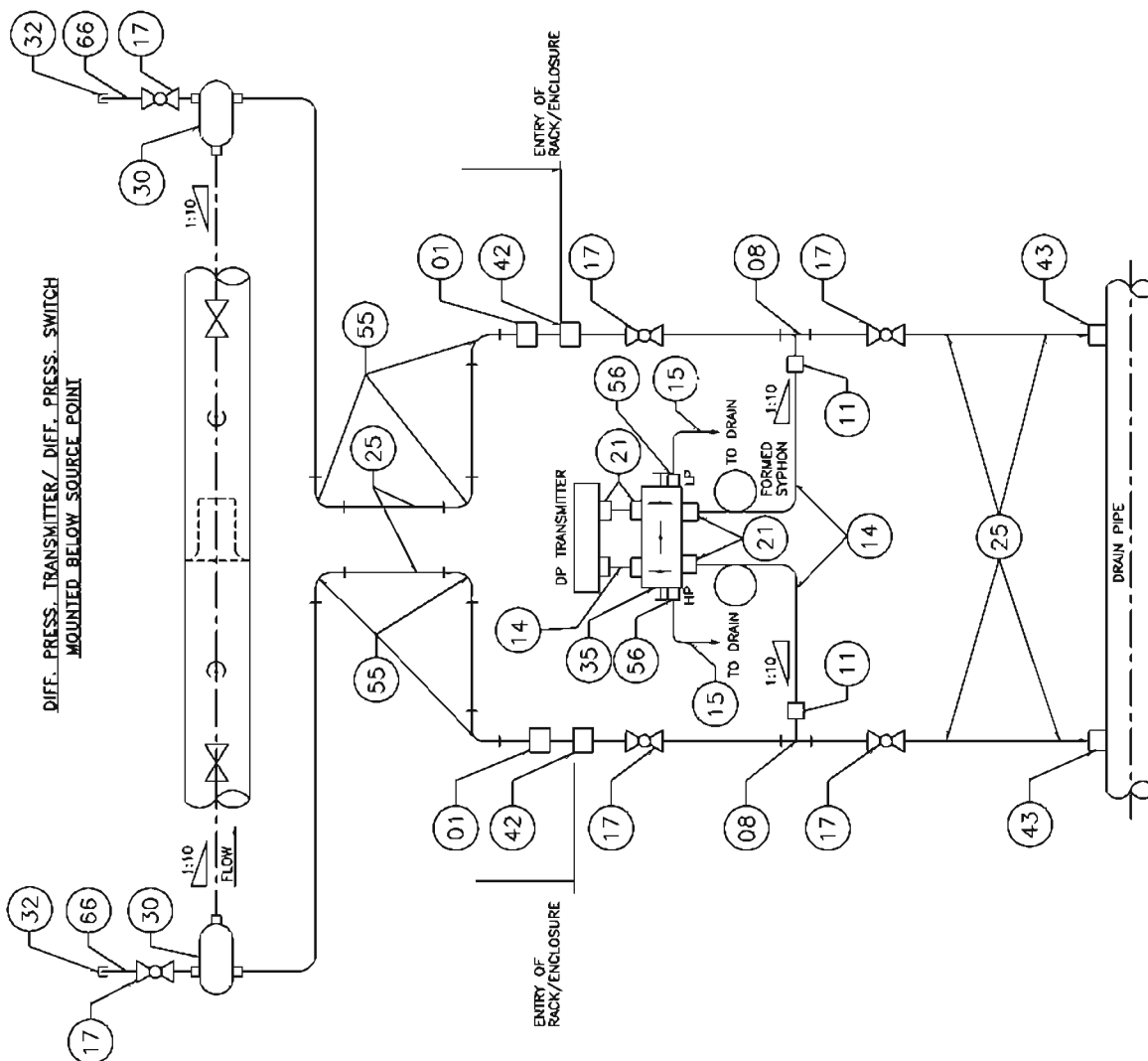


BILL OF MATERIAL		
ITEM NO.	QTY./INST.	DESCRIPTION
51	1	EQUAL TEE (FEMALE) 1/2" SW 6000lbs, CS/AS
52	1	MALE CONNECTOR 1/2" PE x 1/2" OD 6000 lbs, CS/AS
17	2	GLOBE VALVES 1/2" SW 800lbs, CS/AS
14	3 MTRS.	TUBE 1/2" OD, 2.1mm THK, SS 316
53	3	MALE CONNECTOR 1/2" NPT(M) x 1/2" OD 6000 lbs, SS 316
25	15 MTRS.	IMPULSE PIPE 15 NB GR.B SCH 80, CS/AS
33	1	2 VALVES MANIFOLD 1/2" NPT(F), SS 316
01	1	FULL COUPLING 1/2" SW 6000lbs, CS/AS
15	0.15 MTRS.	TUBE 8mm OD, 1.0mm THK, SS 316
54	1	MALE CONNECTOR 1/4" NPT(M) x 8mm OD 6000 lbs, SS 316
55	2	90° ELBOW 1/2" SW 6000lbs, CS/AS
40	1	BULKHEAD UNION/COUPLING CL-6000 lbs, 1/2"NB-SW, AS PER ANSI B16.11, CS/AS
41	1	HALF COUPLING CL-6000 lbs, 1/2" NB-SW, AS PER ANSI B16.11, CS/AS

SERVICE : CONDENSATE, FEED WATER ETC.

FOR BID PURPOSE ONLY

DO NOT SCALE	
PROCON ENGINEERS DIVISION OF MARGO CONSULTING ENGINEERS PVT.LTD.)	
SCALE ~	DATE (REVISED)
BY: INST.	APPROVED
BY: P.N.Z.	DATE (REVISED)
BY: D.J.P.	DATE (REVISED)
MAHARASHTRA STATE POWER GENERATION CO.LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT	
TYPICAL INSTRUMENT INSTALLATION DIAGRAM	



BILL OF MATERIAL		
ITEM NO.	QTY./INST	DESCRIPTION
08	2	EQUAL TEE (FEMALE) 1/2" SW 9000lbs. CS/AS
11	2	MALE CONNECTOR 1/2" PE x 1/2" OD 9000 lbs. CS/AS
17	6	GLOBE VALVES 1/2" SW 800lbs. CS/AS
14	6 MTRS.	TUBE 1/2" OD, 2.1mm THICK, SS 316
21	6	MALE CONNECTOR 1/2" NPT(M) x 1/2" OD 9000 lbs. SS 316
25	30 MTRS.	IMPULSE PIPE 15 NB GR.B SCH 80. CS/AS
35	1	5 VALVE MANIFOLD 1/2" SE 9000 lbs. SS 316
01	2	FULL COUPLING 1/2" SW 9000lbs. CS/AS
30	2	CONDENSATE POT 1/2" SW NPT(F) 9000lbs. CS/AS
32	2	PLUG 1/2" NPT(F) 9000lbs. CS/AS
15	0.3 MTRS.	TUBE 8mm OD, 1.0mm THICK, SS 316
56	2	MALE CONNECTOR 1/4" NPT(M) x 8mm OD 9000 lbs. SS 316
55	6	90° ELBOW 1/2" SW 9000lbs. CS/AS
42	2	BULK-HEAD UNION/COUPLING CL-9000 lbs. AS PER ANSI B16.11, 1/2" NB-SW. CS/AS
43	2	HALF COUPLING CL-9000 lbs/ 1/2" NB-SW. AS PER ANSI B16.11, CS/AS
66	2	15 NB SCH 80. SW x 1/2" NPT(M). SEAMLESS NIPPLE 6000 lbs. CS/AS

SERVICE : STEAM
PRIMARY ELEMENT : FLOW NOZZLE/ORIFICE.

FOR BID PURPOSE ONLY


MAHARASHTRA STATE POWER GENERATION CO. LTD.
 BHUSAVAL T.P.S. UNIT-6 : 1 X 880 MW PROJECT
 AUGUST 2000

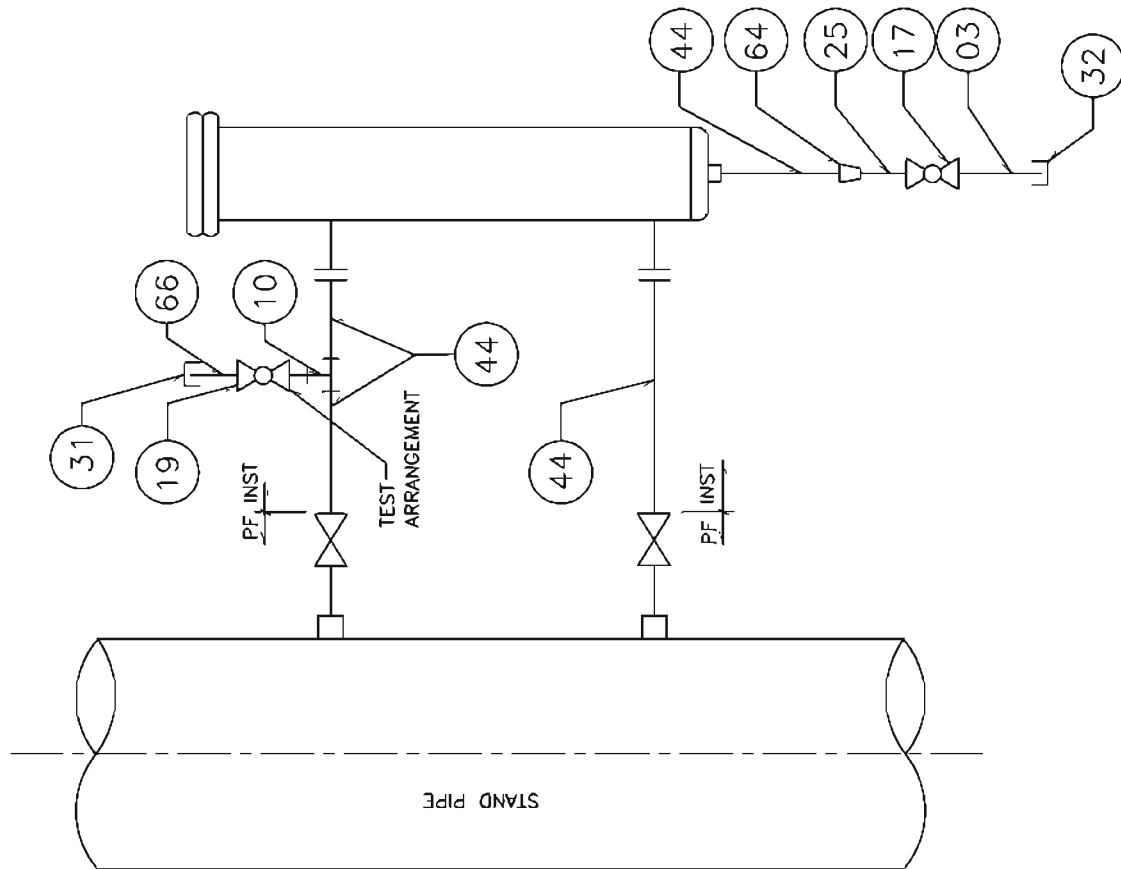
TYPICAL INSTRUMENT
INSTALLATION DIAGRAM

PROCON ENGINEERS
(DIVISION OF NIMCO CONSULTING ENGINEERS PVT. (TD.))

SCALE	~			DATE (NO ISSUE)
DR.	INST.	APPROVED		DATE (CIRCUIT BUILT)
DR.	P.N.Z.			23-08-2011
DR.	D.J.P.			
DWG. NO. PE-189-IN-SK-8003				ISSUE
				P0

[illegible]

FLOAT OPERATED LEVEL SWITCH



SERVICE : CONDENSATE.

BILL OF MATERIAL		
ITEM NO.	QTY./INST	DESCRIPTION
17	1	GLOBE VALVES 1/2" SW 800lbs, CS/AS
25	0.5 MTRS.	IMPULSE PIPE 15 NB SCH 80, CS/AS
32	1	PLUG 1/2" NPT(M) 3000lbs, CS/AS
10	2	EQUAL TEE (FEMALE) 1" SW 3000lbs, CS/AS
44	2 MTRS.	IMPULSE PIPE 25 NB SCH 80, CS/AS
64	1	REDUCER 1" SW x 1/2" SW 3000lbs, CS/AS
19	1	GLOBE VALVES 1" SW 800lbs, CS/AS
31	1	PLUG 1" NPT(F) 3000lbs, CS/AS
66	1	1" NB SCH 80 SW x 1" NPT(M) SEAMLESS NIPPLE 3000 lbs, CS/AS
03	1	15 NB SCH 80 SW x 1/2" NPT(M) SEAMLESS NIPPLE 3000lbs, CS/AS

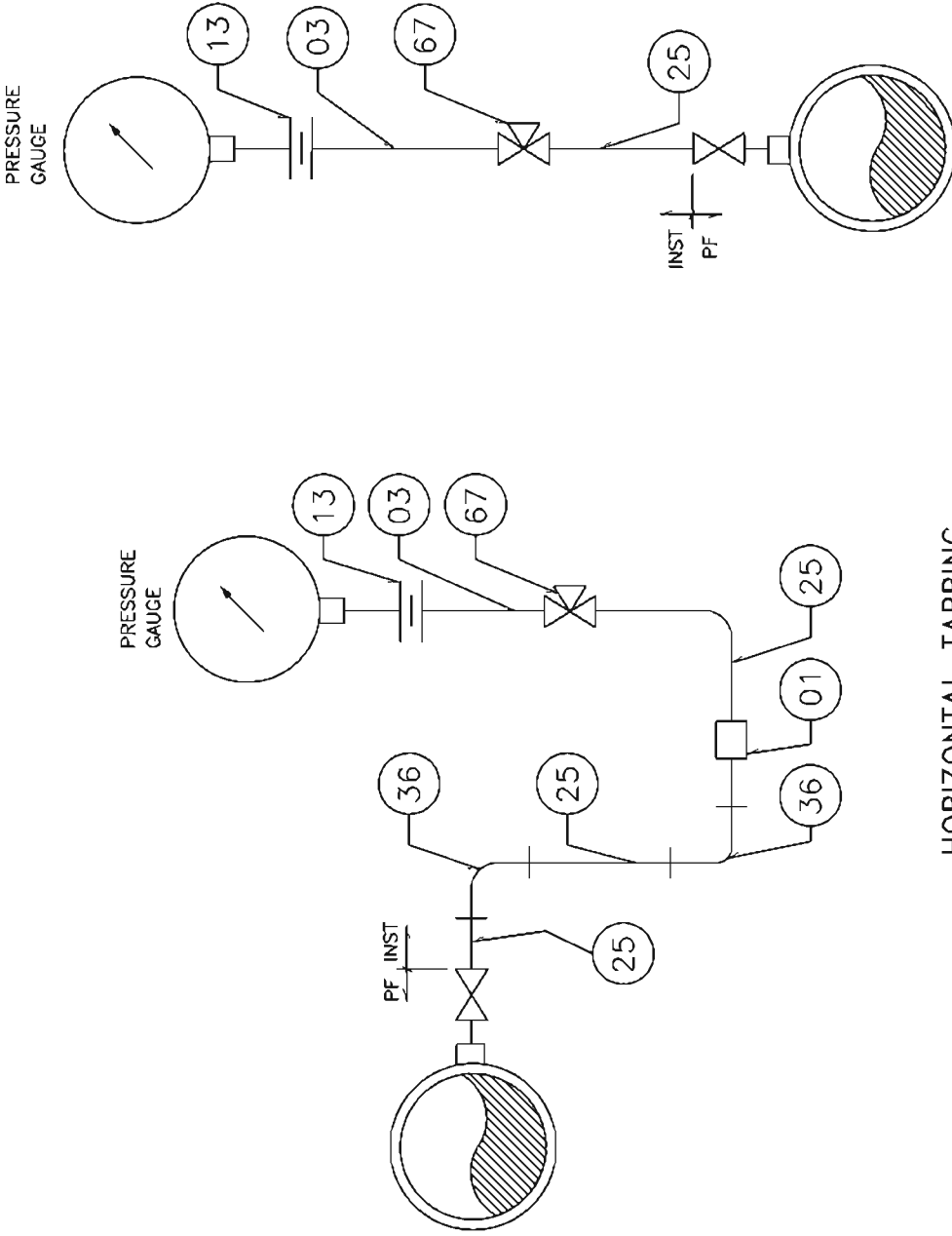
FOR BID PURPOSE ONLY

DO NOT SCALE	
PROCON ENGINEERS (DIVISION OF HIRATO CONSULTING ENGINEERS PVT.LTD.)	
SCALE	DATE (RD ISSUE)
DNV. INST.	APPROVED
DNV. P.N.Z.	DATE (RD ISSUE)
DNV. D.J.P.	DATE (RD ISSUE)
PF-189-N-SK-8003 (REV. 10 OF 20)	

MAHARASHTRA STATE POWER GENERATION CO.LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT	
TYPICAL INSTRUMENT INSTALLATION DIAGRAM	

FOR RD ISSUE ONLY	CLEAR	DATE
DEPT	SIGNATURE	DATE
CHEM		
CIVIL		
ELEC		
MECH		

ISSUE	REVISIONS	BY	CHEM	CIVIL	ELEC	MECH



HORIZONTAL TAPPING

VERTICAL TAPPING

BILL OF MATERIAL		
ITEM NO.	QTY./ INST	DESCRIPTION
25	15 MTRS.	IMPULSE PIPE 15 NB SCH 80, CS/AS
01	1	FULL COUPLING 1/2" SW 3000lbs, CS/AS
36	2	90° ELBOW 1/2" SW 3000lbs, CS/AS
03	1	1/2" NPT(M) x 1/2" PE, 4" LONG NIPPLE, CS/AS
13	1	NUT & TAIL FITTING WITH CU WASHER 1/2" NPT(F) x 1/2" PE
67	1	3 WAY GAUGE COCK 1/2" SW 3000lbs, CS/AS

SERVICE : WATER, CONDENSATE ETC.

FOR BID PURPOSE ONLY				DO NOT SCALE			
				PROCON ENGINEERS DIVISION OF MASTO CONSULTING ENGINEERS PVT.LTD.)			
MAHARASHTRA STATE POWER GENERATION CO.LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT		SCALE ~		DATE/REV ISSUED			
		APPROVED		DATE/REV ISSUED			
		DNV. INST.		P.N.Z.			
		DNV. P.N.Z.		23-08-2011			
CH.		D.J.P.		PE-189-IN-SK-8003 Rev. 11 of 20			
TYPICAL INSTRUMENT INSTALLATION DIAGRAM		MAHARASHTRA STATE POWER GENERATION CO.LTD. BHUSAWAL T.P.S. UNIT-6 : 1 X 660 MW PROJECT		TYPICAL INSTRUMENT INSTALLATION DIAGRAM			
FOR RO ISSUE ONLY DEPT. SIGNATURE DATE CIVIL ELEC MEC		BY CHEN CIVIL ELEC MEC MECH		REVISIONS DATE APPD			
ISSUE REVISIONS DATE APPD		BY CHEN CIVIL ELEC MEC MECH		REVISIONS DATE APPD			

	TITLE:	SPECIFICATION NO. PE-TS-415-154-A001
		SECTION II
	1x660 MW BHUSAWAL TPS TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION -
		REV.NO. 00 DATE: 27.05.2019

SECTION II

	TITLE:	SPECIFICATION NO. PE-TS-415-154-A001
	1x660 MW BHUSAWAL TPS	SECTION II
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION -
		REV.NO. 00 DATE: 27.05.2019

SCHEDULE OF PRE-BID CLARIFICATION

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

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

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

THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-415-154-A001

	SCHEDULE OF DEVIATIONS WITH COST OF WITHDRAWAL								
	PROJECT:- 1x660 MW BHUSAWAL TPS								
	PACKAGE:- CHEMICAL DOSING SYSTEM								
	TENDER ENQUIRY REFERENCE:-								

NAME OF VENDOR:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWAL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWAL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWAL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
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TECHNICAL DEVIATIONS

COMMERCIAL DEVIATIONS

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATIONS	SIGN & DATE	

NOTES:

- 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.
- For directly dispatchable items, cost of withdrawl of deviation will be applicable on the basic price including taxes, duties & freight.
- All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
- Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
- 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.
- Bidder shall furnish price copy of above format along with price bid.
- The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
- Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
- 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.
- Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
- 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.
- 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.
- In case nature of cost of withdrawl (positive/negative) is not specified it shall be assumed as positive.
- In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.

	TITLE:	SPECIFICATION NO. PE-TS-415-154-A001
	1x660 MW BHUSAWAL TPS	SECTION II
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION -
		REV.NO. 00 DATE: 27.05.2019

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate (every sheet) and furnish same with the offer.

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions other than those mentioned under “exclusion” in section IA and those resolved as per ‘Schedule of Deviations’, if applicable, with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the ‘Schedule of Deviations’. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the ‘Schedule of Deviations’.
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ CUSTOMER approval & 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. This shall be within the contracted price with no extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets/ calculations etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ CUSTOMER approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified/ intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre - bid discussions, otherwise BHEL/ Customer’s decision shall be binding on the bidder whenever the deficiency is pointed out.

For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

- f) The commissioning spares shall be supplied on ‘As Required Basis’ & prices for same included in the base price itself.
- g) All sub vendors shall be subject to BHEL/ CUSTOMER approval in the event of order.
- h) Guarantee for plant /equipment shall be as per relevant clause of GCC /SCC /Other Commercial Terms & Conditions.
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price and within purview of the tender specification even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities.

	TITLE:	SPECIFICATION NO. PE-TS-415-154-A001
	1x660 MW BHUSAWAL TPS	SECTION II
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION -
		REV.NO. 00 DATE: 27.05.2019

- j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.
- k) As built drawings shall be submitted as and when required during the project execution.
- l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

	TITLE:	SPECIFICATION NO. PE-TS-415-154-A001
	1x660 MW BHUSAWAL TPS	SECTION II
	TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM	SUB SECTION -
		REV.NO. 00 DATE: 27.05.2019

DECLARATIONS

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

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

Bidders Company Name

Authorized representative's
Signature

Name

Bidder's Name The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated