

**2X660 MW SURATGARH STPS Stage V
UNIT # 7 & 8**

VOLUME: II B & III

**TECHNICAL SPECIFICATIONS
FOR
LP CHEMICAL DOSING SYSTEM**

SPECIFICATION NO.: PE-TS-392-154A-A001



BHARAT HEAVY ELECTRICALS LIMITED

**POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA**



TITLE: TECHNICAL SPECIFICATION FOR
LP CHEMICAL DOSING SYSTEM
2X660 MW SURATGARH STPS STAGE V
UNIT # 7& 8

SPEC. NO. PE-TS-392-154A-A001

VOLUME

SECTION

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SECTION – A

SCOPE OF ENQUIRY

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1.0 SCOPE OF INQUIRY/ INTENT OF SPECIFICATION

- 1.1 This specification is intended to cover design, engineering, manufacturing, fabrication, assembly, inspection & testing at manufacturer's works, painting, mandatory spares, special tools & tackles, proper packing, supply and dispatch to power station site of skid mounted **CHEMICAL DOSING SYSTEM** along with start-up & commissioning spares specified hereinafter for the **2 X 660 MW SURATGARH STPS STAGE V (unit 7 & 8)** for following systems:-
- AMMONIA DOSING SYSTEM– Two number (one number skid per unit).
 - NaOH DOSING SYSTEM– Two number (one number skid per unit).
- 1.2 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the vendor from the responsibility of providing such facilities to complete the supply of **CHEMICAL DOSING SYSTEM**.
- 1.3 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgment is not in full accordance herewith.
- 1.4 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- 1.5 The general term and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- 1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser/Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.
- 1.7 Deviations along with cost of withdrawal (positive or negative), if any, should be very

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clearly brought out clause by clause in the enclosed schedule; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.

- 1.8 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 1.9 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder /vendor and Customer/ Purchaser/Employer will mean BHEL and /or RRUVNL including their consultant as interpreted by BHEL in the relevant context.
- 1.10 The equipment covered under this specification shall not dispatch unless the same have been finally inspected, accepted and shipping release issue by BHEL/Customer.
- 1.11 BHEL's/Customer's representative shall be given full access to the shop in which the equipments are being manufactured or tested and all test records shall be made available to him.

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SECTION – B

PROJECT INFORMATION

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME II SECTION – B
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan GENERAL PROJECT INFORMATION		SHEET 1 OF 3

1.0	Owner	Rajasthan Rajya Vidyut Utpadan Nigam Ltd., Jaipur
2.0	Consulting Engineer	TATA Consulting Engineers Ltd. 73/1, St. Marks Road, Bangalore – 560 001 Tel : 080 – 6622 6000 Fax : 080 – 22274874
3.0	Location of the plant	Prabat Nagar, Suratgarh Sriganganagar district, Rajasthan.
4.0	Latitude and longitude	Latitude : 29 deg. 10 min. N Longitude : 74 deg.01 min. E
5.0	Elevation above mean sea level	186 m (approximate)
6.0	Climatic conditions	
6.1	Temperatures : Monthly basis	
	Mean of daily max.	32.8 deg.C (in the month of May)
	Mean of daily min.	17.6 deg.C (in the month of Jan)
6.2	Temperatures : Annual basis	
	Mean of daily max.	32.3 deg.C
	Mean of daily min.	19.6 deg.C
	Highest temperature recorded	50 deg.C
	Lowest temperature recorded	(-) 2.8 deg.C
	Design Ambient Temperature for Electrical Equipment design	50 deg C
6.3	Relative humidity	Varies between 21% and 81%
6.4	Annual average rain fall	312 mm
6.5	Annual mean wind speed :	4 km / hr.
7.0	Wind load	

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	Calculations for wind effect shall be in accordance with IS:875-1987(Part-3) taking into account the following:	
	a) Basic wind speed = 47 m/sec	
	b) Factor K1 = 1.07	
	c) Category of terrain = Category 2	
	d) K3 – as per IS 875	
8.0	Seismic data (As per IS: 1893 latest issue)	
	a) Zone	Zone II
	Designs & design coefficients shall be based on IS 1893:2002	
	Design condenser cooling water inlet temperature	33 Deg C
9.0	Auxiliary power supply:	
	Auxiliary electrical equipment to be supplied against this specification shall be suitable for operation on the following system:	
	a) For motors rated 160 kW and below.	415V AC, 3-phase, 3-wire effectively earthed.
	b) For motors rated above 160 kW and up to 1500 kW	6600V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
	c) For motors rated above 1500kW	11000V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
	d) For motor control centres	415V AC, 3-phase, 3/4-wire effectively earthed.
	e) DC motor starters, DC solenoids, DC alarm control and protection	220 V DC, 2-wire unearthed
	f) AC control & protective devices	110 V 1 phase, 50Hz, 2 wire AC supply. The single phase 110V AC supply shall be derived by VENDOR by providing 415V / 110 V Control transformers of adequate rating with MCCB / MCB on both the primary and secondary sides.
	g) Uninterrupted power supply	230 V, 1-phase, 50 Hz, 2-wire, AC

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	supply (For all instrumentation and control system equipment and solenoid valves)
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- g) Lighting fixtures and space heaters 240 V, 1 phase, 2 wire, 50Hz, solidly earthed system
- h) Construction supply 415 V, 3 phase, 4 wire, 50Hz AC supply with neutral lead solidly earthed.
- i) The above voltages may vary as follows :

All devices shall be suitable for continuous operation over the entire range of voltage and frequency indicated below without any change in their performance.

AC supply

Voltage variation $\pm 10\%$
Frequency variation $\pm 5\%$

DC supply

Combined voltage & frequency variation 10%

- j) For instrument and control system of steam generator and steam turbine generator. 230 V $\pm 5\%$ AC UPS, 1-phase, 50 Hz, 2-wire. The 24 V DC required for control system shall be generated from this UPS.

10.0 All the electrical equipment shall be designed for 50° C reference ambient temperature.


11.0 LOCATION OF PLANT

The proposed power project shall be located in the state of Rajasthan, in Shriganganagar Distt. The proposed power project is located within 393 km from Jaipur 169 km from Bikaner and 367 Km from Delhi.

Major road distances of the project site are as follows:-


Between	Distance in KMs.
Project-Suratgarh	: 31 km (Nearest Railhead)
Project-Jaipur (State Capital)	: 393 km
Project- Delhi	: 367 Km
Project - Jaipur	: 393 km (Nearest Airport in Rajasthan)
- Amritsar	: 378 km (Nearest Airport)
Project - Bikaner	: 169 km

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SECTION – C

SPECIFIC TECHNICAL REQUIREMENT

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SECTION – C1

SPECIFIC TECHNICAL SPECIFICATION - MECHANICAL

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1. SCOPE:

Complete Boiler Feed water chemical dosing (AVT) system complete with dosing pumps, tanks, associated piping's, supports, fittings, valves, instrumentation and controls etc.

2. 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 DMCW system.

3. SCOPE OF SUPPLY FOR BIDDER FOR LOW PRESSURE CHEMICAL DOSING SYSTEM:

Broad scope of work for bidder for this package includes all equipment and accessories. Please also refer Electrical and C&I sections (section C2 & section C3) for respective scopes

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

3.1 AMMONIA DOSING SYSTEM: (TOTAL NO. OF SKIDS= 2 NOS.)

(Refer drg no. PE-DG-392-154A-A001. Rev. 0)

One number of Ammonia Dosing Skid consists of the following:

- Two number Ammonia mixing cum storage Tank
- Two (2X100%) Ammonia Dosing Pumps
- Two Hand Pumps with flexible hose of 10 meter with each hand pump.
- One number safety shower and eye wash shower
- 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.
- Control & instrumentation as per P&ID of ammonia dosing system, data sheet-A, Section D1, C3 and D3.

3.2 NaOH DOSING SYSTEM FOR ECW SYSTEM: (TOTAL NO. OF SKIDS= 2 NOS.)

(Refer drg. No. PE-DG-392-154A-A002, Rev. 0)


One number of NaOH Dosing skid consists of the following:

- One number NaOH Mixing cum storage tank.
- Two (2x100%) NaOH dosing pumps
- Associated Piping, valves, fitting as indicated in the P&ID of NaOH dosing system and data sheet-A enclosed and as required to make the system complete.
- Control & instrumentation as per P&ID of NaOH dosing system, data sheet-A, Section D1, C3 and D3.

3.3 SCOPE OF SERVICE

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

- Design and engineering.
- Fabrication of the skid mounted chemical dosing system.
- Painting as per the enclosed painting requirement. However, any variation in the painting requirement as finally approved by customer shall be taken care by the bidder without any commercial and delivery implication.
- Inspection and testing of the skid as per the approved quality assurance plan.

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- v. Supply of the skid mounted chemical dosing system up to the power plant site along with all accessories as defined in the technical specification.

3.4 CIVIL SCOPE

Nil.

4. MANDATORY SPARES

Scope of mandatory spares shall be as per mandatory spare list as enclosed in section C1 of this technical specification.

5. ERECTION & COMMISSIONING SPARES

Scope of erection & commissioning spares shall be as per erection & commissioning spare list as enclosed in section C1 of this technical specification.

6. TERMINAL POINTS (ALSO REFER P & I DIAGRAM ENCLOSED)

- All piping beyond battery limit of skid as indicated in P&ID's enclosed with the technical specification is excluded from bidder's scope.
- Electrical scope shall be as per Electrical scope matrix attached in Section C2 of the technical specification.
- 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.
- Counter flanges for all the piping terminal points (as per P&ID) and for the terminal point of drain header shall be in bidder's scope.

7. PAINTING:


Bidder to note that painting shall be 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 section D1 of technical specification.

8. PACKING:

To prevent damage to the equipment 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. Packing and transport instructions are enclosed in section D1.

9. QUALITY PLAN AND SUB VENDOR APPROVAL

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

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10. DRAWINGS/DOCUMENTATION

10.1 DOCUMENTS TO BE SUBMITTED ALONG WITH THE BID(PI refer electrical & C&I portion also):-

- Pre- bid clarifications in given format only.
- Deviations (if any) in given format only.
- Electrical load data format (filled).

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 Volume - III of this technical specification.

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.

10.2 LIST OF DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT (PI refer electrical & C&I portion also):-

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


For the Drawings/Documents Submission Procedure, please refer **Annexure-I**. 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 confirmed drawings submission schedule as follows:

- Drawing/documents submission schedule: First submission of basic drawings/ documents – (P&ID, GA drawings and foundation details and Quality plan) shall be within 3 weeks from the date of LOI.
- Every revised submission incorporating comments – within 7 days.
- BHEL shall provide observation / approval within 03 weeks from the date of document submission by bidder.

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

S. NO	BHEL DRG NO	DRG TITLE	No. of weeks for document submission after placing LOI/PO	Document size
1	PE-V0-392-154A-A001	P&I DIAGRAM FOR CHEMICAL DOSING SYSTEM	3	A3
2	PE-V0-392-154A-A002	TECHNICAL DATA SHEET--CHEMICAL DOSING SYSTEM	4	A4
3	PE-V0-392-154A-A003	GA DRAWING & FOUNDATION DETAILS	3	A3
4	PE-V0-392-154A-A004	LOCAL CONTROL PANEL - CDS	4	A4
5	PE-V0-392-154A-A005	ELECTRICAL LOAD DATA	6	A3
6	PE-V0-392-154A-A006	QAP FOR CHEMICAL DOSING SYSTEM	3	A3
7	PE-V0-392-154A-A007	ERECTION PROCEDURE	6	A4
8	PE-V0-392-154A-A008	ENGINEERING BOQ	10	A3
9	PE-V0-392-154A-A009	O&M MANUAL FOR CHEMICAL DOSING SYSTEM WITH CATALOGUE	20	As applicable

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In addition of above following documents shall also be submitted by bidder during detail engineering:-

- a) Storage instructions

NOTE:-

- a) Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier
- b) 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.
- c) 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 drawing beyond one month will be to customer's account.

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


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

11. SPARES

- a. 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.
- b. The quality plan and the inspection requirement finalised for the main equipment will also be applicable to the corresponding spares.

The vendor warrants:

- i. 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:


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- ii. In case of any failure in the original component/equipments due to faulty designs, materials and workmanship, the corresponding spare parts if any, supplied will be replaced without any extra cost to the BHEL and customer unless a joint examination and analysis by BHEL and/or customer of such spare parts prove that the defect found in the original part that failed can safely be assured not to be present in spare parts.
 - iii. 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.
 - iv. 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.
 - v. 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.
- c. The vendor will indicate the delivery period of the spares, which the BHEL and the customer may procure in accordance with this clause.
 - d. 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.
 - e. 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.
 - f. 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.

12. 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-C & D the following shall also be complied under scope of this specification: The P&ID is enclosed herein in this section for bidder's compliance.

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- 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 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) All valves and instruments will be located such that they are easily accessible during normal operation and maintenance.
- f) 5mm 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 supports, pumps and pipe supports and LCP/LCP supports shall be welded to the checker plate.
- g) Stuffing box shall be provided for mounting the agitator to avoid air ingress.
- h) Vent/overflow pipe from tank shall at least reach the bottom half of the breather/water seal/CO2 absorber.
- i) SS pad shall be provided for welding MS structural supports to SS tanks.
- j) Step ladder and chemical charging platform shall be provided for easy access to top of tank.
- k) All the terminal points shall be easily accessible and towards one side of skid.
- l) All valves shall be easily accessible for the operator.
- m) All tanks/pumps shall have name plate clearly indicating the equipment name.
- n) Pipe fittings of the system shall be done using elbows and tees. Pipe bending is not acceptable.
- o) All equipment shall have SS name plate.
- p) All LCP shall be mounted in their respective dosing skids only.
- 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.

13. MISCELLANEOUS REQUIREMENTS

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

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- c) 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 drawing beyond one month will be to customer's account.
- d) Engineering for this project is being carried out in 3D environment at BHEL end. Name of engineering platform on which BHEL is doing the project IS Smart Plant Suite. This is being done to have automated interface checking and thereby minimising rework at site. Hence bidder, in their own interest, is requested to prepare all layout drawings using 3D Modelling software. These drawings will also be made available to BHEL in soft for checking interface with other agencies in consolidated layout drawings. Bidder's inability to prepare drawing using 3D Modelling software will not be criterion for evaluation of their bid.
- e) 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.
- f) In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- g) Latest version of all codes and standards to be followed.
- h) Billing break up (BBU) of Chemical Dosing System should be equal to Bill of Quantity (BOQ) of the same

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ANNEXURE I


DRAWING DOCUMENTS SUBMISSION PROCEDURE

- Bidder shall submit soft copy/hard copy/CD ROMs of all the finally approved drawings and O&M Manuals as required by Customer/Customer consultant/BHEL-site/BHEL-PEM. The exact number of hard copies/CD ROMs of these documents to be submitted shall be notified to the bidder at the time of detailed engineering and bidder shall submit the same without any commercial/delivery implications to BHEL/Customer.
- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.
- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.
- Editable copy of all the drawings and documents shall be provided.
- The date of submission of drawing documents shall be considered as the date of submission of hard and soft 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 to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.
- Vendor to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.
- Bidder to submit instrument schedule, cable schedule and valve schedule in MS- Excel format during detailed engineering.
- Bidder to also furnish the auto cad copy/MS-Excel/MS-word (as applicable) of the following documents after award of contract. However any other auto cad copy/MS-Excel/MS-word of any other document as per the insistence of BHEL and customer will also be submitted by the bidder without any delivery and commercial implication to BHEL and customer.
 - P&IDs.
 - GA & FOUNDATION DETAILS OF CHEMICAL DOSING SKIDS
 - LCP DETAILS

DRAWINGS/DOCUMENTS DISTRIBUTION LIST (as applicable)

All documents & drawings shall be in English and in metric units


S. No	LIST	TCE	RRVUNL-EC	RRVUNL-SITE/ TCE SITE	BHEL SITE	PMG BHEL	REMARKS
1	Master list of drawings / doc (duly indicating sch of submission)	Soft copy	Soft copy	Soft Copy	-	Soft copy	
2	Drawings / doc for Approval/Information (First Submission)	Soft copy	Soft copy + 1 print	Soft copy + 1 print	-	Soft copy	
3	Return with comments/approval	S	Soft copy	Soft copy	-	Soft copy	
4	Drawings / Documents for approval (second & subsequent submissions till approval)	Soft copy	Soft copy + 1 print	Soft copy + 1 print	-	Soft copy	

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5	Drawings / documents for distribution (Approved by RRVUNL, in cat. A or G)	Soft copy	1 print + Soft copy	2 print + Soft copy	6 prints + Soft copy	Soft copy	
6	Erection Drawings / documents	-	1 print	3 prints	6 prints	-	
7	FINAL Erection / Installation Manual for distribution	-	1 prints+ Soft copy	2 prints+ Soft copy	3 prints+ Soft copy	Soft copy	
8	As built Drawings / documents	-	1 print+ Soft copy	3 prints+ Soft copy	2 prints+ Soft copy	Soft copy	
9	Operation & Maintenance Manual	-	1 prints + Soft copy	3 prints+ Soft copy	2 prints+ Soft copy	Soft copy	
10	Performance & functional Guarantee test reports	-	1 prints + Soft copy	3 prints + Soft copy	2 prints + Soft copy	Soft copy	
11	Type Test Certificate	Soft copy	1 prints+ Soft copy	3 prints+ Soft copy	2 prints+ Soft copy	Soft copy	
12	Commissioning & Performance Procedure Manual	-	1 prints+ Soft copy	3 prints+ Soft copy	2 prints+ Soft copy	Soft copy	
13	Project Completion Report	-	1 prints+ Soft copy	3 prints+ Soft copy	2 prints+ Soft copy	Soft copy	

NOTES:


- The above schedule of submission does not include Docs/Drgs. of quality assurance/inspection and delivery/dispatches.

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DATA SHEET-A

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S. No.	Description	Ammonia	NaOH
1.0	No. of skid(s)	Two (one per unit)	Two (one per unit)
2.0	Mixing cum storage tank:		
a	No. of tanks per Skid	Two per skid	One
b	Capacity in litres	3000	500
c	Type	Vertical cylindrical, dish end bottom tank	Vertical cylindrical, dish end bottom tank
d	Material of the tank	SS-304	SS-304
e	Thickness	Not less than 3 mm	Not less than 6 mm
2.1	Motorised Stirrer	Provided	Provided
a	Material of shaft and propeller	SS-304	SS-304
b	Type of agitator	Motor operated with gear box	Motor operated with gear box
2.2	Dissolving basket	NA	Provided (30 mesh), SS-316
3.0	Dosing pump *:		
3.1	Medium to be handled	1 % Ammonia solution	NaOH solution
3.2	Type of pump	-- Reciprocating Type-----	-- Reciprocating Type-----
3.3	Make of pump	-----Reputed indigenous (BHEL Approved)-----	
3.4	No. of pump-motor assembly	Two (2X100%)	Two (2X100%)
3.5	Capacity	150 LPH	10 LPH
3.6	Discharge pressure	45 Kg/cm ² (g)	10 Kg/cm ² (g)
3.7	All Wetted parts of pumps	SS-316	SS-316
3.8	Pulsation Dampener	One per each pump discharge	One per each pump discharge
4.0	Strainers:		
4.1	No. of strainers	Two	Two
4.2	Type	Y type suction strainers	Y type suction strainers
4.3	Material of screen	SS-304	SS-304
4.4	Mesh Size	50 (BS)	50 (BS)
5.0	Main Piping:		
5.1	Material	ASTM A312 Gr. TP 304 Schedule 40 (seamless)(minimum)	ASTM A312 Gr. TP 304 Schedule 40 (seamless) (minimum)
5.2	Diameter	25 NB	40 NB
6.0	Drain Pipe:		
6.1	Material	SS-304	SS-304
6.2	Diameter	25 NB	40 NB
6.3	Over flow	25 NB	40 NB
7.0	Valves:		
7.1	Body, Cover, Yoke & Trim Material	SS-304	SS-304
7.2	Weld ends	Socket weld ends	Socket weld ends
8.0	Fittings	Forged steel to A105 F304, Dimension to ANSI B 16.11 socket weld ends.	Forged steel to A105 F304, Dimension to ANSI B 16.11 socket weld ends.
9.0	Structural steel	IS 2062	IS 2062
10.0	Flanges-Pump Suction/Discharge	ANSI B 16.5 CL150/ANSI B 16.5 CL 300	ANSI B 16.5 CL150
11.0	Hand pump with accessories.	Two nos. per skid	NA
12.0	Access ladder and platform	Shall be provided (painted)	Shall be provided (painted)
13.0	Nuts and Bolts	SS 304	SS 304
14.0	Safety Shower and eye wash shower	One per skid	N.A.


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LIST OF MANDATORY SPARES

SNO	ITEM DESCRIPTION	TOTAL QUANTITY
1	Dosing pump complete(for each type, rating and size)	1 number
2	Plunger diaphragm(for each type, rating and size)	2 Sets (1 set = One pump requirement)
3	Driving motor(for each type, rating and size)	1 number
4	Agitator with motor(for each type, rating and size)	1 Set (1 set = One system requirement)
5	Plunger packing	4 Sets (1 set = One pump requirement)
6	Oil Seals	4 Sets (1 set = One pump requirement)
7	All pump and motor bearings	2 Sets (1 set = One pump & one Motor requirement)
8	Agitator bearings	4 Sets (1 set = One pump & one Motor requirement)
9	Complete valves (for each type, range and size)	5 % or minimum one whichever is higher.
10	Level gauge (for each type, range and size)	10% or minimum 1 no whichever is higher for each 660 MW Unit
11	Level transmitter (for each type, range and size)	10% or minimum 1 no whichever is higher for each 660 MW Unit
12	Pressure gauge (for each type, range and size)	10% or minimum 1 no whichever is higher for each 660 MW Unit
13	Pressure transmitter (for each type, range and size)	10% or minimum 1 no whichever is higher for each 660 MW Unit
14	Differential pressure gauge (for each type, range and size)	10% or minimum 1 no whichever is higher for each 660 MW Unit
15	Differential pressure transmitter (for each type, range and size)	10% or minimum 1 no whichever is higher for each 660 MW Unit
16	Back up fuse	12 Nos.
17	Pilot Lamp	8 Nos.
18	Push Button	8 Nos.
19	Control Fuse	8 Nos.
20	Bulb for Annunciation	16 Nos.

NOTE:-

1. Whenever % is indicated for the mandatory spares, the quantity shall be calculated for % of supply of supply for total quantity for 2 units of 2 x 660 MW, unless otherwise specified. The quantity to be reckoned for % indicated shall be rounded off to the next higher whole number. For example if the % arrived is 0.2 the quantity to be supplied shall be 1 and is the % arrived is 5.1 the quantity to be supplied shall be 6.
2. Identification: Each spare shall be clearly marked and labelled on the outside of the packing with its description. When more than one spare part is packed in single case, a general description of the contents 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.


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LIST OF ERECTION & COMMISSIONING SPARES


SL. NO.	ITEM DESCRIPTION	Quantity per skid (No.)	TOTAL NOS.
1.0	AMMONIA 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 valves.	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	NaOH 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

Note: -

- 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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INDICATIVE LIST OF SUB VENDOR


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INDICATIVE LIST OF SUB VENDOR:

SN	ITEM	APPROVED SUPPLIERS	PLACE
1	TANK/DISSOLVING BASKET/WATER SEAL POT/CO2 ABSORBER/BREATHING	SELF-MAKE OF MAIN VENDOR	AS APPLICABLE
2	METERING PUMP		
		MILTON ROY INDIA	CHENNAI
		VK PUMP	NASIK
		METACHEM	MUMBAI
		SWELORE	AHMEDABAD
3	SAFETY VALVES/RELIEF VALVES	METACHEM	MUMBAI
		KEYSTONE	BARODA
		V K PUMPS	NASIK
		MILTON ROY	CHENNAI
4	AGITATOR/STIRRER	REMI (REFER NOTE 1)	MUMBAI
		MILTON ROY INDIA	CHENNAI
		CEECON	CHENNAI
		FIBRE & FIBRE	
		POWER PIPING	CHENNAI
		SWELORE	AHMEDABAD
5	Y-TYPE STRAINER / STRAINER (WATER SERVICE)	OTOKLIN	MUMBAI
		GRAND PRIX	NEW DELHI
		JAYPEE	NEW DELHI
		GREAVES COTTON	MUMBAI
		MULTITEX	NEW DELHI / NOIDA
6	PULSATION DAMPENER	TECHNO	MUMBAI
		VK PUMPS	NASIK
		SWELORE	AHMEDABAD
		MILTON ROY INDIA	CHENNAI
7	STRAINER(DUPLEX TYPE)	OTOKLIN	MUMBAI
		JAYPEE	NEW DELHI
		GREAVES COTTON	MUMBAI
		MULTITEX	NEW DELHI
		PENNAUNT & FILTRATION ENGINEERING	
		TECHNO CONSULTANTS	MUMBAI
		BVK FIBROTEK	CHENNAI
8	HAND PUMP	FLUIDYNE INSTRUMENTS	MUMBAI
		SLEEK PUMPS	MUMBAI
		JYOTI ENGINEERS	MUMBAI
		SOLVACID	
9	STROKE CONTROLLER	V K PUMPS	NASIK
		METACHEM	MUMBAI
		SWELORE	AHMEDABAD
		MILTON ROY INDIA	CHENNAI

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10	BALL VALVE (NON FIRE SAFE TYPE)	PEC	NASIK
		FLOWCHEM	AHEMDABAD
		BDK	HUBLI
		AUDCO	CHENNAI / KANCHIPURAM
		MICROFINISH VALVES	HUBLI
		AK INDUSTRIES	HUBLI
		LEADER	JALANDHAR
11	ANGLE VALVE	VELAN INC	CANADA
		IL	PALGHAT
		REINEKE	GERMANY
		SAMPELL AG	GERMANY
12	HIGH PRESSURE BUTTERFLY VALVE / CONTROL VALVE	DEZURICK (UPTO 400 NB)	USA
		TYCO (UPTO 450 NB)	USA
		BRAY	USA
		JAMESBURRY	USA
13	BALL VALVE (HIGH PRESSURE)	VELAN	CANADA
		BRAY	USA
14	SS BALL VALVE 150 LBS	WEIR BDK	HUBLI
		AUDCO	CHENNAI
		MICRO FINUISH	HUBLI
		BRAY	CHINA
15	BUTTER-FLY VALVE (MANUAL / PNEUMATIC) CLASS 150	AUDCO	CHENNAI
		TYCO	HALOL
		WEIR BDK	HUBLI
		CRANE FLOW PROCESS	SATARA
16	DUAL PLATE TYPE NON-RETURN VALVE (SS & CI UPTO 100 NB, CLASS 150)	ADVANCE VALVES	NOIDA
		WEIR BDK	HUBLI
		LEADER	JALANDHAR
17	DIAPHRAGM VALVE (MANUAL / PNEUMATIC) UPTO 80 NB	WEIR BDK	HUBLI
		CRANE FLOW PROCESS	SATARA
18	GATE / GLOBEVALVES UP TO 300 NB PN 10	LEADER	JALANDHAR
		H SARKAR	HOWRAH
		BANKIM & COMPANY	HOWRAH
29	CHECK VALVE / NRV (LINED / UNLINED), FLAP TYPE SIZE UPTO 50 NB	MAJESTIC WORKS	MUMBAI

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20	FITTINGS (CS/SS)		
		BHARAT FORGE	PUNE
		RELIANCE FORGE	
		EBY	MUMBAI
		SIDDARTH & GAUTAM	FARIDABAD
		MS FITTINGS	KOLKATA
		PRADEEP METALS LTD	MUMBAI
		TUBE PRODUCT INCORPORATION	BARODA
21	FLANGES (SS/CS)		
		PRADEEP METALS LTD	MUMBAI
		TUBE PRODUCT INCORPORATION	BARODA
		MS FITTINGS AND FLANGES	KOLKATA
		HAWA ENGINEERING	
		ALIANCE PIPE & PLANGES	KOLKATA
		JAI AMBE	MUMBAI
22	RUBBER LINING FOR PIPES/TANKS		
		RISHI INDUSTRIES	SONEPET
		INDUSTRIAL LINING LTD	BARODA
		MIL	CHENNAI
23	PAINT		
		BERGER	
		ASIAN PAINTS	
		SHALIMAR	
		J&N	
24	WELDING ELECTRODES		
		ADVANI	
		L&T	
		MODI	
		ESAB	
		D&H	
		RAJ KESERI	
		MODI (FOR GENERAL WORKS, NOT FOR STRUCTURE WELDING)	
		MARUTI (FOR GENERAL WORKS, NOT FOR STRUCTURE WELDING)	
25	MS PIPES ERW AND SEAMLESS PIPES		
		TISCO	
		JINDAL SURYA ROSHANI	
		PSL	
		MAHARASHTRA SEAMLESS	
		INDIAN SEAMLESS	
		SAW	
		RAMA STEEL TUBES	
26	SS PIPES		
		KALYANI	
		PRAKASH	
		SAW	

Notes:-

- a) Bidder to note that geared motor of REMI make for stirrers (for stirrers of REMI make ONLY) is acceptable to BHEL.

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- b) The sub vendor list enclosed is indicative only and is subject to approval / acceptance by customer (RRUVNL). Bidder to propose his sub vendor list with back up documents (experience list, end user certificate as applicable) etc. The same shall subject to BHEL and Customer approval during detailed engineering stage without any technical, commercial & delivery implication to BHEL or customer.
- c) Calibration column may be purchased from sources as per pump manufacturer's recommendation.

INDICATIVE LIST OF SUB VENDORS FOR LV & MV MOTORS

Motors Type	Vendor	Address		
MOTORS LV	BHARAT BIJLEE LTD.	Bharat Bijlee Limited, 1st Floor, 7-B, Rajindra Park, Pusa Road, New Delhi - 110 060.		
MOTORS LV	CROMPTON GREAVES	VANDHANA BUILDING	11, TOLSTOY MARG	NEW DELHI-110001
MOTORS LV	ASEA BROWN BOVERI	IST FLOOR,QUTUB HOTEL	SHAHID JEET SINGH MARG	NEW DELHI-110016
MOTORS LV	KIRLOSKAR ELECTRIC CO LTD.	P.O. BOX 5555	MALLESWARAM WEST	BANGALORE 560055
MOTORS LV	NGEF	BANK OF BARODA BDG	PBNO.633,16,SANSAD MARG	NEW DELHI-110001
MOTORS LV	SIEMENS	4A, RING ROAD	I.P. ESTATE	NEW DELHI 110002
MOTORS LV	MARATHON	708, EROS APARTMENT 56, NEHRU PLACE NEW DELHI-110019		
MOTORS LV	GE-POWER	150 AIRPORT ROAD	BANGALORE-560017	
MOTORS LV	RAJINDRA ELECT INDUSTRIES	14 SHAH IND.ESTATE	VEERA DESAI RD,ANDHERI(W)	MUMBAI-400053
MOTORS LV	LAXMI HYDRAULICS PVT. LTD	129/130, INDUSTRIAL ESTATE PATIL NAGAR, HOTGI ROAD SOLAPUR-413003, MAHARASHTRA		
MOTORS MV	BHEL (INDUSTRY SECTOR)	INTEGRATED OFFICE COMPLEX	LODHI ROAD	NEW DELHI 110003
MOTORS MV	CROMPTON GREAVES	VANDAHNA BUILDING	11, TOLSTOY MARG	NEW DELHI-110001
MOTORS MV	KIRLOSKAR ELECTRIC CO LTD.	P.O. BOX 5555	MALLESWARAM WEST	BANGALORE 560055
MOTORS MV	NGEF	BANK OF BARODA BLDG.	PB.NO.633,16,SANSAD MARG	NEW DELHI-110001
MOTORS MV	GE-POWER	150 AIRPORT ROAD	BANGALORE-560017	
MOTORS MV	MARATHON	708, EROS APARTMENT 56, NEHRU PLACE NEW DELHI-110019		

NOTE: VENDOR TO PLEASE NOTE THAT FINAL SUB VENDOR SELECTED OUT OF THE ABOVE RECOMMENDED SUB VENDORS SHALL SUBJECT TO CUSTOMER APPROVAL DURING DETAILED ENGINEERING WITHOUT ANY TECHNICAL, COMMERCIAL & DELIVERY IMPLICATIONS TO BHEL AND CUSTOMER. ANY ADDITIONAL SUB VENDOR OTHER THAN ABOVE SHALL ALSO SUBJECT TO CUSTOMER AND BHEL APPROVAL DURING DETAILED ENGINEERING WITHOUT ANY TECHNICAL, COMMERCIAL & DELIVERY IMPLICATIONS TO BHEL AND CUSTOMER.

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D26
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan INDICATIVE LIST OF SUB VENDORS	SHEET 4 OF 10

Sl. No.	EQUIPMENT	VENDOR
18.	RELAY PANELS	AREAVA T&D ASEA BROWN BOVERI LIMITED, BARODA SIEMENS LIMITED, NEW DELHI EASUN REYROLLE
19.	SWITCHYARD CONTROL & RELAY PANELS	AREAVA T&D ASEA BROWN BOVERI LIMITED, BARODA SIEMENS LIMITED, NEW DELHI
20.	CONTROL PANELS	SIEMENS ABB AREVA BHEL
21.	HT POWER CABLES	UNIVERSAL CABLES LIMITED, SATNA TORRENT CABLES NICCO CABLES RPG CABLES CCI POLYCAB KEI FGIL INDUSTRIAL CABLES GEMSCAB

ISSUE
R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D26
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan INDICATIVE LIST OF SUB VENDORS	SHEET 5 OF 10

Sl. No.	EQUIPMENT	VENDOR
22.	LT POWER & CONTROL CABLES	FINOLEX CABLES, PUNE POLY CAB INDUSTRIES, BARODA RPG CABLES TORRENT CABLES NICCO CABLES UNIVERSAL CABLES KEI DELTON CCI ISHWAR METAL INDUSTRIES ISHWAR CABLES PVT LTD DAKSHA (only for Control cables) TIRUPATI (only for Control cables) ROMESH CABLES ROLLEX ALPHA COMMUNICATION GEMSCAB
23.	INSTRUMENTATION CABLES	ASSOCIATED CABLES (P) LTD. POLYCAB WIRES PVT LTD. GEMSCAB DELTON CABLES LTD. CORDS CABLES INDS. PVT. LTD SKYTONE ELECTRICALS (INDIA) LTD. NICCO CORP.LTD
24.	220 V DC LEAD ACID BATTERIES	EXIDE BATTERIES, CALCUTTA HOPPECKE BATTERIES, GERMANY

ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D26
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan INDICATIVE LIST OF SUB VENDORS	SHEET 7 OF 10

Sl. No.	EQUIPMENT	VENDOR
29.	LV SWITCHGEAR- Non draw out DBs such as Space heater DBs, Lighting DBs, AC & DC distribution boards (TVDB & BVDB excluded), Workshop MCC, Admin building PCC, Welding DBs, Receptacle DBs)	L&T LTD, MUMBAI SIEMENS LTD., MUMBAI CONTROL SWITCHGEAR CO., NEW DELHI SCHNEIDER GE POWER SPACE AGE
30.	MV SWITCHGEAR (11kV & 6.6kV)	ABB, NASIK SIEMENS LTD., MUMBAI BHEL AREAVA, T&D
31.	ELECTRIC MOTORS (HT & LT)	BHEL CGL KEC ABB SIEMENS AREVA (MARATHON)
32.	CABLE END TERMINATION KITS	RAYCHEM LTD, MUMBAI
33.	CABLE GLANDS	COMET DOWELS
34.	ELECTRIC ACTUATORS	AUMA LTD., BANGALORE ROTORK LTD., MUMBAI LIMITORQUE LTD., FARIDABAD
35.	LV/MV CTS /PTS	PRAGATHI INDUSTRIES, KOLKATTA JYOTHI LTD., BARODA GILBERT & MAXELL, BARODA PRECISE ELECTRICALS PRAYOG ELECTRIC BOMBAY

ISSUE R1

INDICATIVE LIST OF SUB VENDORS FOR C&I ITEMS
(AS APPLICABLE)

VENDOR LIST FOR C & I	
ITEMS	MAKE
PLC	ABB /GE FANUC /L& T LTD/ROCKWELL /SIEMENS /SCHNEIDER ELECTRIC
CONTROL VALVE	DeZURIK/CONTINENTAL /CONTROL COMPONENT INC/DRESSER/FOURESS ENGG/FISHER /FORBES MARSHALL/WEIR VALVES /IL/MIL/R.K.CONTROL
LEVEL SWITCH	BLISS ANAND/CHEMTROLS/HI-TECH SYS/LEVCON/RAMAN INST/SIGMA/SOR INC/SBEM /V. AUTOMAT /WAAREE INST
PRESSURE SWITCH	DRESSER/INDFOS /SWITZER/SOR INC/VASU
ANALYTICAL INSTRUMENTS	FORBES MARSHALL /FISHER-ROSEMOUNT /SIEMENS
PRESSURE GUAGE	A.N.INST/BUDENBERG GAUGE/DRESSER IND/FORBES MARSHALL/GENERAL INST CONSORTIUM/GLUCK/H.GURU IND/H.GURU INST/MANOMETER/WAAREE INSTRUMENTS
TEMPERATURE GUAGE	A.N.INST/BUDENBERG GAUGE/FORBES MARSHALL/H.GURU IND/H.GURU INSTWAAREE INSTRUMENTS/GOA INST/GOA THERMOSTATIC INST/
FLOW ELEMENT	BRISTOL BABCOCK/BALIGA LIGHTING EQUIP/ENGINEERING SPECIALITIES /IL/MICRO/MINCO/STAR-MECH
TEMPETAURE ELEMENT	GENERAL INST CONSORTIUM/DETRIVE INST & ELECTRONICS /PYRO ELECTRIC /TOSHNIWAL BROS/WAAREE INST
TRANSMITTERS	BRISTOL BABCOCK/BIRLA KENT-TAYLOR /BLISS ANAND/FISHER-ROSEMOUNT/SIEMENS/SBEM /SMART INST/TATA HONEYWELL/V.AUTOMAT & INSTS/
TEMPERATURE SWITCH	INDFOSS/DRESSER/SWITZER/SOR INC/TOSHNIWAL BRO/VASU TECH
SIGHT FLOW INDICATORS	BLISS ANAND/CHEMTROLS/INSTRUMENTATION ENGINEERS /SIGMA/TELACE EQUIP
INST PIPE FITTINGS	AURA INCORPORATED/HYD-AIR ENGG/METPRESS ENGG/PRECISION ENGG/SWITZER INST/VIKAS INDUSTRIAL
DP SWITCH	KAUSTUBA UDYOG /SWITZER/SOR INC/VASU TECH
ANUBAR	ENDRESS+HAUSER GmbH +Co.KG /SWITZER/STAR-MECH
JUNCTION BOXES	BALIGA LIGHTING EQUIP/CREATIVE INST/DEVI POLY/INFO CONTROL /K.S.INTRUMENTS /MANISHA ENTERPRISE/SUCHITRA INDUSTRIES
INST TUBE FITTINGS	AURA INCORPORATED/HYD-AIR ENGG/METPRESS ENGG/PRECISION ENGG/SWITZER INST/VIKAS INDUSTRIAL
ROTAMETERS	CHEMTROLS SAMIL/EUREKA IND/IL/TRANSDUCERS AND CONTROLS/

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SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT INDICATIVE LIST OF SUB VENDORS FOR C&I ITEMS (AS APPLICABLE)	SHEET 3 OF 16
<p>Universal Cables Ltd Reliance Cables</p> <p>Gems Cab</p> <p>CONTROL CABLES Delton Incab Universal Cables Ltd Reliance Cables Gems Cab.</p> <p>CONDUCTIVITY MEASUREMENT</p> <p>Emerson Process Management Honeywell ABB Ltd. Polymetron. Yokogawa Bluestar Ltd</p> <p>DISSOLVED OXYGEN MEASUREMENT</p> <p>Honeywell Polymetron Emerson Process Management ABB Yogokawa Bluestar Ltd.</p> <p>HYDRAZINE ANALYSER</p> <p>Hach ABB Polymetron Emerson Process Management</p> <p>PH</p> <p>Hach Polymetron Forbes Marshall Honeywell Emerson Process Management ABB Ltd</p>		
		ISSUE R1

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<p>SILICA</p> <p>Hach Polymetron Braun & Leube ABB Emerson Process Management</p> <p>CONTROL VALVES</p> <p>Dresser Masoneilan - France, Fisher Yamatake CCI ABB Welland & Tuxhorn Gulde Regal Armaturen. Pneucon</p> <p>ELECTRICAL ACTUATORS</p> <p>Vaas Bernard Auma India Ltd. Limitorque Rotork Controls Ltd. Antrieb</p> <p>DIFFERENTIAL PRESSURE INDICATORS</p> <p>Indfoss AN Instruments Switzer Instruments Ltd. Waaree Instruments Ltd. General Instruments (GIC) H.Guru A N Instruments</p> <p>DIFFERENTIAL PRESSURE SWITCHES</p> <p>Indfoss Switzer Instruments Ltd. Varma Trafag Waaree Instruments Ltd</p>		
		ISSUE R1

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<p>General Instruments (GIC)</p> <p>PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER</p> <p>Honeywell Emerson Process Management ABB Yokogawa Fuji Yamatake Endress & Hauser SIEMENS</p> <p>DIGITAL DISPLAY UNIT</p> <p>Laxsons Yogokawa Bluestar Ltd. Tata Honeywell Ltd. Gossien Metrawatt</p> <p>DISPLACEMENT TYPE LEVEL TRANSMITTERS</p> <p>Dresser Masoneilan Emerson Process Management Magnetrol Yamatake Endress & Hauser</p> <p>ELECTRIC METERS</p> <p>AE MECO Gossien ABB</p> <p>E/P CONVERTERS</p> <p>Bells Controls Ltd. ABB Emerson Process Management Sical Yamatake</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT INDICATIVE LIST OF SUB VENDORS FOR C&I ITEMS (AS APPLICABLE)	SHEET 6 OF 16
<p>FLOW ELEMENT</p> <p>Star mech Micro precision products Engineering Specialities Pvt Ltd. Mech Engg General Instruments (GIC) Teleflow Emerson Dag Process Instruments Hydropneumatic</p> <p>FLOW GLASSES</p> <p>Eureka General Instruments Levcon V.Automat & Instrument (p) Ltd. Bliss Anand</p> <p>FLOW INTEGRATORS</p> <p>Lectrotek Nishko ABB Ltd. Rockwin</p> <p>ILLUMINATED PUSH BUTTONS</p> <p>EAO H & B L & T Ronan Honeywell Siemens</p> <p>STANDALONE SER</p> <p>Hathaway (Imported) Ronan (Imported)</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT INDICATIVE LIST OF SUB VENDORS FOR C&I ITEMS (AS APPLICABLE)	SHEET 7 OF 16
MICROPROCESSOR BASED ANNUNCIATION SYSTEM Hathaway (Imported) Ronan (Imported) LEVEL GAUGES Chemtrols Engg. Levcon Sigma Instruments co. Technomatic (India) pvt. ltd. Teleflo Instruments co. ltd. Pune Techtrol B K Equipment V Automat SBEM Bliss Anand LEVEL SWITCHES Bells Control Ltd. Levcon Magnetrol Placka Pune Techtrol B K Equipment V Automat SBEM Bliss Anand POSITION TRANSMITTER Endress & Hauser Yamatake Siemens Gulde PRESSURE INDICATORS H.Guru Bells Controls ltd. General Instruments		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT INDICATIVE LIST OF SUB VENDORS FOR C&I ITEMS (AS APPLICABLE)	SHEET 8 OF 16
<p>A.N. Instruments Gauges Bourdon Industrial Eqpt. co. Waaree Instruments Ltd. Odion Druck India Wika Instruments</p> <p>PRESSURE SWITCHES</p> <p>Indfoss (India) Ltd. Switzer Instruments Ltd. Varma Trafag A.N. Instruments Waaree Instruments Ltd Dag Process Instruments Chemtrols</p> <p>PUSH BUTTONS</p> <p>Honeywell Larsen & Toubro Ltd. Siemens Ltd. Tele Mechanic</p> <p>RECEIVER INDICATOR (BAR GRAPH)</p> <p>Laxons Masibus Industrial Instrumentation Yokogawa Teletherm Instruments co.</p> <p>RECEIVER RECORDER / MULTIPOINT RECORDER</p> <p>Laxons Engg. & Electronic Pvt. Ltd. Yokogawa. Tata Honeywell ABB Digital Electronics. Penny & Guile</p>		
		ISSUE R1

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<p>RELAYS</p> <p>Jyothi ABB Paramount Omron SIEMENS</p> <p>SAMPLE COOLER</p> <p>Polymetron Emerson Process Management Sentry Lowe</p> <p>SAMPLING RACK</p> <p>Emerson Process Management Polymetron</p> <p>SOLENOID VALVES</p> <p>Asco Avcon Rotex Schrader Herion-Norgren Schovill Duncan Ltd.</p> <p>TEMPERATURE INDICATORS</p> <p>G.I.Consortium Bells Controls Waaree instruments ltd Dresser-USA</p> <p>TEMPERATURE SWITCH</p> <p>Ashcroft Switzer Instruments Ltd. Waaree Instruments Ltd Dresser-USA</p>		
		ISSUE R1


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<p>TEMPERATURE TRANSMITTERS</p> <p>ABB Ltd. Emerson Process Management Camille-Baur P & F.</p> <p>THERMO COUPLE ASSEMBLY</p> <p>Industrial Instrumentation General Instruments Nagman Sensors (p) Ltd Pyro Electric instruments Toshniwal Industries Pvt. Ltd. Altop Temsens Waaree</p> <p>THERMOWELL</p> <p>General Instruments Nagman Sensors (p) Ltd. Pyro Electric Instruments Detriev Instrumentation Toshniwal Industries Ltd. Altop Temsens Waaree</p> <p>RTD</p> <p>Industrial Instrumentation Nagman Sensors (p) Ltd. Toshniwal Industries Pvt. Ltd Pyro Electric Instruments Altop Temsens Waaree</p> <p>UNIT CONTROL PANELS</p> <p>Industrial Controls & Appliances (P) Ltd. J & H</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT INDICATIVE LIST OF SUB VENDORS FOR C&I ITEMS (AS APPLICABLE)	SHEET 11 OF 16
<p>Chemin Rittal</p> <p>LOCAL CONTROL PANELS</p> <p>Industrial Controls & Appliances (P) Ltd. J & H Pyrotech Rittal Chemin</p> <p>VARIABLE AREA FLOWMETERS</p> <p>Eureka Krone – Marshall Scientific Devices Chemtrols Trac Instrument Engineers</p> <p>CONDITION MONITORING SYSTEM</p> <p>Bently Nevada Schenk Avery SPM Instruments Ltd. Rockwell Automation. Shinkawa.</p> <p>ANNUBAR</p> <p>Dietrich Emerson Process Management</p> <p>ASSIGNABLE TREND RECORDER</p> <p>Honeywell Yokogawa Penny & Guile</p> <p>DESUPERHEATER</p> <p>Fisher Dresser Masoneilan</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
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<p>CCI</p> <p>FLOAT & CHORD TYPE LEVEL INDICATOR</p> <p>Jayati Pune Techtrol B K Equipment V Automat SBEM Bliss Anand</p> <p>LEVEL SWITCH (PROBE TYPE)</p> <p>Level Stat Solatron Keystone Yarway.</p> <p>LAB INSTRUMENTS</p> <p>Dead Weight Tester (Pneumatic)</p> <p>Pressurements Waaree Instruments Ltd</p> <p>PRESSURE AND VACCUM GENERATORS WITH FINE REGULATOR</p> <p>Superb Instruments</p> <p>HIGH PRECISION REGULATORS FOR PRESSURE & VACUUM</p> <p>Fairchild</p> <p>HIGH TEMPERATURE FURNACE</p> <p>Nagman Waaree Instruments Ltd</p> <p>DIGITAL STORAGE OSCILLOSCOPE</p> <p>Phillips</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
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<p>AC CLAMP ON METER</p> <p>Extech</p> <p>DIGITAL STROBOSCOPE</p> <p>Lutron</p> <p>SLING SYNCHROMETER</p> <p>Extech</p> <p>PORTABLE FLUE GAS ANALYSER</p> <p>Emerson Process Management</p> <p>BAROMETER</p> <p>Standard make subject to purchaser's approval</p> <p>SMD REWORK STATION</p> <p>Soldron Hakko OKS</p> <p>LAB & Control room FURNITURE</p> <p>Godrej</p> <p>PNEUMATIC POSITIONER / ELECTRO PNEUMATIC POSITIONER</p> <p>Masoneilan (India) Ltd. ABB</p> <p>ULTRASONIC TYPE LEVEL SWITCHES</p> <p>Nivo Controls Pvt Ltd. SB Electro Mechanics Ltd. E & H. Emerson Process Management</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT INDICATIVE LIST OF SUB VENDORS FOR C&I ITEMS (AS APPLICABLE)	SHEET 14 OF 16
<p>RF Level Switch.</p> <p>EIP Bulk Controls Pvt Ltd. EIP Enviro Controls.</p> <p>TERMINAL BLOCKS</p> <p>Phoenix Weidmueller Wago</p> <p>MINIATURE CIRCUIT BREAKERS</p> <p>Siemens ABB L & T.</p> <p>LARGE VIDEO SCREENS / PLASMA VIDEO WALLS</p> <p>Barco Synelec SONY SAMSUNG LG</p> <p>DCS</p> <p>ABB BHEL Tatahoneywell Emerson Process Management Invensys Siemens Yokogawa Bluestar Ltd</p> <p>PLC</p> <p>AllenBradley ABB Honeywell</p>		
		ISSUE R1

	TITLE: TECHNICAL SPECIFICATION FOR LP CHEMICAL DOSING SYSTEM 2X660 MW SURATGARH STPS STAGE V UNIT # 7 & 8	SPEC. NO. PE-TS-392-154A-A001	
		VOLUME II-B	
		SECTION : C1	
		REV. NO. 00	DATE:
		SHEET	

QUALITY PLAN-MECHANICAL

MANUFACTURER'S NAME & ADDRESS :				QUALITY PLAN				PROJECT		2X660 MW,SURATGARH STPS STAGE V		
ITEM: CHEMICAL DOSING SYSTEM SUB - SYSTEM :				QP.NO : PE - VE-392-154A-A006 REV. : DATE :				PACKAGE CONTRACT NO.		CHEMICAL DOSING SYSTEM		
AMMONIA DOSING SYSTEM AND NaOH DOSING SYSTEM				PAGE : 2 OF 4		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
									M	B	R	
1	2	3	4	5	6	7	8	9	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	SHALL BE TESTED WITH EITHER JOB MOTOR OR SHOP MOTOR OF SIMILAR FRAME SIZE
		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 & NRVL)											
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	
8.1.2	TRIM MATERIAL	HEAT TREATMENT	MA	HEAT TREATMENT	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG. TC/LAB REPORT	P	V	V	
8.2	ASSEMBLY	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	
		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	
				** LEGEND :								
				M : MANUFACTURER/SUB-CONTRACTOR/SUB-VENDOR								
				B : BHEL/NOMINATED INSPECTION AGENCY								
				"P" PERFORM, "W" WITNESS, AND "V" VERIFICATION								
				R: RRUJNL								
SIGNATURE				MAIN SUPPLIER--BHEL								
MANUFACTURER/ SUB CONTRACTOR												
								SIGNATURE OF APPROVAL BY CUSTOMER				
THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-392-154A-A001												



MANUFACTURER'S NAME & ADDRESS :		QUALITY PLAN QP.NO : PE-VE-392-154A-A006 REV. : 0 DATE :		PROJECT		2X660 MW,SURATGARH STPS STAGE V			
				PACKAGE CONTRACT NO.		CHEMICAL DOSING SYSTEM			
MANUFACTURER'S NAME & ADDRESS :		SUB - SYSTEM :		AMMONIA DOSING SYSTEM AND NaOH 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
9.0	FITTING/FLANGES FOR PIPING:								10
9.1	RAW MATERIAL	CHEM. & PHY PROPERTIES	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
		HEAT TREATMENT	MA	100%		ASTM A 182 GR.TP 304	ASTM A 182 GR.TP 304	MFG.TC/LAB REPORT	P V
		IGC TEST	MI	1/HT BATCH		ASTM A 262 PR. 'E'	ASTM A 262 PR. 'E'	MFG.TC/LAB REPORT	P 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
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
10.2	SCREEN	CHEMICAL	MA	CHEMICAL	1/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P V
		MESH SIZE	MA	MEASUREMENT	1/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P V
10.3	FINAL INSPECTION	DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P V
		LEAKAGE		HYDRO TEST	1	BHEL APPD.DATA SHEET	NO LEAKAGE	MFG.TC	P 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
		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
		MICRO STRUCTURE	MI	GRAINS STRUCTURE	1/HT BATCH/SIZE	FOR HEAT TREATMENT	FOR HEAT TREATMENT	MFG.TC/LAB REPORT	P 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
		HYDRO TEST	MA	LEAKAGE	100%	NO LEAKAGE	NO LEAKAGE	MFG.TC/IR	P V/W
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
12.2	FINAL INSPECTION	DIMENSION	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P V
		LEAKAGE	MA	HYDRO TEST	100%	BHEL APPD.DATA SHEET	NO LEAKAGE	MFG.TC	P V
13.0	PRESSURE & DP GAUGE								
13.1	MAT. FOR WETTED PARTS & BOU	CHEM. PROPERTIES	MA	CHEM. TEST	1/HT BATCH	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P V
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
14.0	SWITCHES(LEVEL, PRESURE & DP) & TRANSMITTERS (LEVEL, PRESURE & 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
14.2	PERFORMANCE	FUNCTIONAL	MA	CALIBRATION & VISUAL	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P V
		IR-HV-IR		ELECTRICAL	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P V
		DIMENSIONS		MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG.TC	P V
		DEGREE OF PROTECTION	MI	VERIFICATION OF TYPE TEST CER	TYPE TEST	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P V
MANUFACTURER/ SUB CONTRACTOR		MAIN SUPPLIER--BHEL		R: RUUVNL				SIGNATURE OF APPROVAL BY CUSTOMER	
SIGNATURE									
THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-392-154A-A001									



MANUFACTURER'S NAME & ADDRESS :		QUALITY PLAN				PROJECT		2X660 MW,SURATGARH STPS STAGE V	
ITEM: CHEMICAL DOSING SYSTEM		QP.NO : PE-VI-392-154A-A006				PACKAGE CONTRACT NO.		CHEMICAL DOSING SYSTEM	
SUB - SYSTEM :		REV. : 0				CONTRACT NO.			
		DATE :				MAIN SUPPLIER		BHEL/PEM, Noida	
AMMONIA DOSING SYSTEM AND NaOH 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	REMARKS
1	2	3	4	5	6	7	8	9	10
15.0	CONTROL PANEL :	DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P W W
		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
		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									
MANUFACTURER/ SUB CONTRACTOR		MAIN SUPPLIER--BHEL		M : MANUFACUTRER/SUB-CONTRACTOR/SUB-VENDOR B : BHEL/NOMINATED INSPECTION AGENCY R : RUUVNL					
SIGNATURE				"P" PERFORM, "W" WITNESS, AND "V" VERIFICATION		SIGNATURE OF APPROVAL BY CUSTOMER			
THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-392-154A-A001									

FIRST ANGLE PROJECTION

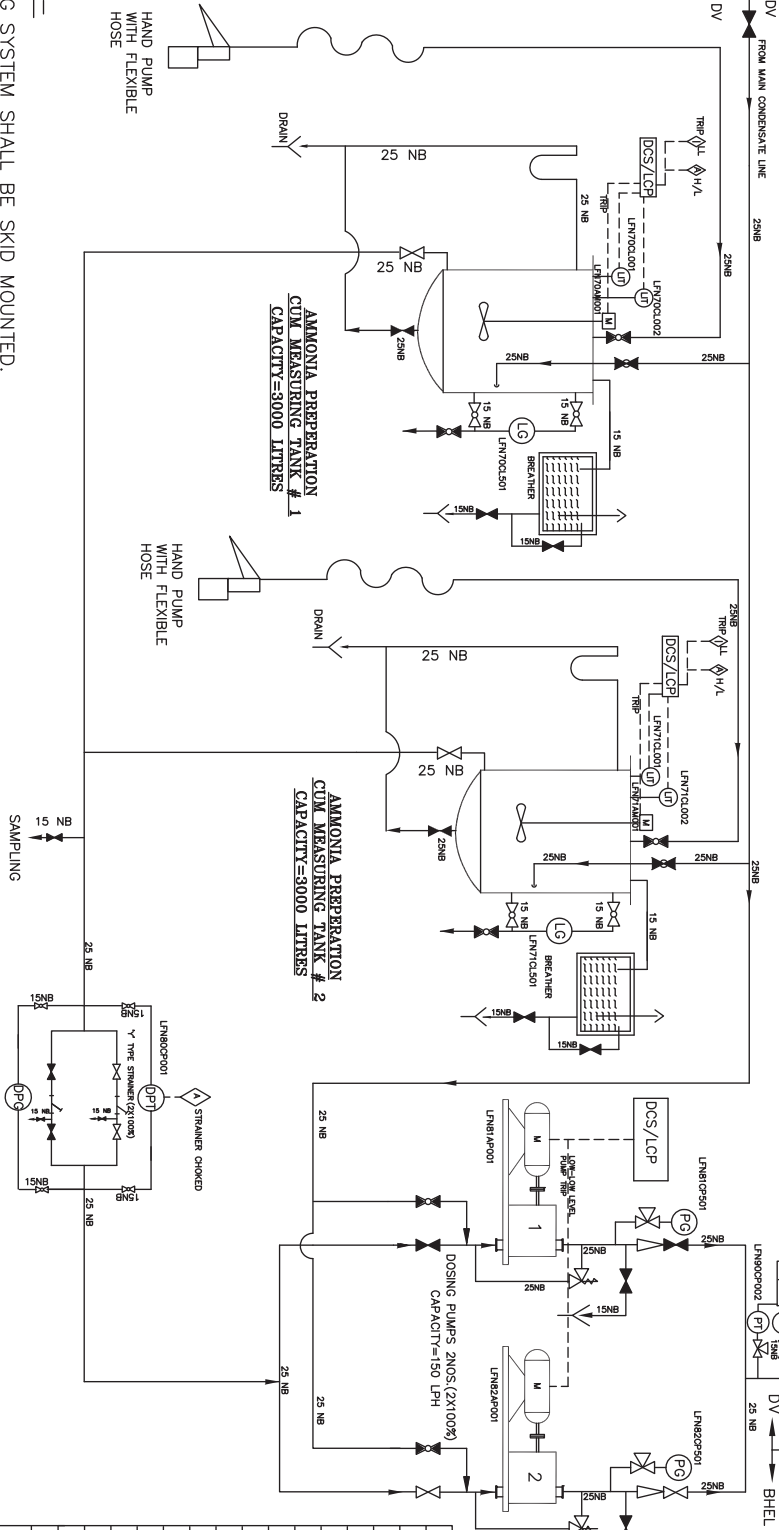
ALL DIMENSIONS ARE IN MM

DRAWING NO.

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NOTES:-

1. DOSING SYSTEM SHALL BE SKID MOUNTED.
2. TANK SHALL BE OF SS-304 CONSTRUCTION,3MM THICK.
3. ALL PIPING SHALL BE OF SS 304 (SCHEDULE 40S) INCLUDING DRAIN PIPES.
4. ALL VALVES SHALL BE OF SS 304 SOCKET WELD ENDS.
5. ALL DRAINS SHALL BE CONNECTED AT ONE POINT ON SKID.
6. TWO NOS. OF HAND PUMPS SHALL BE SUPPLIED WITH ONE SKID.
7. THE SKID SHOWN IN THIS DRAWING IS FOR ONE UNIT.
8. ONE NUMBER SAFETY SHOWER AND EYE WASH SHOWER SHALL BE PROVIDED WITH EACH AMMONIA DOSING SKID.
9. FOR ALL TRANSMITTERS/SWITCHES, BIDDER TO REFER SENSOR REDUNDANCY PHILOSOPHY.



LEGEND

	CONTROL VALVE NORMALLY OPEN
	CONTROL VALVE NORMALLY CLOSED
	GATE VALVE NORMALLY OPEN
	GATE VALVE NORMALLY CLOSED
	NON RETURN VALVE
	GLOBE VALVE NORMALLY OPEN
	GLOBE VALVE NORMALLY CLOSED
	THREE WAY VALVE
	VENT TO ATMOSPHERE
	FUNNEL
	PRESSURE GAUGE
	LEVEL GAUGE
	MOTOR OPERATED (A/C)
	PRESSURE RELIEF VALVE
	LEVEL INDICATOR TRANSMITTER
	Y TYPE STRAINER
	DIFF PRESSURE TRANSMITTER
	DIFFERENTIAL PRESSURE GAUGE
	PRESSURE TRANSMITTER
	HAND PUMP

RAJASTHAN RAJYA VIDYUT UTPADAN NIGAM LTD.
2 X 660 MW SURATGARH STPP, STAGE V



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

TITLE
P&I DIAGRAM FOR
AMMONIA DOSING SYSTEM

DEPT CODE	NAME	SIGN	DATE
DRN	RG		
DESN	RG		
CHD	SK		
APPD	SB		

DRAWING NO.
PE-DG-392-154A-A001

SHEET	01	OF	01	REV	00
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SIZE-A3

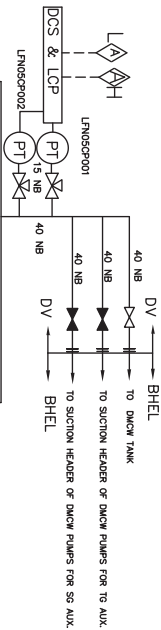
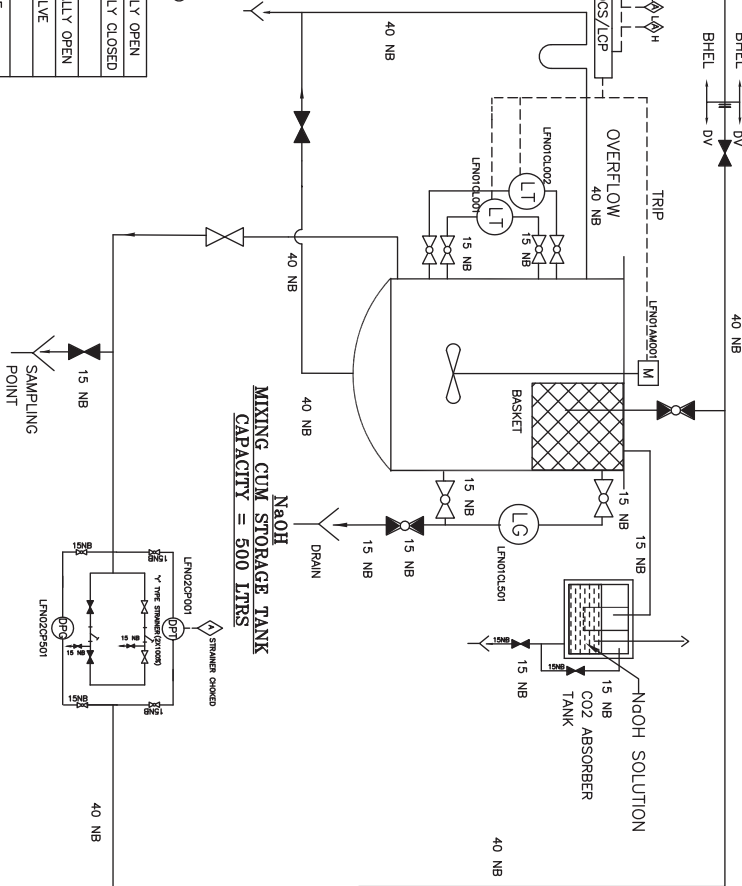
FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

DRAWING No.

	GATE VALVE NORMALLY OPEN
	GATE VALVE NORMALLY CLOSED
	NON RETURN VALVE
	GLOBE VALVE NORMALLY OPEN
	PRESSURE RELIEF VALVE
	THREE WAY VALVE
	VENT TO ATMOSPHERE
	FUNNEL
	PRESSURE GAUGE
	LEVEL GAUGE
	MOTOR OPERATED (AO)
	GLOBE VALVE NORMALLY CLOSED
	LEVEL TRANSMITTER
	Y TYPE STRAINER
	DIFF PRESSURE TRANSMITTER
	DIFFERENTIAL PRESSURE GAUGE
	PRESSURE TRANSMITTER
	LEVEL TRANSMITTER

LEGEND



NOTES:-

1. DOSING SYSTEM SAHL BE SKID MOUNTED.
2. TANK SHALL BE OF SS-304 CONSTRUCTION, 6MM THICK.
3. ALL PIPING SHALL BE OF SS 304 INCLUDING DRAIN PIPES.
4. ALL VALVES SHALL BE OF SS 304 SOCKET WELD ENDS.
5. ALL DRAINS SHALL BE CONNECTED TO ONE POINT ON SKID.
6. THE SKID SHOWN IN THIS DRAWING IS FOR ONE UNIT.
7. FOR ALL TRANSMITTERS/SWITCHES, BIDDER TO REFER SENSOR REDUNDANCY PHILOSOPHY.

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DV
DOSING VENDOR

RAJASTHAN RAJYA VIDYUT UTPADAN NIGAM LTD.
2 X 660 MW SURATGARH STPP, STAGE V



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI


P&I DIAGRAM FOR
Naoh DOSING SYSTEM

DEPT	NAME	SIGN	DATE
DRN	RG		
DESN	RG		
CHD	SK		
APPD	SB		

DRAWING No. PE-DG-392-154A-A002


SHEET 01 OF 01 REV 00

SIZE-A3

	TITLE : TECHNICAL SPECIFICATION FOR LP CHEMICAL DOSING SYSTEM 2X660 MW SURATGARH STPS STAGE V UNIT # 7& 8	SPEC. NO. PE-TS-392-154A-A001	
		VOLUME II-B	
		SECTION : C2	
		REV. NO. 00	DATE:
		SHEET	

SECTION – C2

SPECIFIC TECHNICAL SPECIFICATION – ELECTRICAL

	TITLE : TECHNICAL SPECIFICATION FOR LP CHEMICAL DOSING SYSTEM 2X660 MW SURATGARH STPS STAGE V UNIT # 7& 8	SPEC. NO. PE-TS-392-154A-A001	
		VOLUME II-B	
		SECTION : C2	
		REV. NO. 00	DATE:
		SHEET	

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 SCOPE OF ENQUIRY

- 1.1 General technical requirement of LT motors are indicated in specification no. PE-SS-999-506-E101, Rev00. Project specific technical requirement for LT motors are listed in customer specification for motor & actuator. Stipulations of Customer specifications (inclusive of Datasheet-A for motors & actuators) shall prevail, in case of conflicts between Customer specification and General technical requirements for LT Motors.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER/ PURCHASER

- 2.1 Scope for supply and erection & commissioning of various equipment forming part of electrical system for this package shall be as per Annexure-I Electrical Scope between BHEL and vendor.
- 2.2 Make of various equipment/ items in the scope of bidder shall be subject to approval of owner during detailed engineering stage without any technical, commercial and delivery implications.
- 2.3 Bidder shall furnish all AC as well as DC loads required for the system at different voltage levels (eg. 415V AC, 240 V AC, 220 V DC etc.) of all types, such as motor feeders, supply feeders in PEM format along with the offer.
- 2.4 All electrical equipment shall be suitable for the power supplies, fault levels (mentioned in the customer specification for motor & actuator) and climatic conditions indicated in project information with the specification.
- 2.5 All drawings, data sheets as per required format, Quality Plan, calculations, test reports, test certificates, etc. shall be furnished as specified at contract stage. The same shall be subject to approval without any technical, commercial and delivery implications.
- 2.6 Technical requirements shall be as per specifications listed in Clause 4.1, 4.2, 4.3 & 4.4 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 copy of this sheet "Electrical Equipment Specification for 'CHEMICAL DOSING SYSTEM' and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
 - List of Erection and Commissioning spares.
 - List of Erection & Maintenance tools & tackles.
 - 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

- Electrical scope between BHEL & vendor.
- General Technical requirements (PE-SS-999-506-E101_Rev00)
- Customer Technical specification for Motor & actuator and Data Sheets- C for 415V Electric Motors.
- General Technical specification for Cables.
- Quality Plan for motors.
- Load data format.

THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-392-154A-A001

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: CHEMICAL DOSING SYSTEM

PROJECT : 2 X 660 MW : SURATGARH SCTPS, UNIT# 7 & 8.

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	415V MCC	BHEL	BHEL	1. 415V AC 3 phase, 3 wire supply shall be provided by BHEL based on load data provided by vendor at contract stage. Complete electrical distribution within the skid shall be in bidder's scope. 2. Further, 415V AC, 3-phase, 4-wire requirement or 240V AC – single phase (if required by vendor) to be arranged by vendor only.
2	Local push button	Vendor	Vendor	
3	Power cables, ordinary control cables and screened control cables	Vendor	Vendor	Within the skid
4	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical e.t.c	Vendor	Vendor	
5	Equipment grounding	Vendor	Vendor	Within the skid
6	Motors with base frame and fixing hardware for motors.	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage without any technical, commercial and delivery implications.
7	Cable glands and lugs for equipment supplied by vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass glands. 2. Solderless crimping type tinned copper heavy-duty lugs for power cables. 3. Solderless crimping type heavy duty copper lugs for control cables.
8	Below grade grounding	BHEL	BHEL	


THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-392-154A-A001


ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE: CHEMICAL DOSING SYSTEM

9	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing (including soft copy) in the BHEL cable schedule in excel format (excel format shall be provided to vendor during contract stage) for C & I system for the package shall be submitted by vendor during detailed engineering stage.
10	Electrical Equipment GA drawing & skid GA drawing	Vendor	-	For necessary interface review.


- NOTE :** - 1. Make of all electrical equipment's/ items supplied shall be reputed make & shall be subject to approval of BHEL/ Customer after award of contract.
 2. All QPs shall be subject to approval of BHEL/customer after award of contract without any technical, commercial and delivery implications.
 3. All cabling beyond the battery limit of the skid (i.e all power cables from MCC to motors and cables between DCS and LCP/JB and between MCC and LCP/JB is excluded from bidder's scope.

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME ≥5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	Nos				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)																		
2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V																		
: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)																		
	JOB NO.		PROJECT TITLE		2 X 660 MW SURATGARH STPS, UNIT#7 & 8		NAME		ORIGINATING AGENCY		PEM (ELECTRICAL)							
	SYSTEM		CHEMICAL DOSING SYSTEM		ELECTRICAL		SIGN.		SHEET 1 OF 1		REV. 00		DATA ENTERED ON		DATA FILLED UP ON			
	DEPTT. / SECTION												DE'S SIGN. & DATE		56			
	THIS IS A PART OF TECHNICAL SPECIFICATION PE-TS-392-154A-A001																	

	TITLE : TECHNICAL SPECIFICATION FOR LP CHEMICAL DOSING SYSTEM 2X660 MW SURATGARH STPS STAGE V UNIT # 7& 8	SPEC. NO. PE-TS-392-154A-A001	
		VOLUME II-B	
		SECTION : C3	
		REV. NO. 00	DATE:
		SHEET	

SECTION – C3

SPECIFIC TECHNICAL SPECIFICATION – CONTROL & INSTRUMENTATION

	TITLE : TECHNICAL SPECIFICATION FOR LP CHEMICAL DOSING SYSTEM 2X660 MW SURATGARH STPS STAGE V UNIT # 7& 8	SPEC. NO. PE-TS-392-154A-A001	
		VOLUME II-B	
		SECTION : C3	
		REV. NO. 00	DATE:
		SHEET	

SCOPE OF SUPPLY

- Chemical Dosing system shall be operated from DCS (BHEL's scope).
- All instruments shall be terminated on JB/LCP in field and both instrument and JB/LCP are in vendor scope.
- For cable scope refer to Standard electrical scope between BHEL and vendor (section C-2).
- The junction boxes for termination of instruments/drives and local panel are in vendor's scope.
- Any push buttons, alarms and metering requirement on the LCP panels shall be supplied by vendor and shall be finalized during detail engineering.
- Local Stop push button (shrouded type) shall be provided by vendor for all drives for start and stopping of the drives. The contact of the push button shall be wired directly to MCC. All such contacts shall be suitably connected DCS for reporting of local operation. The PB shall be lockable type.
- Bidder to supply all instruments as per enclosed PIDs.
- The specifications for instruments mentioned in the specification are minimum requirements. The detail specifications shall be finalized during detail engineering.
- All field instrument enclosures shall be IP-65.
- The bidders shall specifically mention any deviation they would like to take on the C&I specification. In absence of only deviation it will be implied they follow the specification without deviation.
- The make/model of various instruments/items/systems shall be subject to approval of BHEL/Customer during detailed engineering stage. No commercial and delivery implication in this regard shall be acceptable. In case of any conflict and repetition of clauses if the specification, the more stringent requirements among them are to be complied with.
- The quantity of instruments for auxiliary system shall be as per tender P & ID wherever provided of the respective system as a minimum, for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. If any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.
- The cable used shall be 0.8mm², F, G type cable for analog, binary signals respectively.
- Terminal box/Junction box shall have provision to add 10% additional terminals.
- Drawings/Documents and data to be furnished after award of the contract:
 - Field instruments data sheet.
 - Panel GA drawings & Termination details.
 - Cable schedule and cable interconnection drawing.
 - Instrument schedule.
 - Drive List and Analog / Binary I/O List
 - Recommended Control write-up
 - Any other document decided during detailed engineering

Additional requirements

- The requirement of C&I engineer of the bidder during panel testing.



TITLE: TECHNICAL SPECIFICATION FOR
LP CHEMICAL DOSING SYSTEM
2X660 MW SURATGARH STPS STAGE V
UNIT # 7& 8

SPEC. NO. **PE-TS-392-154A-A001**


VOLUME **II-B**

SECTION : **D**

REV. NO. 0 | DATE:

SHEET :

SECTION – D
GENERAL TECHNICAL REQUIREMENT

	TITLE: TECHNICAL SPECIFICATION FOR LP CHEMICAL DOSING SYSTEM 2X660 MW SURATGARH STPS STAGE V UNIT # 7& 8		SPEC. NO. PE-TS-392-154A-A001	
			VOLUME II-B	
			SECTION : D1	
			REV. NO. 00	DATE:
			SHEET	

SECTION – D1

GENERAL TECHNICAL REQUIREMENT – MECHANICAL

	TITLE: TECHNICAL SPECIFICATION FOR LP CHEMICAL DOSING SYSTEM 2X660 MW SURATGARH STPS STAGE V UNIT # 7& 8	SPEC. NO. PE-TS-392-154A-A001	
		VOLUME II-B	
		SECTION : D1	
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1.0 DESIGN PHILOSOPHY:

Chemical dosing systems have been 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 DMCW system. For DMCW, NaOH dosing systems is provided to maintain pH in the water.

2.0 LOW PRESSURE CHEMICAL DOSING:

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

2.1 AMMONIA DOSING SYSTEM (1 NOS SKID PER UNIT);

(Refer drg no. PE-DG-392-154A-A001)

Boiler feed water/Condensate water should have proper pH in order to protect the system from corrosion. In order to control the same dosing of dilute solution of Ammonia is done at CPU outlet. Though provision has been kept to dose ammonia at deaerator outlet and boiler fill pumps discharge also, but dosing shall be done at one place at a time only. For this purpose one (1) no. skid mounted ammonia-dosing system per unit shall be provided. Dosing system shall mainly comprise of the following:

2.1.1 HAND PUMP (2 NOS.)

Two nos. hand pump complete with flexible hose and couplings (for transferring ammonia from barrel at ground level to solution preparation cum measuring tanks) shall be provided.

2.1.2 AMMONIA PREPERATION CUM MEASURING TANK (2 NOS. PER SKID)

Two (2) numbers Ammonia preparation cum measuring tank shall be provided for preparing 1% dilute ammonia solution. A dilute solution is prepared in these tanks using condensate and is uniformly mixed by a motorized stirrer. These tanks shall also be provided with accessories like breather with vent, level gauge, level transmitter, motorized stirrer and overflow drain.

The solution is then dosed to the required dosing point with the help of dosing pumps.

2.1.3 AMMONIA DOSING PUMPS (2 NOS. PER SKID)

Two nos. (2X100%) electric motor driven reciprocating type dosing pumps shall be provided. The stroke of the pumps shall be adjustable from zero to 100% even when the pump is in operation so as to achieve a stepless variation of capacity over the specified range of operation. . Two (2x100%) Y type strainers shall be provided in the suction line of the pump with differential pressure transmitter and differential pressure gauge. The pumps shall also be provided with a pressure relief valve and pressure gauge in the individual discharge line.

2.1.4 ASSOCIATED PIPING, VALVES ETC:

As indicated in the drawing / data sheet – A enclosed and as required to make the system complete.

2.1.5 FLUSHING

Condensate tapped from the main condensate line shall be used for preparation of solution and flushing of various pipes lines and pumps of the system as shown in P & I drawing.

2.1.6 CONTROL & INSTRUMENTATION

The normal mode of operation of Ammonia dosing system shall be through DCS including ON/OFF command of the individual pumps and stirrers. All controls, fault indicators/alarms, interlocks, logics shall be implemented in 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.

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Local control panels shall comprise of start, stop and Emergency Stop push buttons along with ON/OFF/TRIP indications, local/remote indication, stroke position indicator, raise/lower push button for stroke position and local annunciation etc. The 'EMERGENCY STOP' Push Button (lockable type) shall also be wired directly to MCC whereas 'START' push button and 'STOP' push button shall be routed to DCS.

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

The stroke position and adjustment shall be done by 4-20 mA DC signal from DCS and the pump stroke actuation shall be suitable for accepting 4-20 mA DC signal. The pumps shall be provided with 24 V DC, two wire LVDT type position feedback transmitters which shall generate 4-20mA signal indicating stroke position.

The Local /Remote selection switch (soft) shall be provided in DCS and its indication shall be provided in LCP.

2.1.7.1 Following interlocks shall be provided at low-low Level in the ammonia preparation cum measuring tank.

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

2.1.7.2 Following conditions to be ensured before starting a stirrer

- i) Level in the tank adequate.
- ii) MCC not disturbed

2.1.7.3 Following conditions to be ensured before starting a pump

- i) Level in the tank adequate.
- ii) MCC not disturbed.
- iii) 'Y' type strainer- Not choked.

2.1.7.4 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/Emergency Stop & Agitator-Start/Stop/Emergency Stop –Push Buttons
- iv) Raise / lower push button for stroke position & local annunciation.
- v) Stroke position indicator

2.1.7.5 Following fault indications and alarms shall be provided in DCS and LCP:

- i. Low level in the preparation cum measuring tank.
- ii. Low Low level in the preparation cum measuring tank.
- iii. High level in the preparation cum measuring tank.
- iv. Stirrer motor tripped due to low low level in the preparation cum measuring tank.
- v. Running Dosing pump motor tripped due to low low level in the preparation cum measuring tank.
- vi. 'Y' type strainer choked.
- vii. Low pressure at pump discharge header.
- viii. High pressure at pump discharge header.
- ix. Running dosing pump 1 trip
- x. Running dosing pump 2 trip

LCP shall be located on the dosing skid.

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2.1.7.6 SIGNAL EXCHANGE

- a) Following signals shall be wired from DCS to LCP. These shall be 24V DC powered signals. (PF contacts are not used to avoid the higher voltage LCP power supply reaching DCS while contact interrogation).
 - i) Operation local selected
 - ii) Operation remote selected
 - iii) Pump- 1/2 & stirrer (ON/OFF/FAULT)
 - iv) Process conditions (as per clause 3.3.5 above)
 - v) Pump- 1/2 stroke length demand signal (4-20 mA)
- b) Following signals shall be wired from LCP to DCS. Binary signals shall be P.F. contacts.
 - i) All field signals
 - ii) START/ STOP–PB commands for all drives (pumps & agitator)
 - iii) Pump- 1/2 stroke length feedback signal (4-20 mA)
- c) Signal Exchange between DCS & MCC shall be as per applicable Drive Control Philosophy
 - i) START/STOP command from DCS to MCC
 - ii) ON/OFF/MCC Disturbed feedback from MCC to DCS
- d) Signal Exchange between LCP & MCC shall be
 - i) EMERGENCY STOP-PB for all drives (pumps & agitator).

2.2 NAOH DOSING SYSTEM FOR DMCW SYSTEM: (1 NO SKID PER UNIT)

(Refer drg. No. PE-DG-392-154A-A002)

Sodium Hydroxide (NaOH) dosing system is provided to dose NaOH solution in Equipment cooling water lines to increase pH up to 9.5. The sodium hydroxide dosing is done in the DMCW cycle during the initial fill and for the compensation of cooling water for any leakage during normal run. The dosing system consists of following:-

2.2.1 NAOH MIXING CUM STORAGE TANK


One (1) no NaOH Mixing cum storage Tank complete with motorized stirrer (200 rpm), CO2 absorber, dissolving basket, level gauge, level transmitter, vent, overflow with water seal & drain shall be provided.

2.2.2 NAOH DOSING PUMPS (2 NOS. PER SKID)

Two nos. (2X100%) electric motor driven reciprocating type dosing pumps shall be provided. The stroke of the pumps shall be adjustable from zero to 100% even when the pump is in operation so as to achieve a step less variation of capacity over the specified range of operation.

Two (2x100%) Y type strainers shall be provided in the suction line of the dosing pumps with differential pressure transmitter and differential pressure gauge. The pump shall also be provided with a pressure relief valve and pressure gauge in the individual discharge line.

2.2.3 ASSOCIATED PIPING, VALVES ETC:

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As indicated in the data sheet – A enclosed and as required to make the system complete.

2.2.4 FLUSHING

DM Water from DM Water header shall be used for preparation of solution and flushing the tank shown in P&I drawing.

2.2.5 CONTROL & INSTRUMENTATION

The normal mode of operation of NaOH system shall be through DCS including ON/OFF command of the individual pumps and stirrers. All controls, fault indicators/alarms, interlocks, logics shall be implemented in DCS. Separate local panel shall be provided for each of the above said system. The starters of all motors shall be clubbed with main plant MCC.

The local control panels shall comprise of start, stop and Emergency Stop push buttons along with ON/OFF/TRIP indications, local/remote indication, stroke position indicator, raise/lower push button for stroke position and local annunciation etc. The 'EMERGENCY STOP' Push Button (lockable type) shall also be wired directly to MCC whereas 'START' push button and 'STOP' push button shall be routed to DCS.

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

The stroke position and adjustment shall be done by 4-20 mA DC signal from DCS and the pump stroke actuation shall be suitable for accepting 4-20 mA DC signal. The pumps shall be provided with 24 V DC, two wire LVDT type position feedback transmitters which shall generate 4-20mA signal indicating stroke position

The Local /Remote selection switch (soft) shall be provided in DCS and its indication shall be provided in LCP.

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

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

2.2.5.2 Following conditions to be ensured before starting a stirrer

- i) Level in the tank adequate.
- ii) MCC not disturbed

2.2.5.3 Following conditions to be ensured before starting a pump


- i) Level in the tank adequate.
- ii) MCC not disturbed.
- iii) 'Y' type strainer- Not choked

2.2.5.4 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/Emergency Stop & Agitator-Start/Stop/Emergency Stop –Push Buttons
- iv) Raise / lower push button for stroke position & local annunciation.
- v) Stroke position indicator

2.2.5.5 Following fault indications and alarms shall be provided in DCS and LCP:

- i) Low level in the mixing cum storage tank.
- ii) Low Low level in the mixing cum storage tank.


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- iii) High level in the mixing cum storage tank.
- iv) Stirrer motor tripped due to low low level in the mixing cum storage tank.
- v) Running Dosing pump motor tripped due to low low level in the mixing cum storage tank.
- vi) 'Y' type strainer choked.
- vii) Low pressure at pump discharge header.
- viii) High pressure at pump discharge header.
- ix) Running dosing pump 1 trip.
- x) Running dosing pump 2 trip.


LCP shall be located on the dosing skid.

2.2.6 SIGNAL EXCHANGE

- a) Following signals shall be wired from DCS to LCP. These shall be 24V DC powered signals. (PF contacts are not used to avoid the higher voltage LCP power supply reaching DCS while contact interrogation).
 - i) Operation local selected
 - ii) Operation remote selected
 - iii) Pump- 1/2 & stirrer (ON/OFF/FAULT)
 - iv) Process conditions (as per clause 4.5.5 above)
 - v) Pump- 1/2 stroke length demand signal (4-20 mA)
- b) Following signals shall be wired from LCP to DCS. Binary signals shall be P.F. contacts.
 - i) All field signals
 - ii) START/ STOP- PB commands for all drives (pumps & agitator)
 - iii) Pump- 1/2 stroke length feedback signal (4-20 mA)
- c) Signal Exchange between DCS & MCC shall be as per applicable Drive Control Philosophy
 - i) START/STOP command from DCS to MCC
 - ii) ON/OFF/MCC Disturbed feedback from MCC to DCS
- d) Signal Exchange between LCP & MCC shall be
 - i) EMERGENCY STOP-PB for all drives (pumps & agitator).

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TECHNICAL SPECIFICATION FOR METERING PUMPS

	TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM 2X660 MW Suratgarh Super Critical TPS, Stage-V Unit 7 & 8 at Suratgarh, Rajasthan	SPEC NO: PE-TS-392-154A-A001	
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1.00.0 GENERAL

- 1.01.01 Specification cover the design, material, construction features, manufacture, inspection, testing the performance at the vendor's/sub-vendor's works, delivery to site, erection, commissioning and testing of metering pumps.


2.00.0 GENERAL DESIGN FEATURES

- 2.00.01 Pumps shall be simplex positive displacement hydraulically operated diaphragm design, driven by squirrel cage induction motor through suitable speed reduction unit. Maximum pump stroke speed shall not exceed 100 per minute.
- 2.00.02 The stroke shall be continuously adjustable to give a capacity variation 0-100% range while the pump is running or stopped. Adjustment of capacity shall be done by manual control facility (micrometric adjusting type) to be provided locally for each of the pump.
- 2.00.03 The stroke shall be continuously adjustable to give a capacity variation 0-100% range while the pump is running or stopped. Adjustment of capacity shall be done by manual control facility (micrometric adjusting type) to be provided locally for each of the pump.
- 2.00.04 Capacity variation may be effected by changing eccentricity of the driving crank or by suitable hydraulic circuit. Pump accuracy shall be industry standard $\pm 1\%$ of capacity setting.
- 2.00.05 Pumps shall be provided with an integral relief valve, spring operated to release pressure when delivery line blockage occurs.
- 2.00.06 Crankcase shall be constructed of high quality cast iron, which will also house the gearbox and guides of cross head.
- 2.00.07 Guided, controlled travel, double-ball check valves or equivalent, shall be provided both on the suction and discharge side.
- 2.00.08 Material of construction of the various parts shall be as per the details furnished elsewhere in the specification. However all parts coming in contact with acid shall be of Hastelloy 'B' and for alkali it should be of SS-316 only.
- 2.00.09 Suitable gland seal shall be provided to prevent leakage.
- 2.00.10 Electric drive motor particulars should follow enclosed electrical chapters.

3.00.00 TESTING

3.01.00 Testing and Inspection at Manufacturer's Works


- 3.01.01 The manufacturer shall conduct all tests required to ensure that the equipment furnished conforms to the requirements of this Specification and is in compliance with requirements of the applicable codes. The particulars of the proposed tests and the procedures for the tests shall be submitted to Owner for approval before conducting the tests.
- 3.01.02 The Owner's representatives shall be given full access to all tests for which the Manufacturer shall inform the Owner allowing adequate time so that if the Owner so desires, his representatives can witness the test.
- 3.01.03 All materials and castings used for the equipment shall be of tested quality. The test certificates shall be made available to Owner.

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- 3.01.04 The pump casing shall be hydraulically tested at 200% pump operating pressure or 150% of design pressure whichever is higher. The test pressure shall be maintained at least for ½ an hour.
- 3.01.05 The rotating parts of pump drive shall be subjected to static balancing.
- 3.01.06 All pumps shall be tested at the shop for capacity, volumetric accuracy, repetitive accuracy, power and volumetric efficiency. The tests are to be done according to the requirements of the "Hydraulic Institute" of U.S.A. and Indian Standards as applicable.
- 3.01.07 The pump accessories e.g. gear box, speed reduction unit etc. will be subjected to tests as per manufacturer's standards. The test results shall be furnished to the Owner.
- 3.01.08 The combined variation of the pump and motor should be restricted within limits specified by Hydraulic Institute Standard, USA when the pump operated singly or in parallel.
- 3.01.09 All pumps shall be subject to strip down examination visually to check for mechanical damages after performance testing at shop.
- 3.01.10 Diaphragm of the metering pump shall be type tested as per applicable code/standard.
- 3.01.11 Performance test shall be carried out for the setting of pressure relief valve.
- 3.01.12 Test reports and certificates of all the above-mentioned tests to ensure satisfactory operation of the system shall be submitted to the Owner for approval before dispatch.

3.02.00 Test at Site

After erection at site pumps as detailed under different groups shall be operated to prove satisfactory performance as individual equipment as well as a system. If the performance at site is found to be not to the requirements, then the equipment shall be rectified or replaced by the Vendor at no extra cost to the Owner.

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PAINTING REQUIREMENT

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME II SECTION – C 13
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan PAINTING REQUIREMENTS	SHEET 1 OF 14
<p>PAINTING</p> <p>13.0</p> <p>13.0.1 This section defines the technical requirements for surface preparation selection and application of paints on equipment, vessels, machinery, piping, ducts etc. However, manufacturers shall follow their standard procedures for painting their equipment. The Bidder shall submit a detailed painting procedure for approval of OWNER / OWNER'S representative after the award of contract.</p> <p>13.0.2 The following surface and material shall require painting:</p> <ol style="list-style-type: none"> All un-insulated carbon steel and alloy steel equipment like columns, vessels, drums, storage tanks, heat exchangers etc. All un-insulated carbon steel and low alloy piping, fitting and valves (including painting of identification marks) All pipe structural steel supports, walkways, platforms, hand rails, ladders etc. <p>13.0.3 The following surfaces and material shall not require painting:</p> <ol style="list-style-type: none"> Non-ferrous materials Austenitic stainless steel Plastic and / or plastic coated materials Insulated surface of equipment and pipes except colour coating wherever required Painted equipment like blowers, pumps, valves, etc., with finishing coats in good condition and with matching colour-code <p>13.1.0 Codes and Standards</p> <p>13.1.0.1 Painting of equipment shall be carried out as per the specifications indicated below and shall conform to the relevant IS specification for the material and workmanship.</p> <p>13.1.0.2 The following Indian Standards may be referred to carrying out the painting job.</p> <p>IS : 5 : Colours for ready mixed paints and enamels</p> <p>IS : 1303 : Glossary of terms relating to paints</p> <p>IS : 2379 : Colour code for identification of pipelines.</p> <p>IS : 1477 : Code of practice for painting of ferrous</p>		
		ISSUE R0

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME II SECTION – C 13
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<p>metals in buildings (Parts I & II)</p> <p>IS: 2524 : Code of practice for painting of non-ferrous metals in buildings (Parts I & II)</p> <p>IS : 2395 : Code of practice for finishing of concrete, masonry and plaster surfaces (Parts I and II)</p> <p>IS : 2338 : Code of practice for finishing of wood and wood based materials (Parts I & II)</p> <p>IS : 158 : Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting</p> <p>IS : 2074 : Ready mixed paint, air drying, red oxide zinc chrome, and priming.</p> <p>IS : 104 : Ready mixed paint, brushing, zinc chrome, priming</p> <p>IS : 2932 : Enamel, synthetic, exterior</p> <p>(a) undercoating (b) Finishing.</p> <p>SIS : 55900 : Swedish standard for blasting</p> <p>IS: 14506 : Epoxy Red oxide Zinc Phosphate Weldable Primer, Two Component Specification</p> <p>IS: 14209 : Epoxy Enamel, Two Component, Glossy Specification</p> <p>IS: 14589 : Zinc priming paint, Epoxy based, Two-pack-specification</p> <p>13.2.0 SURFACE PREPARATION</p> <p>The surface shall be prepared in a manner suitable for coatings. Chemical de-rusters or rust converters shall not be applied. Acid cleaning is subject to approval of PURCHASER / PURCHASER'S representative.</p> <p>13.2.1 Blasting</p>		
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<p>The surface of the part / component shall be blasted before the coating material is applied. Unless otherwise specified in the documents, the surface shall satisfy the following requirements after blasting: Primer paint shall be zinc silicate of approved brand. Dry film thickness of each primer coat shall be 15 – 25 µm</p>		
13.2.2	Manual Rust Removal	
	Manual rust removal shall be allowed for welded zones and for touching up installed components.	
13.2.3	Cleaning	
	Removal of impurity	
	Impurity	Removal
(a)	Dust, loose deposits	Vacuum-cleaning, brushing
(b)	Adhesive deposits	Power brushing
(c)	Oils, greasy impurities	Wet blasting, use of detergent additives by agreement
(d)	Salt deposits	Rinsing
(e)	Markings (e.g., felt tip pen)	Organic solvents to manufacturer's specifications e.g., Trichloro- trifluoro -ethane and solvents containing acetone (renew solvent and rag frequently).
13.3.0	PROCESSING	
13.3.1	General	
13.3.1.1	Application Conditions	
	<p>The primer shall be applied to properly prepared surfaces only. The specifications of the coating material manufacturers shall be observed. The minimum temperature shall be +5°C and the relative humidity shall not exceed 80%. The temperature of the work piece shall be at least 3 °C above dew point.</p>	
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13.3.1.2	<p>Application Procedure</p> <p>The primer shall be applied by means of brush or by spray. The top coats shall be applied by means of brush, roller or by spray.</p> <p>At points where coating application is interrupted, the individual layers shall be adequately stepped to ensure proper layer sequence when coating operations are resumed</p>	
13.3.1.3	<p>Touching Up</p> <p>Before each layer is applied, previous coating shall be touched up where necessary by way of rust removal and cleaning, according coating MANUFACTURER'S specifications. The final top coat shall be reapplied completely, if required.</p>	
13.3.1.4	<p>Uncoated Surfaces</p> <p>Moving parts of machines (e.g., stems, shafts, sliding and locating bearings), nameplates, instruments and sealing surface shall not be coated. Welds shall be left free of coating up to a distance of 30 mm on each side of the weld edge until erection and weld examinations, if any, have been completed.</p>	
13.3.1.5	<p>Bond Strength</p> <p>The pull-off stress determined using the pull-off test method for adhesion shall be not less than 1.5 N/mm², according to ISO 4624.</p>	
13.3.1.6	<p>Surface Conditions of Coating Surfaces</p> <p>The coating surface shall have a uniform film thickness, shade and gloss and shall be free from inclusions, sags and wrinkles.</p>	
13.3.1.7	<p>Coating Systems</p>	
13.3.1.7.1	<p>General Requirements for Coating Systems</p> <p>Coating materials according to SSPC, BS 5493 or DIN 55 928 shall be used. Intermediate coats are to be pigmented with micaceous iron oxide. The materials shall be matched with each other so that they are compatible. Coatings deviating from this specification shall be subject to approval. Standards of surface preparation and painting shall give a time to first maintenance of 10 years.</p> <p>The colour and gloss of top coats shall be in accordance with sub-clause suggested colour codes for painting (Sub-clause 13.10).</p>	
13.3.1.7.2	<p>Standard Coating System (External Coatings)</p>	
		ISSUE R0

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME II SECTION – C 13
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan PAINTING REQUIREMENTS	SHEET 5 OF 14
<p>a) Steel Structures</p> <ol style="list-style-type: none"> i. All steel structures shall receive two primer coats and two finish coats of painting. First coat of primer shall be given in shop after fabrication before dispatch to erection site after surface preparation as described below. The second coat of primer shall be applied after erection and final alignment of the erected structures. Two finish coats shall also be applied after erection. ii. Steel surface which is to painted shall be cleaned of dust and grease and the heavier layers of rust shall be removed by chipping prior to actual surface preparation. The surface shall be abrasive blasted to Sa-2½ finish as per SIS05-5900. Primer paint shall be zinc silicate of approved brand. Dry film thickness of each primer coat shall be 40 microns. iii. Finish paint shall be 2 coats of High built epoxy finish of approved brand. Dry film thickness of each finish coat shall be 90 microns. The undercoat and finish coat shall be of different tint to distinguish the same from finish paint. The total dry film thickness shall be 300 microns. All paints shall be of approved brand and shade as per the OWNER'S requirement. iv. Joints to be site welded shall have no paint applied within 100 mm of welding zone. Similarly where Friction grip fasteners are to be used no painting shall be provided. On completion of the joint the surfaces shall receive the paint as specified. v. Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection including top surfaces of floor beams supporting gratings or chequered plate shall receive one additional coat of finish paint over and above number of coats specified before erection. Portion of steel member embedded / to be encased in concrete shall not be painted. <p>b) Galvanised iron and steel requiring paint finish at site At site</p> <p><u>Surface Treatment</u> Mechanical cleaning from contaminants by means of washing or steam jetting and sweep blasting with fine sand or etching (T-Wash).</p> <p><u>Touch-up mechanical damages:</u> De rusting St 3 and application of high build epoxy primer DFT 80 µm.</p> <p><u>Finish coating:</u> Analogous to standard painting scheme</p>		
		ISSUE R0

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME II SECTION – C 13
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan PAINTING REQUIREMENTS	SHEET 6 OF 14
13.3.1.7.2.1	<p>Painting of indoor components such as valves, pumps, motors, electrical parts, tanks etc.</p> <p>a) At works</p> <p><u>Surface preparation:</u> Blasting according to SIS 055900: grade SA 2 ½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer dry film thickness 15 – 25 µm, may be used.</p> <p><u>Prime coat:</u> Two (2) layers of zinc phosphate epoxy, total dry film thickness 75 µm.</p> <p>b) At site</p> <p>Thorough cleaning to remove oil, grease, dirt and any other contaminants. De-rusting of all mechanical damages according to SIS 055900 Grade ST3. Touch up with dry film thickness 50 µm.</p> <p><u>Finish coat:</u> Application of two finishing coats of Chlorinated rubber paint in approved shades at 30-40 microns DFT each coat in approved shades.</p>	
13.3.1.7.2.2	<p><u>Remarks:</u> Equipment coated with a standard application system can be accepted if the quality of this application system is corresponding with the quality of the above mentioned system.</p>	
13.3.1.7.2.3	<p>Painting of Outdoors equipment (external surfaces) such as piping, valves, pumps, motors, electrical parts, tanks etc.</p> <p>Weather exposure, weather resistance, temperature up to 120°C as per 13.7.1 and 13.7.3.</p> <p><u>Surface Preparation:</u> Blasting according to SIS 055900: grade Sa 2 ½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer dry film thickness 15-25 µm, may be used.</p> <p><u>Prime Coat:</u> Two (2) layers of zinc phosphate epoxy, total dry film thickness 75 µm.</p> <p><u>Intermediate Coat:</u> One (1) layer 2 pack high build epoxy polyamide Mio, dry film thickness 100 µm.</p>	
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SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME II SECTION – C 13
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan PAINTING REQUIREMENTS	SHEET 7 OF 14
<p><u>Finish Coat:</u> Application of two finishing coats of Chlorinated rubber paint in approved shades at 50 microns DFT each coat in approved shades.</p> <p>13.3.1.7.2.4 Special Coating System (External Coatings)</p> <p>Parts exposed to temperatures above 120°C, up to 200°C, not insulated</p> <p>a) At works</p> <p><u>Surface Preparation:</u> Blasting according standard SIS 55900 Grade Sa 2¹/₂ and ISO 8501-1: 1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer, dry film thickness 15-25 µm, may be used</p> <p><u>Prime coat</u> Inorganic ethyl zinc silicate, dry film thickness 75 µm.</p> <p>b) At site</p> <p><u>Pre-treatment:</u></p> <p>De-rusting of all mechanical damages, according to ISO 8501-1: 1989, grade St 3 Touch-up with 1 pack inorganic ethyl zinc silicate, dry film thickness 50 µm. Removal of all decontaminants from prime coat.</p> <p><u>Intermediate Coat:</u> 1 pack silicon acrylic, dry film thickness 35 µm.</p> <p><u>Final coat</u> 1 pack silicon acrylic, dry film thickness as 35 µm.</p> <p>Total system dry film thickness 145 µm. Final coat according to colour code.</p> <p>Parts exposed to temperatures above 200°C, up to 400°C, not insulated</p> <p>At works</p> <p><u>Surface Preparation:</u></p> <p>Blasting according to ISO 8501-1: 1988 grade Sa 2¹/₂. Depending on</p>		
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SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME II SECTION – C 13
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan PAINTING REQUIREMENTS	SHEET 8 OF 14
<p>production flow, a weldable, inorganic ethyl zinc silicate shop primer, dry film 15-25 µm, shall be used.</p> <p><u>Prime coat:</u></p> <p>Inorganic ethyl zinc silicate, dry film of thickness 75 µm.</p> <p>At site</p> <p><u>Pre-treatment:</u> De-rusting of all mechanical damages, according standard Sa 2 1/2 to ISO 8501-1: 1988. Touch-up with coating system according to MANUFACTURER'S recommendations.</p> <p>Insulated Parts, continuously exposed to condensing water or parts exposed to temperatures</p> <p>For parts that are provided with insulation on site.</p> <p>a) Insulated parts, exposed to condensing water</p> <p>At works</p> <p><u>Surface Preparations:</u></p> <p>Blasting according standard Sa 2 1/2 to ISO 8501-1: 1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer, dry film thickness 15-25 µm shall be used.</p> <p><u>Prime coat:</u></p> <p>Inorganic ethyl zinc silicate, dry film thickness 75µm.</p> <p>b) Insulated parts exposed to temperatures Parts, exposed to temperatures up to <400°C at works</p> <p><u>Surface Preparation:</u></p> <p>Blasting according to standard Sa 2 1/2 to ISO 8501-1: 1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer, dry film thickness 15-25 µm shall be used.</p> <p>Parts, exposed to temperatures above 400°C at works (Steam pipes, pressure tubes and parts for the HRSG, such as heating surfaces, heaters and super heaters reheaters, etc.)</p> <p><u>Surface preparation:</u></p>		
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SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME II SECTION – C 13
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan PAINTING REQUIREMENTS	SHEET 9 OF 14
<p>Blasting according standard Sa 21/2 to ISO 8501-1: 1988.</p> <p><u>Temporary primer:</u></p> <p>Varnish.</p> <p>c) Intermittent exposure due to condensing water / chemicals (Indoors) At works</p> <p><u>Surface Preparation:</u> Blasting according to standard Sa 21/2 to ISO 8501-1: 1988. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer, dry film thickness 15-25 µm may be used.</p> <p><u>Prime Coat:</u> Two layers of zinc phosphate epoxy primer total dry film thickness greater than or equal to 75 µm.</p> <p>At site <u>Pre-treatment:</u></p> <p>De-rusting of all mechanical damages, according standard Sa 3 to ISO 8501-1: 1988, touch-up with 2 pack high build epoxy with volume solid content of more than 85%, 75 µm.</p> <p><u>Intermediate Coat:</u> 2 pack high build epoxy, dry film thickness 80 µm.</p> <p><u>Finish coat:</u></p> <p>2 pack epoxy according to colour appearance, dry film thickness of 50 µm.</p> <p>Total system dry film thickness 205 µm.</p> <p>When exposed to weathering, weather resistance finish coat shall be applied.</p> <p>d) Water exposure</p> <p>Surfaces permanently or predominantly in contact with water.</p> <p>At site / works</p> <p><u>Pre-treatment:</u></p>		
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SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME II SECTION – C 13
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan PAINTING REQUIREMENTS	SHEET 10 OF 14
<p>Removal of all welding pearls. Blasting according standard Sa 3 to ISO 8501-1: 1988.</p> <p><u>Coat:</u></p> <p>4 coats 2 pack coal-tar-epoxy, dry film thickness 125 µm each. Total system dry film thickness 500 µm. Touch-up after erection as required.</p> <p>13.3.1.7.2.5 Buried / underground piping system (except for sea water piping) Where pipelines are buried, underground protection shall be provided for the piping system as indicated in any one of the methods given below: Coal tar primer, coal tar enamel, inner wrap of fibre glass, final outer wrap of enamel impregnated fibre glass. Total thickness of coating shall not be less than 4.0 mm. With anti-corrosive tape of minimum 4 mm thick conforming to IS-10221 and AWWA C 203-93.</p> <p>Pipe surfaces shall be cleaned by shot or sand blasting before application.</p> <p>Tests to be carried out after application Bond / Adhesion test Holiday test</p> <p>13.3.1.7.3 INTERNAL COATINGS</p> <p>13.3.1.7.3.1 Tanks (Internal Surfaces) as specified in relevant sections of specification Industrial, deionised, demineralised and potable water up to 60°C pH range: 4.5 – 9.5. Blasting according to ISO 8501-1: 1988, grade Sa 2¹/₂.</p> <p><u>Prime coat:</u> Two layers of zinc phosphate epoxy primer total DFT greater than or equal to 75 µm.</p> <p><u>Pre-treatment:</u> De-rusting of all mechanical damages, according to standard Sa 3 to ISO 8501-1:1998, touch up with 2 pack high build epoxy with volume solid content of more than 85%, 75 µm.</p> <p><u>Intermediate coat:</u> 2 pack high build epoxy, dry film thickness 80 µm.</p>		
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SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME II SECTION – C 13						
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan PAINTING REQUIREMENTS	SHEET 11 OF 14						
<div><div>13.3.1.7.3.2</div><div><p><u>Finish coats:</u> 2 pack solvent free epoxy paint dry film thickness 150 µm per coat. In case of service or potable water tanks, the coating material selected shall not taint the water. QA / QC procedure, including pinhole inspection, for shall be submitted for approval by Owner / Owner’s Representative.</p><p>Rubber Lining of Pipes, Valves and Tanks as specified in relevant sections.</p><p>At works</p><p><u>Pre-treatment:</u></p><p>Blasting according standard 2¹/2 to ISO 8501-1: 1988.</p><p><u>Rubber lining:</u></p><p>Hard-rubber 5mm for DM water applications, thickness greater than or equal to 3 mm for others. In case of failure of rubber lining for both pipes and vessels, the rubber lining shall be replaced by COROCOAT</p></div></div>								
<div><div>13.4.0</div><div>13.4.1</div></div>	<div><p>Painting for Electrical Items</p><p>All the steel work shall be thoroughly cleaned of rust, scale, oil, grease, dirt and scarf by pickling, emulsion cleaning, etc. The sheet steel shall be phosphated / oven dried and then painted with two coats of zinc rich primer paint. After application of the primer, two coats of finishing synthetic enamel paint shall be applied. The colour of the finishing coats inside shall be glossy white and exterior of the treated sheet steel shall be shade 631 of IS-5 / RAL 7032 for all switchboard/MCC/ Distribution boards, control panels, etc.</p></div>							
<div><div>13.4.2</div></div>	<div><p>All electrical equipment shall be given tropical and fungicidal treatment and outdoor equipment shall be provided with rain hood to prevent entry of rain water into the equipment.</p></div>							
<div><div>13.5.0</div><div>13.5.1</div></div>	<div><p>Painting for I & C equipment: Epoxy coating required for all I&C equipment.</p><p>Suggested Colour Codes for Painting</p></div>							
<table><tr><td>Sl. No.</td><td>Item / Service</td><td>Colour</td><td>IS–5</td><td>Colour (Band)</td><td>IS - 5</td></tr></table>			Sl. No.	Item / Service	Colour	IS–5	Colour (Band)	IS - 5
Sl. No.	Item / Service	Colour	IS–5	Colour (Band)	IS - 5			
<div>ISSUE R0</div>								

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED				VOLUME II SECTION – C 13
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan PAINTING REQUIREMENTS				SHEET 12 OF 14
13.5.1	Structures, platforms, galleries, ladders and handrails.	Dark Admiralty Grey	632	-	-
13.5.2	Boiler casing, ducting	Nut Brown	413	-	-
13.5.3	Crane				
(a)	Crane structure	Golden Yellow	356	Black	-
(b)	Trolley and hook	Crimson	540	-	-
13.5.4	Pump motors, compressors	Light Grey	631	-	-
13.5.5	Tanks (without insulation and cladding)				
(a)	Outdoor	Aluminium	-	-	-
(b)	Indoor	Light Grey	631	-	-
13.5.6	Vessels and all other proprietary equipment (without insulation and cladding)	Light Grey	631	-	-
13.5.7	Switchgear	Light Grey	631	-	-
13.5.8	Control and relay panels	Light Grey	631/ 7078 of IS1650	-	-
13.5.9	Turbines	Light Grey	631	-	-
13.5.10	Generators and exciter	Light Grey	631	-	-
13.5.11	Transformers	Aluminium	-	-	-
13.5.12	Machinery guards	Signal red	537	-	-
13.5.13	Piping (Without insulation and cladding)				
(a)	Water System				

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SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED				VOLUME II SECTION – C 13
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan PAINTING REQUIREMENTS				SHEET 13 OF 14
(i)	Boiler feed	Sea Green	217	-	-
(ii)	Condensate	Sea Green	217	Light Brown	410
(iii)	DM Water	Sea Green	217	Light Orange	557
(iv)	Soft Water	Sea Green	217	French Blue	166
(v)	Bearing cooling water	Sea Green	217	French Blue	166
(vi)	Potable and filtered water	Sea Green	217	French Blue	166
(vii)	Service and clarified water	Sea Green	217	French Blue	166
(viii)	Cooling water	Sea Green	217	French Blue	166
(ix)	Raw water	Sea Green	217	White	-
(b)	Air system				
(i)	Station air	Sky Blue	101	-	-
(ii)	Control air	Sky Blue	101	White	-
(c)	Oil system				
(i)	Light oil (HSD)	Light Brown	410	French blue	166
(ii)	Lubricating oil	Light Brown	410	Light grey	631
(iii)	Transformer oil	Light Brown	410	Light Orange	557
(d)	Gas system				
(i)	Fuel gas (Re-gassified LNG)	Canary Yellow			
(ii)	Carbon dioxide	Canary Yellow	309	Light grey	631
(iii)	Hydrogen	Canary Yellow	309	Signal red	537
(e)	Fire Services	Fire red	536	-	-
(f)	Effluent pipes	Black	-	-	-
(g)	Vacuum pipes	Sky Blue	101	Black	-
(h)	Drainage	Black	-	-	-
NOTES					
1.	This colour code basically refers to IS: 2379 for piping with necessary modifications.				
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SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME II SECTION – C 13
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan PAINTING REQUIREMENTS	SHEET 14 OF 14
<p>2. Where band colour is specified, same shall be provided at 10 metre intervals on long uninterrupted lines and also adjacent to valves and junctions.</p> <p>Note: Bidder shall furnish his painting specification to suit corrosive atmosphere of coastal area along with the bid. The specification shall in general be in line with the above requirements.</p>		
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	TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM 2X660 MW SURATGARH STPS STAGE V UNIT # 7& 8	SPEC. NO. PE-TS-392-154A-A001	
		VOLUME II-B	
		SECTION : D1	
		REV. NO. 00	DATE:
		SHEET	

PACKING AND TRANSPORT INSTRUCTIONS

SPEC. NO. TCE.M4-906	TATA CONSULTING ENGINEERS LIMITED	SECTION: E
	PACKING, MARKING AND TRANSPORT INSTRUCTIONS FOR EQUIPMENT	SHEET 1 OF 5
1.0	<u>PACKING</u>	
1.1	All equipment and material shall be protected for ocean shipment, inland transport, and storage at the site, according to applicable Indian Standards (IS) and to the instructions given in this specification.	
1.2	The PURCHASER/CONSULTANT may require inspecting and approving the packing before the items are despatched. However, the VENDOR/CONTRACTOR shall be entirely responsible for ensuring that the packing is suitable for the mode of shipment and such inspection will not exonerate the VENDOR/CONTRACTOR from any loss or damage due to faulty packing.	
1.3	The VENDOR/CONTRACTOR shall be responsible for any damage to the equipment and materials during transit due to improper and inadequate packing.	
1.4	Any material found short upon opening the intact packing cases shall be supplied by the VENDOR/CONTRACTOR at no extra cost to the PURCHASER.	
1.5	Only packages constructed out of sound material and of dimensions proportional to the size and weight of contents shall be used.	
1.6	All packing cover and packing material shall become the property of the PURCHASER.	
1.7	In the case of large and bulky equipment, the VENDOR/CONTRACTOR shall be responsible for ascertaining transport limitations and supply the equipment in the minimum number of components or sub-assemblies, within the framework of transport limitations.	
1.8	For ocean transport, containers shall be used as far as possible. Dimensions of packages and kind of packaging must be chosen to fully utilise the size of containers.	
1.9	All equipment shall be protected for the entire period of despatch, storage and erection, against corrosion, incidental damage due to vermin, sunlight, rain, high temperature, humid atmosphere, rough handling in transit and storage in open including possible delays in transit. Material and equipment shipped across the sea shall be packed to withstand without damage, the effects of saline atmosphere. All machined and plated parts shall be protected with anti-rust grease. Precautions shall be taken to protect shafts and journals where they rest on wooden or other supports likely to contain moisture. At such points, wrappings impregnated with anti-rust composition or vapour phase inhibitors shall be used. These shall have sufficient strength to resist chafing and indentation due to the movement, which is likely to occur in transit. The protective wrappings and impregnation shall last for a minimum period of three months or transport time whichever is more.	
1.10	All openings in the equipment shall be tightly covered, plugged or capped to prevent foreign material from entering into the equipment.	
1.11	The contents of the packages shall be sealed in thick polythene sheets. The inside walls of the packages shall be lined with waterproof material to protect	
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SPEC. NO. TCE.M4-906	TATA CONSULTING ENGINEERS LIMITED	SECTION: E
	PACKING, MARKING AND TRANSPORT INSTRUCTIONS FOR EQUIPMENT	SHEET 2 OF 5
<p>the equipment from damage due to dust and moisture.</p> <p>1.12 Adequate provision of skids or pallets shall be made to keep the packages above the ground drain water. Crates and other large containers should have drain holes in the bottom to prevent collection of water within the packing. This is especially important where the cargo itself is subjected to condensation (cargo sweat).</p> <p>1.13 Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.</p> <p>1.14 All cases shall be provided with suitable cut-outs, closed by bolted wooden planks to facilitate inspection by custom authorities. Waterproof transparent papers shall be provided at the cut-out locations to prevent water ingress into the casing through the cut-out.</p> <p>1.15 The contents of the package shall be punched on non-corrosive metal plate and nailed to the package on a prominently visible place. If the number of items in the package is too many, a typed list in transparent waterproof bag shall be kept inside a galvanised sheet steel pocket nailed on to the outside of package at prominently visible location.</p> <p>Copies of the packing list, in triplicate, shall be forwarded to the PURCHASER prior to despatch. All items of material shall be clearly marked for easy identification against the packing list.</p> <p>1.16 Fragile materials shall be securely braced within the package or otherwise amply fastened and packed to prevent shifting or rattling. Soft non-hygroscopic packaging materials shall be placed between the hard packing materials and the fragile equipment. Articles, which do not completely fill the selected package/container, must be cushioned, braced, fastened or blocked to prevent damage to the article itself or destruction of the package. Inner bracing or blocking must be such that the content's weight is distributed over interior surfaces rather than concentrated at one or two points.</p> <p>1.17 Components containing glass shall be carefully covered with shock absorbing protective material such as expanded polystyrene ('Thermo Cole').</p> <p>1.18 All flanges, etc., which are prone to scratching shall be provided with either metal or wooden or plastic blanks bolted in place. Metal blanks should have a minimum thickness of 3 mm and wooden blanks should be made from two layers of wood, each of 10 mm thickness, nailed together with the grain of each layer located at right angles to one another.</p> <p>1.19 Loose material, e.g. bolts, nuts, etc. shall be packed and sealed in polythene bags with proper tagging and packed in cases.</p> <p>1.20 All spare parts shall be packed and treated for long storage conditions at site.</p> <p>2.0 <u>MARKING</u></p>		
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SPEC. NO. TCE.M4-906	TATA CONSULTING ENGINEERS LIMITED	SECTION: E
	PACKING, MARKING AND TRANSPORT INSTRUCTIONS FOR EQUIPMENT	SHEET 3 OF 5
<p>2.1 All packages shall be clearly, legibly and durably marked with uniform block letters (preferably with waterproof paint) on at least three sides with:</p> <ul style="list-style-type: none"> (a) Purchaser's Name and destination address (b) Purchase Order/Contract Number and Date (c) Vendor's/Contractor's or Sub-Vendor's/Sub-Contractor's Name (d) Consignment Serial Number (e) Overall Dimensions (f) Net and gross weights (g) Sign showing 'side up' (h) Sign showing 'fragile' marks in case of delicate equipment (i) Sign showing slinging and sling position (j) Any handling and unpacking instructions, if considered necessary (k) Identification markings relating to the appropriate shipping documents (l) In case of spare parts, each spare part shall be clearly marked and labelled on the outside of its packing with its description and catalogue/ part number and item number of main equipment to which it relates. <p>2.2 <u>ERECTION MARKS</u></p> <p>All equipment comprising multi part assemblies, e.g. steel frameworks, piping, etc., shall be marked with identifying numbers and/or letters corresponding to those of the approved drawings or material lists. These erection marks shall be clearly readable.</p> <p>Colour banding to an approved code shall be employed to identify members of similar shape or type but of different strengths or grades.</p> <p>3.0 <u>TRANSPORT</u></p> <p>3.1 No equipment or material shall be despatched without prior consent (acceptance certificate) of the PURCHASER/CONSULTANT or his representative. On receipt of the acceptance certificate, the equipment shall be packed up and made ready for despatch either on Free On Board (FOB), (Free Alongside Ship (FAS), Free On Road (FOR), Free On Truck, (FOT), Free Alongside Road (FAR), or free alongside Truck (FAT) basis as per the PURCHASE ORDER/CONTRACT. If it is on FOB basis, the VENDOR/ CONTRACTOR is responsible for loading the equipment on the board of ship. On FAS basis, another agency takes over from the VENDOR/CONTRACTOR</p>		
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SPEC. NO. TCE.M4-906	TATA CONSULTING ENGINEERS LIMITED	SECTION: E
	PACKING, MARKING AND TRANSPORT INSTRUCTIONS FOR EQUIPMENT	SHEET 4 OF 5
<p>for loading. The same applies to FOR, FOT and FAR, FAT.</p> <p>3.2 Depending upon the equipment and the mode of transport the VENDOR/ CONTRACTOR may propose to deliver the equipment in container or as Break Bulk i.e. in components or sub-assembly form.</p> <p>3.3 In the event of VENDOR/CONTRACTOR proposing to deliver the equipment in Break Bulk form, he shall furnish full particulars of the quantity and approximate size of each item. All sub-assemblies shall be match-marked to facilitate assembly at site.</p> <p>3.4 In case of ocean shipment, the VENDOR/CONTRACTOR shall send an advance 'Advice of Shipment' to the PURCHASER and site separately, so as to reach at least seven (7) days in advance for foreign supply and three (3) days in advance for domestic supply. This advice shall state the Cost including Freight and Insurance (CIF) value of the consignment, the details of the transport and the probable date of its departure and arrival. Copies of packing list shall also be sent along with the advance intimation.</p> <p>3.5 The VENDOR/CONTRACTOR shall ship the equipment on behalf of the PURCHASER by the first available vessel belonging to a recognised shipping line. He shall ensure that the freight rates charged are not higher than the conference rates applicable to the shipping route at the time of shipment and all rebates and refunds available for such consignments are duly taken into account. The VENDOR/CONTRACTOR shall be responsible for the correct appraisal of freight rates (structural or machinery as the case may be), weights and volumes. In no case, the PURCHASER will pay any warehouse or wharf charges.</p> <p>3.6 Immediately after the shipment has been effected, the shipping documents, comprising Bill of Lading, Freight Invoice, FOB/FAS/FOR/FOT/FAT/FAR Invoice, Packing List, Certificate of Origin, Letter to Insurers and Certificates of Inspection shall be issued by the VENDOR/CONTRACTOR in accordance with the instructions of the PURCHASER/CONSULTANT. These documents shall reach the PURCHASER before the arrival of ship. Responsibility for delays, loss or damages of shipping documents shall rest with the VENDOR/ CONTRACTOR.</p> <p>3.7 In case of inland despatch by rail or truck, similar equivalent procedures as applicable to rail or truck transportation shall be adopted.</p> <p>3.8 All Equipment manufactured by the VENDOR/CONTRACTOR shall be under his charge. The PURCHASER shall arrange for insurance coverage during shipment and till delivered at site, if necessary.</p> <p>4.0 <u>TRANSPORT OF ELECTRICAL EQUIPMENT AND INSTRUMENTATION ITEMS</u></p> <p>4.1 Transformers rated 2000 kVA and less shall be shipped filled with oil. Transformers rated above 2000 kVA shall be shipped without oil but with the</p>		
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SPEC. NO. TCE.M4-906	TATA CONSULTING ENGINEERS LIMITED	SECTION: E
	PACKING, MARKING AND TRANSPORT INSTRUCTIONS FOR EQUIPMENT	SHEET 5 OF 5
<p>tank filled with nitrogen or equivalent inert gas. A gas cylinder with suitable reducer connection and pressure gauge shall be supplied. These accessories shall become the property of the PURCHASER. The required quantity of oil shall be supplied separately in non-returnable drums.</p> <p>4.2 Switchgear cubicles and instrument control panels shall be packed and shipped in separate and convenient sections. All withdrawable equipment like circuit breakers and circuit breaker arc-chutes shall be packed and shipped separately. All relays and panel-mounted instruments shall be packed and shipped separately with their operating mechanisms temporarily arrested from movement during transport.</p> <p>4.3 Batteries shall be shipped to site in dry, uncharged condition. Appropriate quantity of acid of the correct specific gravity shall be shipped separately in non-returnable porcelain jars packed in steel wire baskets.</p> <p>4.4 Cables shall be shipped on non-returnable drums, adequately braced, and with cable ends adequately sealed to prevent ingress of moisture.</p>		
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TITLE: TECHNICAL SPECIFICATION FOR
LP CHEMICAL DOSING SYSTEM
2X660 MW SURATGARH STPS STAGE V
UNIT # 7& 8

SPEC. NO. **PE-TS-392-154A-A001**

VOLUME **II-B**

SECTION : **D2**

REV. NO. 0 | DATE:

SHEET :

SECTION – D2
GENERAL TECHNICAL REQUIREMENT
ELECTRICAL

TECHNICAL SPECIFICATION FOR MOTOR AND ACTUATOR

- * LT motors for continuous duty (S1) operation & S3 (intermittent periodic duty) with a cyclic duration factor of 80% or higher, shall be energy efficient class IE-3 in line with IS -12615-2011

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 1 OF 7
<p>1.0 <u>AC & DC MOTORS</u></p> <p>1.1. HT motors of rating above 1500kW shall be suitable for 11kV, 3 phase, 50Hz power supply. Motors above 160kW and up to 1500kW shall be suitable for 6.6kV, 3 phase, 50Hz. Motors rated 160kW and below shall be suitable for 415V, 3 phase, 50 Hz power supply. *</p> <p>1.2. All LT motors shall be energy efficient class – I in line with IS: 12615. However, the starting current shall be limited to 600% (inclusive of 20% tolerance) of full load current. *</p> <p>1.3. The motor rating shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment, whichever is higher, considering highest system frequency. Motors shall be capable of starting and accelerating the load with the applicable method of starting without exceeding acceptable winding temperatures when supply voltage is 80% of the rated voltage for HT motors and 85% for LV motors. HT motors shall also be capable of satisfactory operation at full load at a supply voltage of 80% of the rated voltage for 5 min. commencing from hot condition. DC motors shall be suitable for the DC system voltage of 220V. Motor shall be capable of starting and accelerating the load with the applicable method of starting, without exceeding acceptable winding temperatures, when the supply voltage is in the range of 85% to 110% of rated motor voltage.</p> <p>1.4. Motors shall be capable of running for one second if the supply voltage drops to 70% of the rated voltage. If such operation is envisaged for a period of one second, the pull out torque of the motor shall be at least 205% of full load torque.</p> <p>1.5. Motors shall withstand for 1 second the voltage and torque stresses developed due to the vector difference between the motor residual voltage and the incoming supply voltage equal to 150% of the rated voltage during fast changeover of buses.</p> <p>1.6. Locked rotor current of the HT motors rated 1500 kW and below shall be limited to 600% (inclusive of 20% tolerance) of the full load current of the motors and motor rated above 1500 kW shall be limited to 450% (inclusive of 20% tolerance) of full load current of the motor.</p> <p>1.7. The locked rotor withstand time under hot condition at 110% rated voltage shall be more than the starting time at minimum permissible voltage specified above by at least three seconds or 15% of the accelerating time whichever is greater. Provision of speed switch shall be avoided to the extent possible.</p> <p>These motors shall be designed to withstand at least 5% harmonics in the supply voltage.</p> <p>1.8. The degree of protection for the motor enclosure (including terminal box) shall be IP-55 for outdoor. For single core cable termination, gland plates shall be of non-magnetic material. All motors located in hazardous area shall have flame proof enclosure.</p>		
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PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 2 OF 7
<p>1.9. All HT motors shall be provided with vibration pads for mounting vibration detectors. Vibration monitoring devices shall be provided on DE and NDE side in X & Y direction with remote DCS monitoring, alarms and tripping</p> <p>1.10. Motors rated 1000kW and above shall be provided with differential protection. These motors shall be provided with star connected stator windings. The 3 nos. current transformers, one for each phase shall be mounted in a separate compartment in the neutral side terminal box. The three phases shall be connected to form the star point after they pass through the CTs. The CTs shall be of relay accuracy and the CT characteristics shall be compatible with the differential relay. The additional 3 nos. CTs of identical characteristics shall be provided in the 11kV/6.6 kV switchgear panel.</p> <p>1.11. The terminal box of motor shall be of suitable size, suitable to terminate and maintain the cables easily. Terminal box shall be suitable to rotate at 90 degrees.</p> <p>1.12. The ring oiling system shall be adequate for starting and continuous operation of the motor for at least one half hour without pressure oiling system in operation.</p> <p>1.13. For 11kV & 6.6 kV motors, 6-nos. duplex RTD s for winding shall be provided for remote monitoring, alarm and tripping at DCS. Each bearing shall be provided with one duplex RTD for temperature remote monitoring, alarm and tripping at DCS. 6 nos. spare RTDs shall be provided for winding in HT motors.</p> <p>1.14. The maximum double amplitude vibrations for motors shall be as per IS 12075.</p> <p>1.15. Maximum noise level measured at a distance of 1.5 meter from the outer surface of the motor shall not exceed 85 db (A).</p> <p>1.16. Cable boxes of all 11kV & 6.6 kV motors shall be Phase segregated & shall be provided with quick disconnecting type terminal connectors to facilitate easy disconnection and removal of the motors without requiring unsealing or otherwise disturbing the external cable connections and leaving the phase segregated terminal box intact. The terminal boxes shall have fault withstand capacity equal to at least rated short circuit level of system voltage for 0.25 sec. The terminal boxes shall be reversible to suit cable entry from top or bottom and suitable for termination of FRLS, XLPE armoured cables.</p> <p>1.17. The star connection side terminal box should have sufficient capacity to accommodate CT's for differential protection for motor above 1000kW.</p> <p>1.18. The insulation system for 11000 V AC & 6600 V AC motors shall withstand the negative or positive 0.3 / 3.0 microsecond wave (2.7 pu rated peak line to earth operating voltage) switching surges originating from non-effectively earthed power system. All 11000V AC & 6600 V AC motors shall have BIL and power frequency withstand voltage as per relevant standards.</p> <p>1.19. Motor bearing shall be insulated wherever required.</p> <p>1.20. All HT motors shall be with VPI insulation or better</p>		
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<p>1.21. All HT motors / LT motors 15 kW and above shall be provided with external greasing arrangement</p> <p>1.22. CACW motor shall be provided with water leakage detector with remote alarms and tripping.</p> <p>1.23. All HT motors / LT motors 30 kW and above shall be provided with space heaters using 240 V AC supply. However, for all the actuators, irrespective of its rating, space heaters shall be provided using 240V AC supply.</p> <p>1.24. All motors below 15 kW shall be provided with sealed ZZ bearings</p> <p>1.25. Each motor shall have two earthing terminals.</p> <p>1.26. All motors for outdoor duty shall have detachable metal canopy.</p> <p>1.27. HT motors shall be designed for operation as follows:</p> <p>a) Upto 1000kW – Vacuum circuit breakers/SF6.</p> <p>b) Above 1000kW-Vacuum circuit breakers/SF6.</p> <p>c) All motors shall be suitable for DOL starting.</p> <p>1.28. Separate terminal boxes to be provided for space heater, RTDs for windings/bearings, vibration monitors etc. All terminal boxes shall be provided with two earth studs for termination of protective earth conductor. Double compression type brass cable glands and crimping type copper lugs shall be provided for termination.</p> <p>1.29. Provision shall be made at DCS to monitor, integrate running hours, nos. of starts and stop recording for all motors.</p> <p>1.30. The terminals of all motors shall be suitable for terminating Aluminium conductor, XLPE insulated, armoured cables, the sizes of which will be intimated by the Purchaser.</p> <p>2.0 <u>ACTUATOR</u></p> <p>2.1. GENERAL TECHNICAL REQUIREMENT</p> <p>2.1.1. Actuator shall be weatherproof type with enclosure conforming to IP-64 degree of protection. It should be suitable for out-door use without the need for canopy. If the IP-68 degree of protection is required due to occasional submergence, the purchaser shall specify the depth and duration of such submergence.</p> <p>2.1.2. The actuator shall be suitable for installation in any position without lubrication leakage or other operational difficulty.</p> <p>2.1.3. All actuators shall be supplied with non integral starters for open & close. The main gearbox of the actuator shall be special grease filled.</p> <p>2.1.4. Each actuator should have a hand wheel for emergency manual operation. Clockwise operation of hand wheel shall cause clockwise movement of the</p>		
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PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 4 OF 7
<p>output drive. The hand wheel shall be clearly marked with an arrow and the word CLOSE.</p> <p>2.1.5. The hand wheel shall automatically disengage when the power to the motor is restored i.e. power drive shall have a preference over manual drive.</p> <p>2.1.6. The manual effort should not exceed 400 N (push / pull). A top bevel gear set (side mounted hand wheel) shall be employed to reduce the manual effort.</p> <p>2.1.7. Each actuator shall have a local mechanical position indicator. It should be suitable to indicate 0 - 100% position of the valve (continuous type).</p> <p>2.1.8. In order to minimise the amount of spare parts required, parts and sub-assemblies limit / torque switches, limit switch counter gear assembly, torque switch drive assembly, mechanical position indicator assembly etc. individually interchangeable / replaceable throughout the models selected.</p> <p>2.1.9. The actuator shall be painted with corrosion resistant epoxy resin paint. Paint shade shall be Grey (Shade 631) as per IS-5.</p> <p>2.1.10. In order to prevent condensation, a space heater shall be provided in the switch compartment, suitable for continuous operation. Actuator mounting dimensions shall be according to ISO-5210. For rising stem applications, the design must allow the removal of actuator from the output drive without disturbing the function of valve.</p> <p>2.2. LIMIT AND TORQUE SWITCHES</p> <p>2.2.1. Independent torque and limit switches shall be provided in the actuator. A minimum of two position limit switches and two torque switches, one each for each direction of travel, having 4 NO + 4 NC potential free contacts, shall be supplied. If called for in the data sheet, two additional limit switches shall be provided for intermediate positions.</p> <p>2.2.2. Torque switch dial shall be graduated directly in "kg-m" for easy setting to desired value within the range specified. Separate dials shall be provided for CLOSE and OPEN torque switches.</p> <p>2.2.3. Two additional limit switches with 2NO + 2NC contacts, each adjustable at any intermediate position, shall be provided in the actuator.</p> <p>2.2.4. The rating of both torque and limit switches shall be 240 V AC, 5 Amps. The switches shall individually be enclosed to a minimum of IP-64 protection class.</p> <p>2.2.5. Torque and limit switches shall have only stainless steel flaps for better protection against environmental condition.</p> <p>2.2.6. Limit switches shall be operated by gear driven cams, which are mechanically linked to the driving devices. The counter gear used for counting and tripping the limit switches shall be of metallic construction like brass etc. No plastic gearing shall be allowed.</p>		
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SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
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<p>2.2.7. To guarantee proper function under high ambient temperatures, torque and limit switch sensing shall be of mechanical type.</p> <p>2.3. ELECTRIC DRIVE FOR ACTUATOR (MOTOR)</p> <p>2.3.1. All motors shall be specifically designed for valve actuator operation, which is characterised by high starting torque, low stall torque & low inertia. All motors shall be high starting torque type to facilitate 'unseating' of valve.</p> <p>2.3.2. Motor shall be suitable for power supply of 415 V, 3 ph, 50 Hz, AC.</p> <p>2.3.3. Motor shall be squirrel cage induction type and shall generally conform to IS-325.</p> <p>2.3.4. Motor shall have minimum class 'F' insulation with temperature rise restricted to class 'B' under the design ambient temperature.</p> <p>2.3.5. Motor shall be of totally enclosed surface cooled (TESC) type with IP-67 protection class after mounting on actuator.</p> <p>2.3.6. Motor shall have three thermostats connected in series, one in each phase of stator winding, for protection against overheating.</p> <p>2.3.7. Motor shall be suitable for operation under voltage variation of + 10%, frequency variation of + 5% and combined voltage & frequency variation of 10% absolute.</p> <p>2.3.8. Motor shall be suitable for direct on-line (DOL) starting and starter shall be non integral to the motor.</p> <p>2.3.9. It should be possible to separate the motor from the lubricant filled gearing of the actuator allowing easy replacement of motor without losing any lubricant regardless of mounting position.</p> <p>2.3.10. Finish shall be provided on the motor body to ensure better heat dissipation.</p> <p>2.3.11. It shall be possible to change the output rpm of the actuator, if required, at the site at a later date, without hampering the mounting arrangement and loss of any lubricant.</p> <p>2.4. CODES & STANDARDS</p> <p>All the equipment specified herein shall comply with the requirements of the latest issue of the relevant National & International standards.</p> <p>The design and materials used for the components shall also comply with the relevant National & International standards.</p> <p>As a minimum requirement, the following standards shall be complied with :</p> <p>Electric motor operated actuators:IS 9334</p>		
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<p>Degrees of protection provided by enclosures at low:IS 2147 voltage switch gear and control gear</p> <p>Flame Proof enclosure at electrical apparatus:IS 2148 Specification for three phase induction motors:IS 325</p> <p>AC contactor for voltages not exceeding 1000 V:IS 2959</p> <p>Degree of protection provided by enclosures for :IS 4691 Rotating electrical machinery</p> <p>Specification for rotating electrical machines:IS 4722 For other code refer Section D28.</p> <p>2.5. OTHER REQUIREMENTS OF ACTUATOR.</p> <p>2.5.1. Common potential free contact shall be available to annunciate the fault condition to the remote control station or DCS.</p> <p>2.5.2. The following individual relay / potential free contacts shall be provided for the remote indication:-</p> <ul style="list-style-type: none"> – Actuator OPEN. – Actuator CLOSE – Actuator fault feed-back – Thermal overload relay shall be provided to trip the actuator in case of overload <p>2.6. The DC and AC actuator shall be provided with accessories viz., Torque limit switch, end of travel switch, adjustable limit switch, hand wheel motor, thermostat, etc. Complete actuator shall be tested at factory as per IS 9334. All actuators should have minimum 2 limit switches for each position, and should have position transmitters wherever required.</p> <p>3.0 TESTS</p> <p>3.1. All routine & acceptance tests as per relevant IS shall be conducted on motors. For all AC and DC motors of rating below 100kW, type test certificates shall be furnished. If the test reports are not found in order by Purchaser then these tests shall be conducted by the Vendor without any cost implication.</p>		
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<p>3.2. Type test shall be carried out on one no. of each type and rating of motor of rating 100kW and above, which shall be witnessed by Purchaser.</p> <p>3.3. Efficiency and loss measurements shall be done for all LT motors as per relevant standard (Being energy efficient motors.) as routine test.</p> <p>3.4. For 11000V AC & 6600V AC motors, in addition to all the tests specified above, polarisation index test shall be carried out as a routine test on each motor (the minimum value of polarisation index for all motors shall be 2 when determined according to IS: 7816).</p> <p>3.5. Noise level measurement test shall be conducted on one motor of each type.</p> <p>3.6. Vibration measurement shall be taken for each motor of 45kW & above.</p> <p>3.7. Dielectric tests to establish the insulation withstand level of motors as indicated above shall be performed on a sample coil (identical to those to be used in the motor quoted for) for each type of motor. These tested sample coils shall not be used in the motors to be supplied.</p> <p>4.0 For technical particulars refer datasheet-A.</p>		
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PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan DATA SHEET-A MOTOR & ACTUATOR		SHEET 1 OF 6

Sr. No.	Descriptions	Unit	Client specification
1.	Applications		*
2.	Manufacturer		*
3.	Frame Size		*
4.	Quantity		*
5.	Model No. of motor		*
6.	Supply Conditions		*
	(a) Allowable variation in		*
	(i) Voltage AC/DC	%	$\pm 10/ +10\%$ to -15%
	(ii) Frequency	%	± 5
	(iii) Combined	%	10
	(b) Permissible unbalance in supply voltage		*
7.	Speed	rpm	*
8.	Rated voltage a)HT motors b)LT motors c)UPS supplied d)Single phase e)DC motors		a)11000V & 6600V AC b)415V AC c)230V AC d)240V AC e)220V DC
9.	Number of phase		3-Phase
10.	Rated frequency for AC motor	Hz	50
11.	Normal winding connection	Star / Delta	*
12.	Method of starting a)AC motors b) DC motors		a)DOL (preferably) b) Resistance start
13.	Temperature rise above ambient of 50 deg. by Resistance method	Deg. C	HT motors – Shall be limited to Class B LT motor – Class B

REV. NO.	R0	R1	JOB NO. TCE - 5750A	CLIENT : RRVUNL
PPD. BY :	UM	SK		
CKD. BY :	MSVM	MSVM		
DATE	NOV'2009	JUN'2012		PROJECT : 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan DATA SHEET-A MOTOR & ACTUATOR	SHEET 2 OF 6

Sr. No.	Descriptions	Unit	Client specification
14.	Type of rotor (Slip ring/ squirrel cage)		Squirrel cage
15.	Type of duty		*
16.	Duty designation		*
17.	Synchronous speed a) Constant speed b) Variable speed (for VFD)		*
18.	Starting time at specified minimum starting voltage	Sec	*
19.	Starting torque	% of FLT	*
20.	Pull out torque	% of FLT	*
21.	Class of insulation		HT motors- Class F LT motors including actuator motors-Class F.
22.	Ref. Ambient temperature	deg. C	50
23.	Location considered – Hazardous area division		*
24.	Installation		
24.1.	Location		Indoor/Outdoor
24.2.	Hazardous area division (IS:5572 or equivalent)		*
24.3.	Atmosphere considered- Chemical/Dusty/Salt laden		*
25.	Type of cooling (IS: 6362) LT motors HT motors		TEFC TEFC / TETV / CACW

REV. NO.	R0	R1	JOB NO.	CLIENT : RRVUNL
PPD. BY :	UM	SK	TCE -	
CKD. BY :	MSVM	MSVM	5750A	
DATE	NOV'2009	JUN'2012		PROJECT : 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan DATA SHEET-A MOTOR & ACTUATOR		SHEET 3 OF 6

Sr. No.	Descriptions	Unit	Client specification
26.	Degree of protection		IP 55 – Outdoor IP 54 - Indoor
27.	Rotation as seen from Non-drive end		Clockwise/Anti-Clockwise
28.	Main terminal box		
28.1.	Terminal box Short time rating a) HT for 0.25 sec b) LT for 0.25 sec Dynamic rating a) HT b) LT	KA KA KA peak KA peak	40 (minimum) 50 (minimum) 102 (minimum) 127.5 (minimum)
28.2.	Location as seen from non- drive end:		TOP/RIGHT/LEFT
28.3.	Phase Segregated	YES/N O	*
28.4.	Terminal box degree of rotation	Degree	90
29.	Weather motor is suitable for VFD drive		*
30.	Details of bearing		*
31.	Color shade of paint		Shade 631 of IS-5
32.	Whether CT for differential protection required		*
32.1.	C.T. PARTICULARS :		
32.2.	3 CTs, one in the neutral lead of each phase		
32.3.	Ratio		
32.4.	Class	PS	

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PPD. BY :	UM	SK		
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SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
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Sr. No.	Descriptions	Unit	Client specification
32.5.	Knee point voltage	KPV	*
32.6.	MAX. R.C.T. secondary winding resistance	OHMS	*
32.7.	MAX. exciting current AT 1/2 KPV		*
32.8.	Class of Insulation		*
33.	Whether vibration detectors required		*
34.	Details of winding / space heaters		*
35.	Guaranteed Efficiency of motor a) At full load b) At duty point c) At no load		*
36.	Guaranteed Power factor of motor a) At full load b) At duty point c) At no load		*
37.	Current at a) Starting b) Full load c) Duty point d) Full load & 70 % of rated supply voltage.		*
38.	Quantity & type of temperature detectors for all HT motors a) Winding hot spot b) Bearing		Minimum 6 Duplex RTD Minimum two thermocouple per bearing.
39.	Details of accessories a) Fans		*

REV. NO.	R0	R1	JOB NO.	CLIENT : RRVUNL
PPD. BY :	UM	SK	TCE -	
CKD. BY :	MSVM	MSVM	5750A	
DATE	NOV'2009	JUN'2012		PROJECT : 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME IV SECTION: D13
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Sr. No.	Descriptions	Unit	Client specification
	b) Temperature gauge c) Bearing d) Cooling motors e) Cooling water parameters f) Heaters g) Lube oil system details		
40.	Maximum size & number of cables that can be accommodated in motor terminal box.		*
41.	Thermal capability curve to be attached		*
42.	Relay co-ordination guide to be attached.		*
43.	Min. voltage required under starting conditions to accelerate driven equipment to rated speed.	Volts	*
44.	Locked rotor current withstand time (safe stall time) at 110 % rated voltage a) At rated temp. (hot) b) When cold	sec sec	*
45.	Stator thermal time constant	sec	*
46.	Permissible no. of equally spread starts per hour a) Normal service conditions b) In quick succession with cold M/C at room temp. c) Hot restarts		*
47.	Method of Starting and maximum starting current inclusive of tolerances AC HT Motors a) DOL		450 % above 1500 kW & 600 % all other.

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PPD. BY :	UM	SK		
CKD. BY :	MSVM	MSVM		
DATE	NOV'2009	JUN'2012		PROJECT : 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
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Sr. No.	Descriptions	Unit	Client specification
	b) Soft starters		*
	AC LT Motors		
	c) DOL		600 %
	d) Star Delta		200 %
	e) Star Delta with series resistance		200%
	f) Soft Starters		*
	DC Motors		
	a) Resistance starting		200%
	b) Soft starters		200%
	c) Any other		*

REV. NO.	R0	R1	JOB NO.	CLIENT : RRVUNL
PPD. BY :	UM	SK	TCE -	
CKD. BY :	MSVM	MSVM	5750A	
DATE	NOV'2009	JUN'2012		PROJECT : 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan


	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		REV NO. : 00 DATE : 29/08/2005
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GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 1 OF 4

1.0 INTENT OF SPECIFICATION

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

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

2.0 CODES AND STANDARDS

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

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

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

3.0 DESIGN REQUIREMENTS


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


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


3.3 Starting Requirements


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

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

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<p>The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.</p> <p>3.3.3 The following frequency of starts shall apply</p> <ul style="list-style-type: none"> i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature. ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour) iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor <p>3.4 Running Requirements</p> <p>3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.</p> <p>3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.</p> <p>3.5 Stress During bus Transfer</p> <p>3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.</p> <p>3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.</p> <p>3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.</p> <p>3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.</p> <p>4.0 CONSTRUCTIONAL FEATURES</p> <p>4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy</p> <p>4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.</p> <p>Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled</p> <p>4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.</p>		

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

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<p>4.9.1 Motors provided for similar drives shall be interchangeable.</p> <p>4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.</p> <p>4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.</p> <p>4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.</p> <p>4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.</p> <p>4.9.6 Name plate with all particulars as per IS: 325 shall be provided</p> <p>4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.</p> <p>5.0 INSPECTION AND TESTING</p> <p>5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.</p> <p>5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.</p> <p>5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.</p> <p>5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.</p> <p>6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT</p> <p>a) OGA drawing showing the position of terminal boxes, earthing connections etc.</p> <p>b) Arrangement drawing of terminal boxes.</p> <p>c) Characteristic curves: (To be given for motor above 55 kW unless otherwise specified in Data Sheet).</p> <p>i) Current vs. time at rated voltage and minimum starting voltage.</p> <p>ii) Speed vs. time at rated voltage and minimum starting voltage.</p> <p>iii) Torque vs. speed at rated voltage and minimum voltage. For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.</p> <p>iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.</p>		

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LT MOTORS**A. GENERAL**

1. Manufacturer & Country of origin.
(Shall be as per approved QA make)
2. Equipment driven by motor
3. Motor type
4. Quantity

B. DESIGN AND PERFORMANCE DATA


1. Frame size
2. Type of duty
3. Type of enclosure /Method of cooling/Degree of protection
4. Applicable standard to which motor generally conforms
5. Efficiency class as per IS 12615
6. (a) Whether motor is flame proof Yes/No
(b) If yes, the gas group to which it conforms as per IS:2148
7. Type of mounting
8. Direction of rotation as viewed from DE END__
9. Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)
10. Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)
11. Maximum continuous load demand of driven equipment in KW
12. Rated Voltage (volts)
13. Permissible variation of :

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- a. Voltage (Volts)
 - b. Frequency (Hz)
 - c. Combined voltage and frequency
14. Rated speed at rated voltage and frequency(RPM)
15. At rated Voltage and frequency:
 - a. Full load current
 - b. No load current
16. Power Factor at
 - a. 100% load
 - b. NO load
 - c. Starting.
17. Efficiency at rated voltage and frequency,
 - a. 100% load
 - b. 75% load
 - c. 50% load
18. Starting current (amps) at
 - a. 100 % voltage
 - b. 85% voltage
 - c. 80% voltage
19. Minimum permissible starting Voltage (Volts)
20. Starting time with minimum permissible voltage
 - a. Without driven equipment coupled
 - b. With driven equipment coupled

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21. Safe stall time with 100% and 110% of rated voltage
 - a. From hot condition
 - b. From cold condition
22. Torques :
 - a. Starting torque at min. permissible voltage(kg-mtr.)
 - b. Pull up torque at rated voltage.
 - c. Pull out torque
 - d. Min accelerating torque (kg.m) available
 - e. Rated torque (kg.m)
23. Stator winding resistance per phase (ohms at 20 Deg.C.)
24. GD^2 value of motors
25. No of permissible successive starts when motor is in hot condition
26. Locked Rotor KVA Input
27. Locked Rotor KVA/KW
28. Vibration limit :Velocity (mm/s)
29. Noise level limit (dBA)

C. CONSTRUCTIONAL FEATURES

1. Stator winding insulation
 - a. Class & Type
 - b. Winding Insulation Process
 - c. Tropicalised (Yes/No)

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- d. Temperature rise over specified maximum ambient temperature of 50 deg C
 - e. Method of temperature measurement
 - f. Stator winding connection
2. Main Terminal Box
 - a. Type
 - b. Location (viewed from NDE side)
 - c. Entry of cables(bottom/side)
 - d. Recommended cable size (To be matched with cable size envisaged by owner)
 - e. Fault level (MVA), Fault level duration (sec)
 - f. Cable glands & lugs details (shall be suitable for power cable)
3. Type of DE/NDE Bearing
4. Motor Paint shade
5. Weight of
 - a. Motor stator (KG)
 - b. Motor Rotor (KG)
 - c. Total weight (KG)

D. List of accessories.

1. Space Heaters (Applicable for 30 KW & above motor)
(Nos./Power in watts/supply voltage)
2. Terminal Box for Space Heater (Yes/No)
3. Speed switch (Yes/No)
No of contacts and contact ratings of speed switch

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4. Insulation of bearing (Yes/No)

5. Noise reducer(Yes/No)

6. Grounding pads

i) No and size on motor body

ii) Nos on terminal Box

7. Vibration pads

i) Nos and size

ii) Location

8. Any other fitments

E. List of curves.

1. Torque speed characteristic of the motor

2. Thermal withstand characteristic

3. Starting. current Vs. Time

4. Starting. current Vs speed

5. P.F. and Effi. Vs Load

F. Additional Data to be filled for each rating of DC Motor

1. Rated armature voltage (Volt)

2. Rated field excitation (Amp)

3. Permissible % variation in voltage


4. Minimum Permissible Starting voltage (volt)

5. At rated voltage

i) Full load Armature current.(Amp)


ii) Full load Field current (Amp)

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- iii) No load Armature current (Amp)
6. Full load Field current (Amp)
7. No load Armature current (Amp)
8. Minimum permissible field current(Amp) to avoid overspeeding at
 - i) Maximum permissible voltage
 - ii) Rated voltage
 - iii) Minimum Permissible Voltage
9. Resistance (indicative Values) in ohm
 - i) Armature winding (Arm + IP + Series) at 25 deg.C
 - ii) Field Winding at 25 deg. C
10. Inductance (indicative values)
 - i) Armature winding
 - ii) Field winding
11. Value of trimmer resistance (ohm) to be connected in series with the shunt field to obtain rated speed at
 - i) 220 V DC
 - ii) 250 V DC
 - iii) 187 V DC
12. Value of the external resistance (ohm) required to be connected in series with armature during starting only
13. Technical data sheet for external resistance box
14. GA drawing of motor
15. Starting time calculation

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16. Starter resistance design calculation
17. Electrical connection diagram of motor

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CABLES AND CABLE CARRIER SYSTEM

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PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 1 OF 9
<p>1.0 CABLES</p> <p>1.1 H T POWER CABLES</p> <p>System cables shall be 11kV (UE) and 6.6 kV (UE) grade suitable for use in medium resistance earthed system, stranded & compacted aluminium conductor, extruded semi conducting screen over conductor, XLPE insulated, semi-conducting followed by copper tape screened, extruded PVC Type ST – 2 inner sheathed, aluminium/GS wire armoured, overall FRLS PVC outer sheathed, conforming to IS 7098 (Part II), IEC-502 for constructional details and tests.</p> <p>1.2 L T POWER CABLES</p> <p>LV Power Cables shall be 1100 V grade, single / multi core, stranded aluminium conductor, XLPE insulated, with PVC inner sheath, armoured and outer sheath made of FRLS PVC compound, generally conforming to IS 7098 (for XLPE). The cables used for DC system shall be of single core type. Minimum conductor cross section of power cables shall be 6-sq. mm for aluminium cables.</p> <p>1.3 CONTROL CABLES</p> <p>Control cables shall be 1100 V grade, multi core, minimum 1.5 sq. mm cross section, stranded copper conductor having minimum 7 strands, PVC insulated, PVC inner sheathed / galvanised steel wire armoured, overall FRLS PVC outer sheathed generally conforming to IS 1554 Part-I. In situations where accuracy of measurement or voltage drop in control circuit warrants, higher cross sections as required shall be used.</p> <p>1.4 INSTRUMENTATION CABLES</p> <p>The instrumentation cables shall be Annealed, tinned stranded copper conductor, 0.5 sq mm , twisted into pairs, overall screened (I1 type) for digital signals, individual and overall screened (for I2 type) for low level analog signals, individual triplet and overall screened (type I3), PVC insulated , inner PVC sheathed, GS wire armoured and overall sheathed with FRLS PVC. The insulation shall be strippable manually as well as by mechanical stripping devices without damage to the conductor.</p> <p>1.5 TRAILING POWER AND CONTROL CABLES FOR MOBILE EQUIPMENT.</p> <p>11 kV(UE) and 6.6 kV (UE) and 1100V-(E) grade power & control flexible trailing, annealed tinned copper conductor, EPR insulated, EPR inner sheathed, CSP outer sheathed and shall have conductor screen of rubber. Cables shall conform to IS requirements and any other applicable standards.</p> <p>1.6 FIRE SURVIVAL CABLES</p> <p>1.6.1 Power and control, single/multi, stranded copper conductor fire survival cables complying with IEC-60331 shall be provided for following systems as per CEA guidelines.</p>		
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<p>(a) DC emergency lube oil pumps</p> <p>(b) DC seal oil pumps</p> <p>(c) DC emergency lighting cables for main building</p> <p>(d) Batteries to chargers and DC distribution boards</p> <p>(e) Turbine lube oil pumps</p> <p>(f) Jacking oil pumps</p> <p>(g) Emergency turbine trip by pushbutton in control room</p> <p>(h) Boiler Turbine: Generator inter trip which includes the interconnecting cables between:</p> <ul style="list-style-type: none"> – Boiler master fuel trip and turbine trip relays – Generator trip relays and turbine trip relays – Generator trip relays and 400kV breakers – Generator trip relays and generator field breakers – Generator trip relays and ST and UT breakers <p>1.6.2 FS cables shall have following properties:</p> <p>(a) Excellent fire resistance characteristics</p> <p>(b) Cables shall have features of nontoxic and low smoke generation</p> <p>(c) Flame non-propagation property</p> <p>(d) Ability to withstand burning & continue to function during and after fire</p> <p>(e) Low smoke emission & low halogen property to maintain circuit integrity to essential services under severe fire condition.</p> <p>1.6.3 Construction of FS cables</p> <p>(a) Conductor- Copper stranded</p> <p>(b) Fire proof layer- heat barrier based</p> <p>(c) Insulation- elastomer rubber</p> <p>(d) Fire proof layer- same as 2 above but optional – natural or synthetic, fibre or elastomer</p> <p>(e) Filler- suitable filler optional</p> <p>(f) Binder tape – two layers of glass fibre tape</p> <p>(g) Inner sheath- HOFR FRLS elastomer (heat & oil flame retardant)</p> <p>(h) Armouring/screening – suitable wire</p> <p>(i) Over all sheath – HOFR FRLS</p>		
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<p>1.7 Cables for the fire detection and alarm system and communication system shall be as described else where.</p> <p>2.0 <u>CABLE PROPERTIES</u></p> <p>2.1 All single core power cables shall have wire / strip armouring of aluminium, whereas multi core power cable shall have galvanised steel wire / strip armouring.</p> <p>2.2 The sheath shall be resistant to water, UV radiation, fungus, termite and rodent attack.</p> <p>2.3 The outer sheath of FRLS PVC compound shall meet the following performance requirements:</p> <p>(a) The critical oxygen index value shall be minimum 29 when tested at $27 \pm 2^{\circ}\text{C}$ as per ASTM-D-2863-77 and the temperature index shall be minimum 250°C at oxygen index value of 21 when tested as per ASTM-D-2863.</p> <p>(b) The maximum acid gas generation as determined by titration method shall be less than 20% by weight when tested as per IEC-60754-1 (1994). Halogen acid content in outer sheath in FS cables shall not be more than 2%.</p> <p>(c) Flammability</p> <p>(i) Cables shall pass tests under fire condition as per IS-10810-Part-53.</p> <p>(ii) Cables shall also pass tests as per IS-10810 Part-61 & Part-62. Category group shall be considered as Category 'A'.</p> <p>(iii) Fire survival cables in addition to tests (i) and (ii) above shall pass tests as per IEC-331.</p> <p>(d) The smoke generation under fire shall have maximum smoke density rating of 60% when tested as per ASTM-D-2843-77 (1977). Smoke density in FS cables shall not exceed 20%.</p> <p>(e) The cables shall pass the ultraviolet tests as per DIN 53387.</p> <p>(f) The cables shall pass the tests for Water absorption tests as per IS 10810.</p> <p>2.4 The finished cable shall pass the flammability test as per IEC-322-1 (1993) and IEEE-383. In addition, it shall also pass flammability test as per Class F3 of Swedish Standard SS-424-1475 (1977).</p> <p>2.5 In addition, cables for devices mounted on or near hot surfaces of Steam Generators, Turbine Generators, Main steam etc shall have heat resistance type outer sheath.</p> <p>2.6 All LT cable shall have embossing at interval of 1 meter for owner name, size/ core type and length.</p>		
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<p>2.7 All cables shall be embossed with the name of RVUNL in addition to what is specified in the standards.</p> <p>3.0 <u>DESIGN CRITERIA FOR CABLE SIZING</u></p> <p>3.1 POWER CABLES</p> <p>Power cable sizes shall be selected on the following basis:</p> <p>3.1.1 Power cables shall carry the full load current of the circuit continuously under site conditions considering the condition listed below:-</p> <ul style="list-style-type: none"> (a) Ambient design temperature 50 deg. C. (b) Maximum allowable temperature under normal full load condition and under short circuit condition based on material selected (XLPE). (c) Maximum short circuit fault current. (d) Ambient temperature for underground cables, 50 deg. C. (e) De-rating factors as per IS/IEC and manufacturer's standard catalogues. <p>3.1.2 Power cables shall withstand the fault current of the circuit for the duration not less than the maximum time taken by the primary protective system to isolate the fault. Fault clearing times for ties between two 6.6 kV switchgears shall be considered as 1 sec. Fault clearing times for ties between two 415V switchgears shall be considered as 0.5 sec.</p> <p>3.1.3 For the cables to 415 V motors and feeders protected by fuses, the cross section shall be chosen according to the cut-off current of the fuse and its fusing time.</p> <p>3.1.4 Voltage drop from transformer secondary to motor terminals during starting of motors will be limited to the following values:</p> <ul style="list-style-type: none"> (a) For HV motors (except MDBFP motor) – 15% of the rated voltage (b) For MDBFP motors – 20% of the rated voltage (c) For LV motors – 15% of the rated voltage. <p>3.1.5 Voltage drop in feeder cables shall be limited to 3% during full load running condition. Voltage drop from transformer secondary to motor terminals during full load running of motors shall be limited to 5 % of rated voltage.</p> <p>3.1.6 For power supply to valve actuator motors, actuators of various isolating and regulating dampers and exhaust fans, 3 core 2.5 sq. mm stranded copper conductor cable may be used in view of ease of termination. These cables shall be in other respects similar to cables described in Clause 1.2 above.</p> <p>3.1.7 Design Calculation for arriving at cable size shall be submitted for purchaser's approval.</p> <p>3.1.8 DC System Cables:-</p>		
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<p>3.1.8.1 1100 V grade, single core cables as specified in LT power cables shall be used from batteries/ battery chargers to main DCDB, between main Distribution Board, from main Distribution Board to sub distribution board, main DC supply to various system cabinets/panels, Switchgears etc and for critical auxiliaries. Flexible cables with PVC insulation shall be used where termination of XLPE/PVC insulated cables is difficult.</p> <p>3.1.8.2 Voltage drop in cables between battery to DCDB and battery charger to DCDB shall be limited to 2%. Voltage drop in cables between DCDB and loads shall be limited to 3%.</p> <p>3.1.8.3 Design Calculation for arriving at cable size shall be submitted for purchaser's approval.</p> <p>3.2 <u>CONTROL CABLES</u></p> <p>3.2.1 Current transformer leads shall be checked for the lead burden vis-a-vis the current transformer VA capacity. In case 2.5 sq. mm conductor impose unacceptably high burden on CTs, 4.0-sq. mm conductor shall be used. The conductor material shall be copper.</p> <p>3.2.2 Voltage transformer leads shall be checked for voltage drop which shall be limited to within 1% for all cases other than tariff metering. For tariff metering the voltage drop shall be limited to 0.2%. In case the voltage drop with 2.5 sq. mm conductors exceed this value, higher conductor sizes shall be used.</p> <p>3.3 <u>INSTRUMENTATION CABLE</u></p> <p>3.3.1 Element identification : As per IEC-60189-2</p> <p>3.3.2 Core wrapping : By non-hygroscopic material by taping or by extrusion</p> <p>3.3.3 Element screening : By copper tape of minimum 0.04mm thickness or by copper laminated plastic tape</p> <p>3.3.4 Rip cord : Non-metallic rip cord under the core wrapping</p> <p>3.3.5 Drain wire : A tinned copper drain wire of minimum 0.05 mm² cross section in contact with each screen of cabling element.</p> <p>Cabling elements shall be any one of the following:</p> <p>A 'Pair' of two insulated conductors twisted together designated by alphabet 'p' printed on a binding tape at 200 mm intervals.</p> <p>A 'Triple' of three insulated conductors twisted together designated by alphabet 't', printed on a binding tape at 200 mm intervals.</p> <p>Maximum length of lay in the finished cable shall be 120 mm.</p> <p>3.3.6 <u>Units</u></p> <p>Cables shall be bunched together in units of twenty cabling elements or sub units of five or ten elements, stranded in concentric layers. The units or sub</p>		
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SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 6 OF 9
<p>units shall be designated by p1, p2, p3,. t1, t2, t3...,q1, q2, q3, .., or Q1, Q2, Q3 ..., etc. depending on the combination.</p> <p>3.3.7 <u>Overall screening and armouring</u></p> <p>Cables shall have an overall screen made up of copper/aluminium tape of 0.04 mm thickness or copper/aluminium of 0.008 mm thickness laminated with plastic tape with a minimum overlap of 15%.A drain wire of tinned copper with minimum 0.5 mm² cross section shall be provided in continuous contact with the screen.</p> <p>3.3.8 <u>Inner and Outer Sheath</u></p> <p>The inner and outer sheaths shall consist of black PVC compound.</p> <p>3.3.9 <u>Insulation Resistance</u></p> <p>Minimum insulation resistance per km shall be 500 mega Ohm.</p> <p>3.3.10 <u>Mutual Capacitance</u></p> <p>Mutual capacitance of any pair of conductors shall not exceed 120 nF/km.</p> <p>3.3.11 <u>Capacitance Unbalance</u></p> <p>The capacitance unbalance between any two pairs shall not exceed 400 pF for 500 metre length of cable.The construction, performance and testing of cables except as mentioned above shall generally comply with the following standards :</p> <p>IEC-60189 - Part-1 : Low frequency cables and wires with PVC insulation and sheath. General test and measuring methods</p> <p>IEC-60189 - Part-2: (-do- Cables in pairs and triples).</p> <p>4.0 <u>CABLE TERMINATIONS</u></p> <p>4.1 Cables shall be laid in trays /trenches/ conduits by the Bidder. Also joint markers shall be provided at each joint.</p> <p>4.2 All 1100V termination for XLPE/PVC power cables and control cables shall be by Double compression weather proof type cable glands. Heavy duty, tinned, long barrel copper lugs shall be used for termination.</p> <p>5.0 <u>CABLE JOINTS</u></p> <p>Cable joints shall be avoided to the extent possible. If joints are unavoidable due to circuit length, in excess of permissible maximum drum length, they shall be heat shrinkable types having a short circuit with stand capacity value as specified in clause 3.1.2 above. Lugs shall be heavy duty, tinned copper, long barrel type. All cable glands shall be double compression, weather proof.</p> <p>6.0 <u>POWER RECEPTACLES</u></p>		
		ISSUE R1

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 7 OF 9
<p>3 phase, 5 pin, 63A power receptacles with switch shall be provided . The receptacle shall be industrial heavy duty type and shall have suitable interlock facility for safety. The receptacle shall conform to IS 1293 and the switch to IS 4064.</p> <p>7.0 <u>CABLE CARRIER SYSTEM</u></p> <p>7.1 The cable carrier system shall be designed considering the following :</p> <ul style="list-style-type: none"> (a) Facility for easy laying of cables. (b) Access to maintenance. (c) Neat and aesthetic appearance. (d) Safety of equipment & personnel. (e) Ground water seepage. (f) Drainage system for oil and water. <p>7.2 Cables shall be laid in prefabricated ladder (for power and control) / perforated (instrumentation) type trays and in conduits. Also joint markers shall be provided at each joint. The cable trays shall be laid vertical in boiler and ESP area, coal handling and ash handling area.</p> <p>7.3 Cable trays and supporting structures in chemically corrosive area like battery room and water treatment plant shall be mild steel painted trays finished with chlorinated rubber based paint/epoxy paint.</p> <p>7.4 Cable trenches will be avoided to the extent possible inside Fuel oil pump house, water treatment plan where possibility of oil and water collection exists and Boiler & ESP areas.</p> <p>7.5 No direct underground burial cables shall be laid except lighting tower, street lighting. For some exceptional case like isolated individual equipments it shall be allowed after approval by the owner /consultant.</p> <p>8.0 <u>CABLE INSTALLATION AND ACCESSORIES</u></p> <p>8.1 All material and accessories required for cable installation like cable trays, tray covers, support steel, etc., shall be hot dip galvanized. Conduits/pipes shall also be hot dip galvanized steel. The racks/trays, conduits/pipes, trenches required to route the cables to individual equipment shall be supplied and installed by the BIDDER.</p> <p>8.2 Separate trays shall be provided for LV Power (AC&DC)/Control & Instrumentation cables.</p> <p>8.3 After laying all the cables, BIDDER shall dress all cables by clamping at every metre, so that the cables are securely held and aesthetically good.</p> <p>8.4 Cable trays shall be avoided very close to the pipes carrying high temperature steam. When they are inevitable, it shall be laid after OWNER approval and</p>		
		ISSUE R1

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 8 OF 9
<p>suitable insulation material shall be provided between the cable trays and pipes.</p> <p>8.5 1100 V cables up to 120-sq. mm. can be laid in two layers. Control and Instrumentation cables can be laid in three layers.</p> <p>8.6 One spare conduit shall be provided for cable of center / outer drive in clarifier.</p> <p>8.7 Power and control cables for critical / emergency drives / equipment like DC EOP / JOP shall be kept away and routed in separate cable trays</p> <p>8.8 All cable entries to the buildings to be sealed by fire proof & water proof cement after cable installation.</p> <p>8.9 One drum (500m) spare LT power/control of each size of cable shall be included.</p> <p>9.0 CABLE TRAYS AND COVERS</p> <p>9.1 All outdoor cable trays are to be provided with covers. All vertical cable tray race ways are to be provided with covers all round. Cable trays shall be of ladder / perforated type complete with all necessary coupler plates, elbows, tees, bends, reducers, stiffeners and other accessories. Cable trays of ladder and perforated types and the associated accessories such as coupler plates, tees, elbows, etc., shall be fabricated from 12 gauge (2.5 mm thick) mild steel sheets. Cable tray covers shall be provided for all cable trays and raceways. The cable tray accessories like trays, elbows, bends, etc., shall be fabricated and galvanized before bringing to site. Cable tray covers shall be fabricated from 16 gauge (1.7 mm thick) MS sheets. All the sheet steel shall be hot dip galvanized.</p> <p>9.2 1100 V rated cables of sizes 120-sq. mm and above shall be laid in single layer. Single core cables used for 3-phase AC power circuits shall be laid in Trefoil form with suitable PVC aluminum clamps to hold the cables.</p> <p>9.3 The sizing of cable trays from TG building to other areas shall consider para 9.2 above an additionally to avoid crowding and criss crossing of cables, especially in boiler area where vertical risers are to be provided for various power, control and instrumentation cables to higher elevations of boiler.</p> <p>9.4 Slotted angles shall not be used for cabling. In all locations smaller size cable trays of 50 mm / 100 mm wide shall be used for one or two cables.</p> <p>10.0 FIRE-PROOF SEALING OF CABLE PENETRATION</p> <p>Cables / cable tray openings in walls and floors or through pipe sleeves from one area to another or one elevation to another, between the units and within the same unit, shall be sealed by a fire-proof sealing system. The fireproof sealing system (FPSS) shall effectively prevent the spread of fire from the flaming to the non-flaming side, in the event of a fire. The FPSS shall conform to the following requirements:</p>		
		ISSUE R1

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 9 OF 9
<p>(a) FPSS shall have a fire rating of two hours.</p> <p>(b) The FPSS shall be subjected to fire endurance test, hose stream test, temperature measurement of non-flaming side as per ASTM-E119. 'Standard method of fire tests of building construction and materials'.</p> <p>(c) The FPSS will also conform to the in-combustibility test carried out in accordance with IS: 3144-1992.</p> <p>(d) Under fire condition, the FPSS material shall not emit excessive smoke or any corrosive or toxic fumes.</p> <p>(e) FPSS shall have minimum life of 25 years.</p> <p>11.0 FIRE BREAK</p> <p>11.1 Fire break shall be provided by applying a suitable fire-resistant coating on cables for the required length to meet the fire rating of 30 minutes.</p> <p>11.2 Fire break shall be provided at an interval of 15 metres in the straight portion of each of the cable tray above ground, at intervals of 30 metres in cable trenches and at 5M for all vertical trays. All cable inter section and tee offs shall be provided with firebreaks.</p> <p>11.3 When pipe sleeves are provided for cables from outdoor areas to indoor areas, the pipe opening at the outdoor side shall be sealed by fire proof sealing material, which is also continuously waterproof. The indoor side of the pipe opening shall also be sealed by continuous fire proof sealing materials. The duct banks in outdoor areas also need to be sealed by water proof seals. It is necessary to explore possibility of applying waterproof coating on fireproof sealing.</p> <p>12.0 TESTS</p> <p>All routine tests and FRLS tests as per relevant standard shall be performed on each size of cable. If same size is supplied in different lots, inspection shall be done for each lot. If same cable is supplied by different agencies, test shall be carried out on cables supplied by each agency. These tests shall be carried out as per relevant standards as applicable.</p> <p>Routine and acceptance test shall be carried out on FPSS.</p> <p>Type test certificates for type tests conducted on identical design and size of the Cables shall be submitted for review. If type tests have not been done or the certificates are found to be not in order by purchaser then these type tests shall be conducted on Cables to be supplied for this project at no extra cost to Purchaser.</p> <p>13.0 For technical particulars refer datasheet-A.</p>		
		ISSUE R1

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan DATA SHEET-A CABLE & CABLE CARRIER SYSTEM		SHEET 1 OF 2

Sr. No.	Description	unit	Client specification
1.0	Name of manufacturer		*
2.0	Make of cable		
3.0	Conductor No. core x Size Form- circular/segmented Effective cross sectional area sq. mm		*
4.0	Whether cores identification numbers for cables with 5 cores and above to be provided		Yes
5.0	Whether incremental running lengths are marked on cable		Yes
6.0	Finished cable a) Diameter under armour in mm b) Diameter over armour in mm c) Overall diameter in mm		*
7.0	Cable drums a) Whether cable drums confirm to IS : 10417 b) Length of cables in drum & tolerance c) Weight of cable drum without cables d) Weight of cable drum with cables e) Type of end sealing		*
8.0	FRLS cables a) Critical oxygen index value at 250 deg C when tested for temperature index test as per ASTM-		Ref. Clause 2.3


REV. NO.	R0	R1	JOB NO. TCE - 5750A	CLIENT : RRVUNL PROJECT : 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan
PPD. BY :	UM	SK		
CKD. BY :	MSVM	MSVM		
DATE	NOV'2009	JUN'2012		

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan DATA SHEET-A CABLE & CABLE CARRIER SYSTEM	SHEET 2 OF 2


Sr. No.	Description	unit	Client specification
	<p>D-2863</p> <p>b) Total acid gas generation by weight when tested as per IEC – 754-1 in %</p> <p>c) Percentage of light transmission under fire for assessment of smoke generation when tested as per ASTM – D – 2843-77</p> <p>d) Will the cables offered against this specification pass the flammability tests as per</p> <p>1) Class – F3 – Swedish standard S5-424- 1475</p> <p>2) IEC 60332 – 1C</p> <p>3) IEC 60331 – 1</p>		
9.0	Maximum dielectric loss of cable per KM at normal voltage and frequency	Watt/km	*
10.0	Short circuit capability for 1 Sec (HT & LT Power Cable)	kA rms	Minimum 40kA and 50 kA for HT and LT respectively and shall be in line with requirements of the switchgear and protection.
11.0	Maximum dielectric stress at core screen	KV/cm	*
12.0	Max. overall diameter of cables	mm	*


‘*’ indicated above shall be filled by BIDDER.


REV. NO.	R0	R1	JOB NO.	CLIENT : RRVUNL
PPD. BY :	UM	SK	TCE -	
CKD. BY :	MSVM	MSVM	5750A	
DATE	NOV'2009	JUN'2012		PROJECT : 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan


	TITLE : TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM 2X660 MW SURATGARH STPS STAGE V UNIT # 7& 8		SPEC. NO. PE-TS-392-154A-A001	
			VOLUME II-B	
			SECTION : D2	
			REV. NO. 00	DATE:
			SHEET	


QUALITY PLAN FOR MOTORS


		QUALITY PLAN		CUSTOMER : RRVUNL		PROJECT TITLE		2X660 MW SURATGARH STPS STAGE		SPECIFICATION : PE-TS-392-154A-A001	
COMPONENT/OPERATION		SHEET 2 OF 9		BIDDER/ VENDOR		QUALITY PLAN		NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION :	
SL. NO.	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION		VOLUME III	
								AGENCY		REMARKS	
								P	W	V	
1	2	3	4	5	6	7	8	9	10		11
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUF'R'S DRG.	LOG BOOK	3	-	2
		4. INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUF'R'S SPEC. BHEL SPEC.	-DO-	3	2	1 FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUF'R'S DRG. SPEC.	MANUF'R'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	MANUF'R'S DRG. / SPEC.	MANUF'R'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		CUSTOMER : RRVUNL		PROJECT TITLE		2X660 MW SURATGARH STPS STAGE		SPECIFICATION : PE-TS-392-154A-A001	
BIDDER/ VENDOR		SYSTEM : LP CHEMICAL DOSING SYSTEM		BIDDER/ VENDOR		QUALITY PLAN		NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION :	
SHEET 3 OF 9		CAT.		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORM	
COMPONENT/OPERATION		CHARACTERISTIC CHECK		METHOD OF CHECK		EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORM	
1		3		4		5		6		7	
2		3		4		5		6		7	
1.7		1. SURFACE COND. ETC.		MA		VISUAL		100%		-	
1.8		2. OTHER CHARACTERISTICS		MA		TEST		SAMPLE		MANUF'S SPEC.	
1.9		1. SURFACE COND.		MA		VISUAL		100%		-	
1.9		2. DIMENSIONS INCLUDING BURS HEIGHT		MA		MEASUREMENT		SAMPLE		MANUF'S DRG.	
1.9		3. ACCEPTANCE TESTS		MA		ELECT. & MECH TESTS		-DO-		MANUF'S SPEC./ RELEVANT IS	
1.9		1. SURFACE FINISH		MA		VISUAL		100%		-	
1.9		2. ELECT. PROP. & MECH. PROP		MA		ELECT. & MECH. TEST		SAMPLES		RELEVANT IS/ BS OR OTHER STANDARDS	
BHEL		PARTICULARS		BIDDER/VENDOR		BIDDER/VENDOR		BIDDER/VENDOR		BIDDER/VENDOR	
NAME		NAME		NAME		NAME		NAME		NAME	
SIGNATURE		SIGNATURE		SIGNATURE		SIGNATURE		SIGNATURE		SIGNATURE	
DATE		DATE		DATE		DATE		DATE		DATE	
BIDDER'S/VENDORS COMPANY SEAL		BIDDER'S/VENDORS COMPANY SEAL		BIDDER'S/VENDORS COMPANY SEAL		BIDDER'S/VENDORS COMPANY SEAL		BIDDER'S/VENDORS COMPANY SEAL		BIDDER'S/VENDORS COMPANY SEAL	


<div></div>		CUSTOMER : RRVUNL		PROJECT TITLE		2X660 MW SURATGARH STPS STAGE		SPECIFICATION : PE-TS-392-154A-A001									
		BIDDER/ VENDOR :		QUALITY PLAN		NUMBER PED-506-00-Q-007, REV-03		TITLE									
		SYSTEM : LP CHEMICAL DOSING SYSTEM		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD									
SHEET 4 OF 9		CAT.		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		7		8		9		10		11	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	3	4	5	6	7	8	9	10	11						
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	MANFR'S DRG./ APPROVED DATASHEET	-DO-	Log Book	3	-	2						
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	-DO-	-DO-	3	-	2						
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	-DO-	-DO-	3	-	2						
		3.SURFACE FINISH	MA	VISUAL	100%	-	-DO-	-DO-	3	-	2						
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-						
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-						
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2						
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2						
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG/SPECS.	-DO-	3	-	-						
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-						
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-						
BHEL			PARTICULARS		BIDDER/VENDOR												
			NAME														
			SIGNATURE														
			DATE														
			BIDDER'S/VENDORS COMPANY SEAL														

		QUALITY PLAN		CUSTOMER : RRVUNL		PROJECT TITLE		2X660 MW SURATGARH STPS STAGE		SPECIFICATION : PE-TS-392-154A-A001	
				BIDDER/ VENDOR :		QUALITY PLAN		NUMBER :			
COMPONENT/OPERATION		SHEET 5 OF 9		SYSTEM : LP CHEMICAL DOSING SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		TITLE		SPECIFICATION :	
SL. NO.	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	SECTION	VOLUME III	REMARKS
								P	W	V	
1	2	3	4	5	6	7	8	9	10	11	
2.0	IN PROCESS										
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	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/SVENDORS COMPANY SEAL					

<div></div>		QUALITY PLAN		CUSTOMER : RRVUNL		PROJECT TITLE		2X660 MW SURATGARH STPS STAGE		SPECIFICATION : NUMBER :			
COMPONENT/OPERATION		CHARACTERISTIC CHECK		BIDDER/ VENDOR		QUALITY PLAN		SPECIFICATION :		TITLE			
				SYSTEM: LP CHEMICAL DOSING SYSTEM		NUMBER PED-506-00-Q-007, REV-03		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION			
SL. NO.			CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	P	W	V	VOLUME III REMARKS
1	2	3	4	5	6	7	8	9	10				11
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	1	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	-	
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	1	
2.6	IMPREGNATION	4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	1	FOR MV MOTOR
		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	1	
		1.VISCOSITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	-	
		2.TEMP. PRESSURE VACCUUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	1	THREE DIPS TO BE GIVEN
BHEL		PARTICULARS		BIDDER/VENDOR									
		NAME											
		SIGNATURE											
		DATE											
						BIDDER'S/VENDORS COMPANY SEAL							

<div></div>		CUSTOMER : RRVUNL		PROJECT TITLE		2X660 MW SURATGARH STPS STAGE		SPECIFICATION : PE-TS-392-154A-A001				
		BIDDER/ VENDOR :		QUALITY PLAN		NUMBER PED-506-00-Q-007, REV-03		SECTION VOLUME III				
		SYSTEM : LP CHEMICAL DOSING SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)								
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS		
									P	W	V	
1	2	3	4	5	6	7	8	9	1011			
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC. 2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC. 3.VIBRATION & NOISE LEVEL 4.OVERALL DIMENSIONS AND ORIENTATION 5.DEGREE OF PROTECTION 6. MEASUREMENT OF RESISTANCE OF RTD & BTD 7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER 8. NAMEPLATE DETAILS 9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED) 10. PAINT SHADE, THICKNESS & FINISH	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1
			MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
			MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1\$	1	\$ NOTE - 2
			MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
			MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
			MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
			MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2
			MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1\$	1	\$ NOTE - 2
			MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
			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										

<div></div>		QUALITY PLAN		CUSTOMER : RRVUNL		PROJECT : 2X660 MW SURATGARH STPS STAGE V		SPECIFICATION : PE-TS-392-154A-			
COMPONENT/OPERATION		CHARACTERISTICS CHECK		SHEET 1 OF 2		BIDDER/ VENDOR		SPECIFICATION			
						TITLE		NUMBER :			
SL. NO.	2	3	4	5	6	7	8	9	10	11	
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	
		3.CORRECTNESS COMPLETENESS/ TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUF'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									

		QUALITY PLAN		CUSTOMER : RRVUNL		PROJECT : 2X660 MW SURATGARH STPS STAGE V		SPECIFICATION : PE-TS-392-154A-A001		
				BIDDER/ :		TITLE		NUMBER :		
				VENDOR		QUALITY PLAN		SPECIFICATION :		
				SYSTEM: LP CHEMICAL DOSING SYSTEM		NUMBER PED-506-00-Q-006, REV-01		TITLE :		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	VOLUME III REMARKS
1	2	3	4	5	6	7	8	9	10	11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2 1 -	
NOTES:										
1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON 2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. 3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.										
<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: TECHNICAL SPECIFICATION FOR
LP CHEMICAL DOSING SYSTEM
2X660 MW SURATGARH STPS STAGE V
UNIT # 7& 8

SPEC. NO. **PE-TS-392-154A-A001**

VOLUME **II-B**

SECTION : **D3**

REV. NO. 0 DATE:

SHEET :

SECTION – D3

GENERAL TECHNICAL REQUIREMENT CONTROL & INSTRUMENTATION



TITLE: TECHNICAL SPECIFICATION FOR
LP CHEMICAL DOSING SYSTEM
2X660 MW SURATGARH STPS STAGE V
UNIT # 7& 8

SPEC. NO. **PE-TS-392-154A-A001**

VOLUME **II-B**

SECTION : **D3**

REV. NO. 0 DATE:

SHEET :

SPECIFICATION OF INSTRUMENTS

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION : D5.4
Package: EPC	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT SPECIFICATION FOR INSTRUMENTATION & CONTROL EQUIPMENT	SHEET 1 OF 42
<p>1.0 SPECIFICATIONS FOR INSTRUMENTS TO BE SUPPLIED ARE AS FOLLOWS.</p> <p>1.1 Pressure Indicators/DP indicators</p> <p>Direct reading, pipe mounted Pressure gauges of die-cast aluminium body, with 6 inch(150mm) phenolic dial (white dial with black numerals), 316 SS/304 SS Bourdon tube for high pressure application and 316SS Diaphragm/bellow for low pressure applications, AISI 304 movements and micrometer type adjustable aluminium pointer an accuracy of +/-1.0% of span including accessories like siphons for steam services, snubbers for pump discharge applications and chemical diaphragm for corrosive and oil services and name plate, etc. Material of accessories shall be SS. IP65 or equivalent degree of protection for enclosure. Over range protection shall be 50% above maximum pressure. Armoured capillary of 10 M shall be provided as required. Process connection shall be 1/2"NPT (F).</p> <p>1.2 Pressure Switches/DP Switches</p> <p>Non indicating type, field mounted Pressure Switches of aluminium casing (epoxy coated), and 316 SS element and repeatability of +/-1% of span, including accessories like siphons for steam services, snubbers for pump discharge applications and chemical diaphragm for corrosive and oil services, name plate & mounting brackets. Material of accessories shall be SS. Auto reset micro switch with internal adjustment for set values with 2 SPDT contacts rated for 0.2 A at 220 V DC. IP 65 or equivalent degree of protection for enclosure. Over range protection 50% above maximum pressure. Scale for setting shall be provided. Piston actuated for high pressure applications and diaphragm/bellows for low pressure/vacuum. Process connection 1/2" NPT (F).</p> <p>1.3 Pressure Transmitters/DP Transmitters/Flow transmitters(DP type/Level transmitters/DP type (SMART))</p> <p>Micro-processor based 2 wire indicating type (LCD display), rack mounted with accuracy of +/-0.075% of span, external zero and span adjustment, self diagnostics, temperature sensor for compensation. Power supply 24 V DC; output signal of 4-20 mA DC. IP 65 or equivalent degree of protection. Aluminum housing with epoxy coating, Accessories like snubbers for pump discharge applications and chemical diaphragm. 10 m PVC covered SS armoured capillary for corrosive and oil services, three way manifold, nameplate etc. Material for accessories shall be SS. Turn down ration 30:1. Load impedance 700 ohm (min).Process connection-1/2"NPT (F). 2 valve manifold for absolute pressure, 3 valve manifold for gauge/vacuum and 5 valve manifold for DP/level/flow measurements. For HFO, LFO applications, SS capillary with ANSI RF flanged ends shall be provided.</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION : D5.4
Package: EPC	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT SPECIFICATION FOR INSTRUMENTATION & CONTROL EQUIPMENT	SHEET 3 OF 42
<p>than 5M ohms. Repeatability over full range shall be better than 0.02%. RTDs shall be ungrounded. RTD shall be supplied as an assembly complete with thermo wells meeting ANSI 19.3 (latest) requirements.</p> <p>1.8 Level Gauges</p> <p>Tubular type level gauges for low pressure upto 7 kg /sq.cm & reflex type for high pressure water & steam services & vacuum services with automatic ball check valves, illuminator (240 AC), pyrex/ tempered toughened borosilicate glass, mica shield, brass guard rods & brass holders. Body material: Forged carbon steel/304SS. Accuracy- +/- 2% with vertical scale.4 Material of accessories (name plate, etc.) shall be SS. Tubular glass OD shall be 5/8". Vent & drain valves shall be provided. Connection shall be screwed or flanged (ANSI class 150 RF).</p> <p>1.9 Level Switches</p> <p>External cage magnetic float operated level switches for tanks and vessels and top mounted level switches for sumps and underground tanks. The top mounted level switches shall be supplied with still tubes to suit the requirement. Micro switch with 2 SPDT contacts rated for 0.2 A, 220 V DC. Material of float & float chord shall be 316 SS & cage material shall be fabricated steel and the material of accessories shall be SS. IP65 or equivalent degree of protection for enclosure.</p> <p>Accessories like name plate, drain valve for external case type level switches, mating flange, gaskets (asbestos), fasteners, bolts & nuts, etc. shall be supplied.</p> <p>Conductivity type electronic Probe type level switches shall be supplied for Drain pots. The required pressure vessel assembly for mounting probes are included in the scope.</p> <p>1.10 Level Transmitter</p> <p>Ultrasonic type level transmitters top mounted with integral local LCD indicator, IP-65 protection; 2 wire type transmitter with 4-20mA output with HART protocol; Accuracy $\pm 0.25\%$; Resolution 1mm; Repeatability $\pm 0.1\%$; Linearity $\pm 1\%$; Response time 150ms; Beam angle $< 12^\circ$; Auto false echo-suppression; Accessories like integral cable between sensor and transmitter unit with connectors on both side, gasket and cable gland, digital panel meter, name plate & metal tag; the material of accessories will be SS.</p> <p>Radar type level transmitters top mounted with LCD indicator, IP-65 protection; 2 wire type transmitter with 4-20mA output with HART protocol; Accuracy $\pm 1\%$; Resolution 1mm; Repeatability ± 1 mm; Linearity $\pm 0.01\%$; Beam angle $< 20^\circ$; Accessories like integral cable between sensor and transmitter unit with connectors on both side, gasket and cable gland, digital panel meter, name plate & metal tag; the material of accessories will be SS.</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION : D5.4
Package: EPC	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT SPECIFICATION FOR INSTRUMENTATION & CONTROL EQUIPMENT	SHEET 7 OF 42
<p>coloured LCD or fluorescent tube with user selectable span; programmability (selection of input & scan/storage rate) shall be through Front panel keyboard; the recorder shall have the capability of being drawn out from the front side of the housing for maintenance and shall have electrical connection of plug-in type; material of casing shall be die-cast aluminium with epoxy coating and with a non-glare shatter proof Glass; enclosure shall be IP32 The quantity of Hybrid recorders shall be 4 nos.</p> <p>1.21 Pressure and Differential Pressure Transmitter Racks</p> <p>Open type transmitter racks to mount all pressure, differential pressure and flow transmitters with vibration dampener: air supply lines and header shall be provided with bulk head fittings to receive impulse lines; Also provided with blow down/drain header. The material of accessories shall be SS. Drains shall be connected upto suitable Owner / Project Manager's drain header. The quantity shall be as required for the specified Pressure and Diff. Pressure transmitter.</p> <p>1.22 Junction Boxes (JB)</p> <p>All JB's shall be Galvanised. Wall/column mounted junction boxes having 32 (2x16) terminals and cable entry only at the bottom and sealed with fireproof compound; Screwed terminal type; IP 65 or equivalent degree of protection for enclosure. Separate terminal blocks shall be used for analog and digital signal and also for signals with different voltages. Removable gland plate shall be supplied. JB shall have single lockable door with gasket, able to open side ways, with common keys. Painting inside shall be glossy white & outside - IS-5 shade 631. Shield bus for screw connection shall be provided. Terminal size shall be suitable for 0.5 sq.mm to 2.5 sq.mm wire. Terminal blocks shall be vertical. JB shall have provision to add 10% additional terminals. Accessories like metal tag (SS), clamps, fixtures, bolts (SS), nuts (SS), gaskets (neoprene), lock & key, fireproof compound for sealing, etc. shall be supplied. The grouping of instruments in JB's is subject to Owner / Project Manager's approval. All the field Junction boxes shall have single doors and provision for locking. The doors shall not have screwed type of locking, but turnable hinge based. The JB's are subject to approval prior to manufacturing All JB's shall be provided with individual canopies to avoid ingress of water. All the TB's used shall be 6.6polymide to withstand corrosion and the metallic portion shall be coated against rust / corrosion.</p> <p>1.23 Programmable Logic controller (PLC)-Refer Cl.no. 9.0 & Table-15</p> <p>1.24 Interposing Relays (IPR)</p> <p>Electro magnetic type IPRs with plug-in type connections, suitable for channel/rail mounting in cabinets; coil rating 24V D.C; 2 set of silver plated Change over contacts rated for 0.2A 220 V DC. Freewheeling diode across relay coil (copper) and self reset type status indicator flag (electronic) shall be provided. All relays</p>		
		ISSUE R1

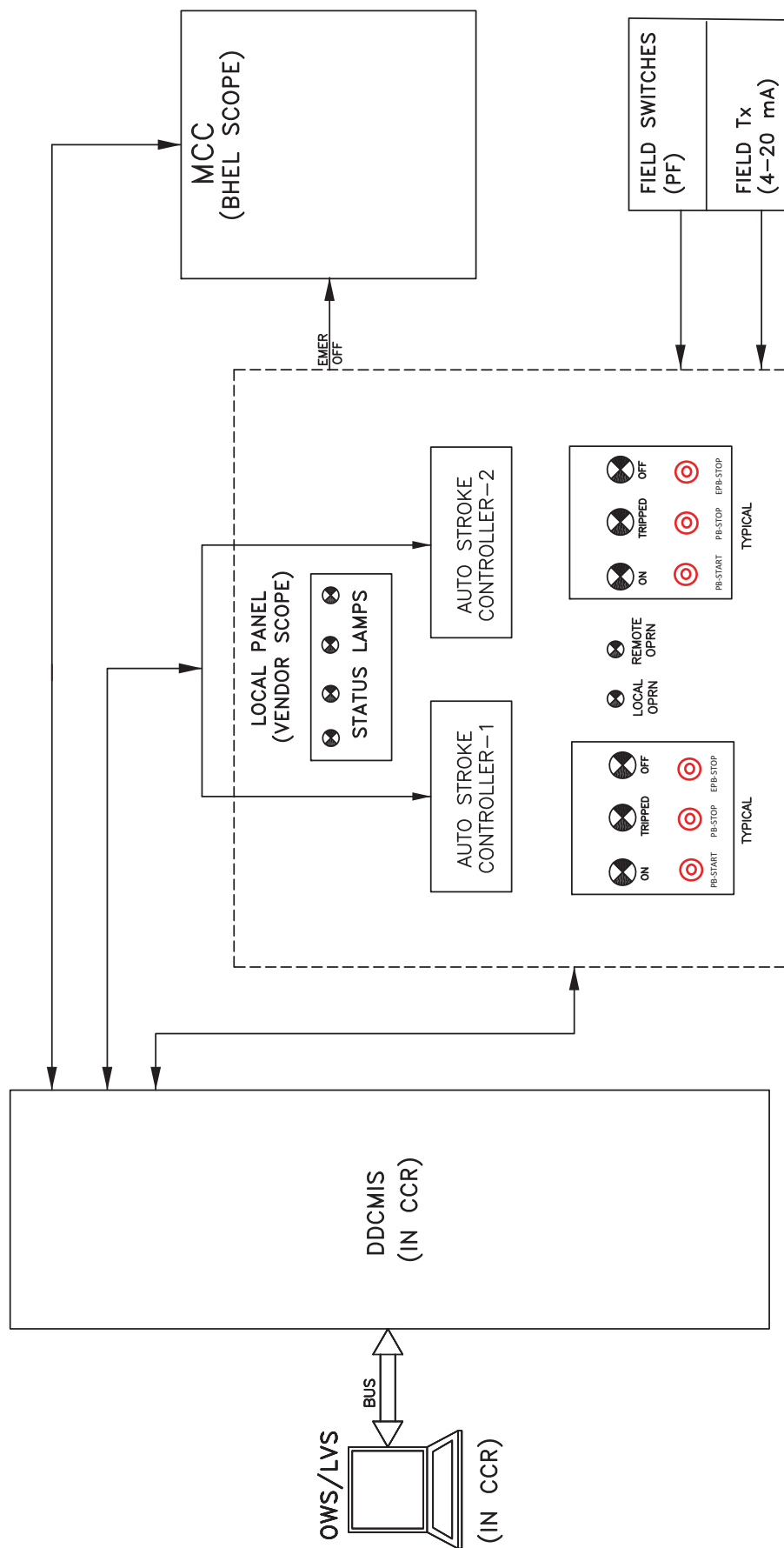
SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION : D5.4
Package: EPC	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT SPECIFICATION FOR INSTRUMENTATION & CONTROL EQUIPMENT	SHEET 9 OF 42
<p>hinged at one end to facilitate easy isolation shall be provided wherever necessary. All cabinets shall be provided with spare terminals for the spare inputs/outputs as specified else where in the specification.. The type of terminals for terminations from cabinets/panels shall match with the pre fabricated cables and pins supplied. The terminals for field cables shall be arranged in a logical order of equipment/system wise and shall be worked out by Bidder, subject to approval by Owner / Project Manager/ Consultant. Door shall have concealed type hinges and swing of 180 Degree & lockable. The doors shall be provided both on the front and rear. Channels, bolts & nuts shall be zinc plated and passivated. Two coats of premier paint and black colour paint shall be applied. Fluorescent lamp of 40W shall be provided and shall be operated by the door switches as well as by manual switches. The marshalling cabinets, the terminal blocks, the terminals and the electronic hardware if any, shall have identification numbers. Each cabinet shall be provided with one each 3 pin receptacles for 240 V AC, 1Ph, 50 c/s and receptacles for +24V DC. A system cabinet and associated cabinets shall be supplied on a skid to avoid outside interconnecting cables. Cabinet shall be delivered totally wired. Preparation of interconnection schedule (ICS) between marshalling cabinets & JBs/FTCs and JBs to Instruments is in Bidder scope. The format of Interconnection Cable Schedule (ICS) shall be submitted by the Bidder during detailed engineering stage for approval by Owner / Project Manager.</p> <p>All cabinets shall have common key for the locks.</p> <p>All the terminals shall have no screws and the cables shall be gripped by spring. Each terminal shall have LED indication with fuses to indicate and isolate earth faults.</p> <p>1.27 Local Panels</p> <p>1.27.1 Indoor/Outdoor located, free standing vertical type local panels with 2 mm thick sheet material of cold rolled steel; ant vibration pads of 15 mm thick; fluorescent lighting; Double doors with neoprene gaskets at every 1.5 m; blower & louvers in each section with brass mesh; fire proof compound (50 mm thick) for sealing cable entry (bottom); fire detector for each section; space heater with thermostatic control for each section (strip type). IP-52 degree of protection for enclosure for outdoor and IP-32 for indoor. Removable cover plates with locking facility shall be provided along the bottom of the front desk continuously to facilitate maintenance work. The length of each cover plate shall not exceed 1 m. Fluorescent lamp of 40 W shall be provided from one end of the panel to the other end at continuous length and shall be operated by the door switches as well as by manual switches. Nameplates shall be provided for all instruments/inserts with Tag. No. & short description of service engraved. These shall be phenolic overlays (1.6 mm thick), black background with white lettering & shall be fixed to the panel by stainless steel screws (counter sunk). Each section of the panels shall be provided with one each 3 pin receptacles for 240V AC, 1P, 50 c/s &. Panel shall be delivered totally wired. All instruments, inserts and annunciation windows shall be mounted & wiring connections at these hardware shall be terminated at site by Bidder.</p>		
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SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION : D5.4
Package: EPC	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT SPECIFICATION FOR INSTRUMENTATION & CONTROL EQUIPMENT	SHEET 10 OF 42
<p>1.27.2 All the Terminal Blocks shall be rust proof and corrosive resistant for outdoor mounted panels. Terminal Blocks housing material shall be 6.6 polyamide and metallic portion shall be coated against rust/corrosion.</p> <p>1.27.3 In each Local Panel, a 24 V DC Voltmeter shall be provided to check the Field Interrogation voltage.</p> <p>1.28 Vibration Monitoring And Analysis System</p> <p>Refer TABLE-13.</p> <p>1.29 230 V AC Distribution Board</p> <p>The function of the 230V AC distribution is sub distribution of 230V AC power supply from UPS to all the utilities viz., system cabinets, HMI and peripherals. Redundant feeders shall be provided for each utility. The cabinets shall be free standing vertical cabinets, designed for indoor location. Material of construction shall be 2mm thick CRCA. Fluorescent lighting, fire detector and space heater shall be provided for each cabinet. Isolating switches and HRC cartridge fuses shall be provided for individual feeder isolation. Ammeter and voltmeter shall be provided for incoming feeders to the distribution boards.</p> <p>Each terminal shall have LED indication with fuses to indicate and isolate earth faults.</p> <p>1.30 Control Valves</p> <p>1.30.1 Multistage, anti-cavitation, balanced, modulating, globe type, cage guided, single ported, diaphragm type of actuator with hand wheel, SMART positioner, air filter regulator, air lock device, solenoid valve as applicable, limit switches and position transmitters completely tubed with junction box. Smart positioner shall be suitable for accepting 4-20mADC signal. Pneumatic (PVC coated copper) tubing complete with accessories, fittings, If any up-gradation of the offered system is envisaged before completion of the job to meet the specified requirements, the same shall be incorporated in the system, with the approval of the OWNER without any additional cost. Positioner shall be provided with input/output/bypass gauges. Local position indicator & Non-contact type position transmitter with 2 wire, 4-20mA DC output. All limit switches/position transmitters, E/P converter signals etc., shall be wired out to external block of actuator and respective junction boxes.</p> <p>1.30.2 Control valves shall be sized to have an opening of 15% at minimum flow condition and 85% at maximum flow condition. Noise level shall not exceed 85 dB at a distance of about 1.5 M from the valve. In case of predicted noise level above 85dBA, suitable low noise trim shall be provided. Noise reduction shall be achieved through an inherent Trim design and not through external means.</p>		
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SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION : D5.4
Package: EPC	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT SPECIFICATION FOR INSTRUMENTATION & CONTROL EQUIPMENT	SHEET 11 OF 42
<p>1.30.3 All control valves shall have a leakage class of V and tight shut off application class VI shall be provided.</p> <p>1.30.4 Either extended type bonnet or cooling fin type bonnet shall be provided for service above 200 Degree C and for other service the bonnet type shall be standard.</p> <p>1.30.5 The end connections shall be socket welded for sizes below 50 NB and butt welded for sizes 50 NB and above. Flanged connection shall be provided for DM water services, with suitable rubber lined interfaces.</p> <p>1.30.6 Water seal shall be provided for valves that could be subjected to below atmospheric conditions.</p> <p>1.30.7 Generally stem and guide material(trim) shall be SS 316 stellited, and plug and seat material shall be 17-4 PH SS, except for specific applications like DM water, HP bypass services. Refer to mechanical section of this specification for selection of control valve body material and actuator type.. The trims supplied shall be suitable for quick changing. Actuator housing shall be of pressed steel construction.</p> <p>1.30.8 Trim shall be designed such that trim exit velocity shall be limited to avoid cavitation.</p> <p>1.30.9 The action of valves on failure of operating media shall be determined by the process requirements with regard to safe operation and emergency shut down requirements.</p> <p>1.30.10 Control valve sizing shall be accompanied with data sheets. Following size calculation details shall be furnished for Control valves:</p> <p>1.31 Pneumatic block valves</p> <p>Balanced, on off, plug type, single ported, gate valve. End connection socket welded for sizes 50 NB and below & butt welded for sizes above 50 NB and flow direction shall be horizontal.</p> <p>For body and bonnet material refer mechanical section of this specification.</p> <p>Packing material GRAFOIL.</p> <p>Trim : Cage guided, metal seated with flow characteristic of quick opening with stem, plug, seat and guide material of SS 316.</p> <p>Actuator : Diaphragm (Nitrile) type with handwheel & travel indicator and adjustable stop. It shall be sized for shut off differential pressure.</p> <p>Accessories like air filter regulator, solenoid valve, limit switch with Nema4 enclosure, etc. shall be supplied. Actuators & accessories requiring tubing shall be mounted and tubed.</p>		
		ISSUE R1


SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION : D5.4
Package: EPC	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT SPECIFICATION FOR INSTRUMENTATION & CONTROL EQUIPMENT	SHEET 12 OF 42
<p>1.32 Control Damper Drives</p> <p>Pneumatic actuator type, located in flue gas/air area with damper shaft bearings mounted externally. Bearings are grease lubricated. Blades(SS) shall be linked together. Accessories like position transmitters (2 wire) with 4-20mA DC output, Local Position indicator, position locks, limit/torque switches, etc. shall be supplied, after integrating, calibrating & testing at works. Smart Positioners with all required accessories, required for the positioning of control damper drives shall be provided. Spare cams for accommodating any change in characteristic to achieve better process control during commissioning shall be supplied as required.</p> <p>All the field mounted Damper accessories (position indicator, limit switches etc.) shall comply to IP 65.</p> <p>1.33 SMART Positioners of Control Valves.</p> <p>1.33.1 Positioner shall be microprocessor based with digital communication by means of HART protocol. Positioner has to be 2-wire, 4-20 mA loop powered by the control system and capable of split ranging operation.</p> <p>1.33.2 The SMART positioner shall be suitable for both single acting and double acting actuators. The SMART positioner shall be fully modular in construction with Encapsulated printed wiring board and pressure gauges inside the positioner cover to protect from transit/site damage.</p> <p>1.33.3 SMART positioner shall preferably be of the same make as the Control Valve, to ensure repeatability in Calibration, serviceability and proper maintenance of the Control System.</p> <p>1.33.4 The SMART positioner shall have pressure sensors to measure the pneumatic outputs to the actuator.</p> <p>1.33.5 The control algorithm for the positioner shall use feedback signal from the motion of the pneumatic relay beam instead of pressure feedback to minimize pneumatic related effects and for stable and smooth response of the control valve. The SMART positioner shall have user adjustable tuning sets to identify the optimum tuning for the total valve assembly. SMART Positioner with HART Communication facility shall communicate all the valve diagnostics to DCS.</p> <p>1.33.6 The electrical housing shall be designed to meet NEMA 4X, IEC 60529 IP66.</p> <p>1.34 Void</p> <p>1.35 Void</p> <p>1.36 Void</p>		
		ISSUE R1

STANDARD BLOCK INTERFACE DIAGRAM FOR LP DOSING SYSTEM (TYPICAL)



NOTES:

1. SIGNAL EXCHANGE BETWEEN DDCMS & LP DOSING LOCAL PANEL SHALL BE AS PER CONTROL PHILOSOPHY.
2. FIELD INSTRUMENT SHALL BE TERMINATED IN LOCAL PANEL.
3. SIGNALS FOR INTERFACE TO/FROM DDCMS ARE ALSO TERMINATED IN LOCAL PANEL.
4. THE LOCAL PANEL IS TYPICAL. SIMILAR PANELS SHALL BE APPLICABLE FOR
 - A. AMMONIA DOSING SYSTEM
 - B. NaOH DOSING SYSTEM
5. AUTO STROKE CONTROLLER SHALL HAVE FACILITY OF STROKE LENGTH ADJUSTMENT THROUGH PUSH BUT & 4-20mA SIGNALS.

	2 x 660 MW SURATGARH STPS STAGE-V		DRG.NO.	PE-DG-999-145-I273A
	UNIT # 7 & 8		DATE	
	TITLE STANDARD BLOCK INTERFACE		REV.NO.	01
	DIAGRAM FOR LP DOSING SYSTEM		SHT	

CHECK LIST/ QUALITY PLAN



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			P	W	V	
	ACCURACY						
	REPEATABILITY						
	SET POINT ADJUSTMENT						
3	OVER PRESSURE & LEAK TEST		P	W	V		
4	OPERATION OF PRESSURE. RELIEF DEVICE	ONE	P	W	V		
5	REVIEW OF TC FOR	FOR LOT	V	V	V		
	MATERIALS OF SENSOR						
	MOVEMENT						
	PROCESS CONNECTION						
	HOUSING						
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST	V	V	V		
7	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW	V	V	V		

Legend :

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

Note :

- 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.


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													SHEET 1 OF 7					
Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			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													\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.			1 - BHEL 2 - Vendor 3 - Sub-vendor		

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
		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	CR	Visual	Sample	BHEL Spec. and BOM	BHEL Spec. and BOM	Log Book	2	---	---				
		2. Verification of Test Certificates	CR	Scrutiny of Type / Routine T.Cs.	100%	Relevant IS	Relevant IS	Log Book	2	---	---				
		3. Operation / Functional check	CR	Electrical	Sample+ 100%@	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	+ for relay & contactors only			
		4. I.R.	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	@ for all components except relays & contactors.			
		5. H.V.	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---				
		6. Calibration	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	1				
		7. Pick up / Drop off Voltage	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---				
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics												\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. 1 - BHEL 2 - Vendor 3 - Sub-vendor			

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks							
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												1 - BHEL 2 - Vendor 3 - Sub-vendor							

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Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks		
									P	W	V			
9.0	Pre-treatment and Painting	1. Pretreatment Process 2. Process parameters like bath temp. concentration etc. 3. Dipping / Removal Time 4. Surface quality after every dip 5. Primer after phosphating 6. Putty Application & Rubbing after primer 7. Paint first coat 8. Putty Application and Rubbing after first coat of paint 9. Paint second coat	MA MA MA MA MA MA MA	Visual Measurement Measurement Visual Visual, Thickness Visual Visual, Thickness, Scratch test Colour adhesion	100% Periodic 100% 100% 100% 100% 100%	Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005	Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005	Log Book Log Book Log Book Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2 2 2 2	--- --- --- --- --- --- --- ---	1 1 1 1 1 1 1 1			
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics												\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. 1 - BHEL 2 - Vendor 3 - Sub-vendor		

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
10.	Panel Wiring	1. Wiring Layout 2. Wiring Termination (Crimped Lugs) 3. Ferrule numbers 4. Colour of wiring 5. Size of Conductor	MA MA MA MA MA	Visual Visual Visual Visual Measurement	100% 100% 100% 100% 100%	Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs.	Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs.	Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2	--- --- --- --- ---	--- --- --- 1 1				
11.	Component Mounting	1. Correct components 2. Fixing	MA MA	Visual Visual	100% 100%	Approved drgs., Specs. & BOM Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM Approved drgs., Specs. & BOM	Log Book Log Book	2 2	--- ---	--- ---				
12.	FINAL Final Inspection	1. Workmanship 2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components 3. Components identification Marking / Name plates	MA MA MA	Visual Visual Visual	100% 100% 100%	Factory Standard BHEL approved drg. / Spec. BHEL approved drg. / Spec.	Factory Standard BHEL approved drg. / Spec. BHEL approved drg. / Spec.	Inspection Report Inspection Report Inspection Report	2 2 2	1 1 1	1 1 1	At Random by BHEL, based on 100 % internal test reports by Mfr.			
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics															
\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.															
1 - BHEL 2 - Vendor 3 - Sub-vendor															

<div></div> <div>PEM :: C&I</div>		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										STD QUALITY PLAN NO.: PE-QP-999-145-I056						
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks						
		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 MA - Major characteristics MI - Minor characteristics		\$		P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.	1 - BHEL 2 - Vendor 3 - Sub-vendor
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
									P	W	V		
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant 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		

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


[Logo] PEM :: C&I		STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)						QUALITY PLAN NO.: PE-QP-999-145-I 006 VOLUME IIB SECTION D REV. NO. 05 DATE: 24.07.2010 SHEET 1 OF 6				
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
1.0 MATERIAL												
1.1	Body & Bonnet casting / forgings, plug, stem.	1. Physical, Chemical properties	MA	Physical, Chemical tests	One/ Heat(HT Batch)	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Test Certificate	3	---	2, 1	
		2. Heat Treatment	MA	Review of H.T. Chart	Each H.T.	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Test Certificate	3/2	2	1	IBR Certification (if applicable) to be verified by BHEL
		3. Internal quality of castings	MA	RT for Body & UT for Bonnet(NDT)	100%	ASME B 16.34	ASME B 16.34	Test Report / FILM	3/2	2	1	Only for rating ANSI 900 and above. Applicable for Body and Bonnet only. For Lower rating only if called for in specification.
		4. Surface Quality	MA	1. Visual	100%	MSS-SP-55	MSS-SP-55	Test Certificate	3/2	---	2, 1	
				2. MT/PT	100%	ASME B 16.34	ASME B 16.34	Test Certificate	3	2	1	After Machining on machined surface only
		5. Pressure test for shell	MA	Hyd. Test	100%	ISA-S-75.19/ ASME B 16.34	ISA-S-75.19/ ASME B 16.34	Test Certificate	2	2	1	For Body & Bonnet after machining
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics \$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. 1 - BHEL 2 - Vendor 3 - Sub-vendor												

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
1.2	Diaphragm	1. Surface Quality	MA	Visual	100%	Mfr. standard	Mfr. standard	Test Certificate	3/2	---	2,1	
		2. Hardness	MA	Measurement	100%	Mfr. standard	Mfr. standard	Test Certificate	3/2	---	2,1	
		3. Endurance / Life cycle	MA	Cyclic test 10,000 cycles	One / Type	10,000 cycles/ Mfr. standard.	No damage	Test Certificate	3/2		2,1	
1.3	Spring	1. Composition	MA	Chemical-Analysis	One sample/ Heat	Material spec. / Mfr. standard	Material spec. / Mfr. standard	Test Certificate	3	---	2,1	
		2. Mech. Properties	MA	Mech. Test	One sample/ Heat	Material spec. / Mfr. standard	Material spec. / Mfr. standard	Test Certificate	3	---	2,1	
		3. Performance	MA	1. Stiffness ratio 2. Scragging 3. Cyclic test (Endurance) 4. Dimension (Measurement)	100% 100% One / type	Material spec. / Mfr. standard Material spec. / Mfr. standard 10,000 cycles	Material spec. / Mfr. standard Material spec. / Mfr. standard Appd Drg	Test Certificate Test Certificate Test Certificate Record	3 3 3 3	---	2,1 2,1 2,1 2,1	
1.4	Electrical items [Limit switches, Solenoids, Position Transmitter(if provided externally)]	1. Routine Test	MA	HV, IR, Continuity function	100%	Rele. Standards	Rele. Standards	Test Certificate	3	---	2,1	In case TC is not available, Actual test shall be conducted
		2. Degree of protection	MA	IP/NEMA Tests	One sample / type	Approved Data sheet	Approved Data sheet	Test Certificate	3	---	2,1	
<div>LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics</div> <div>RT- Radiographic Test PT – Dye penetrant Test 1 - BHEL UT – Ultrasonic Test MT- Magnetic Test 2 - Vendor V - Agency Verifying the Test. 3 - Sub-vendor</div>												

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		PEM :: C&I		Component / operation		Characteristics Checked		* Category		Type/Method of Check		Extent of Check		Reference documents		Acceptance Norms		Format of Records		Agency \$		Remarks	
		Sl. No.																					
1.5	Pressure Gauges		1. Performance	MA	Review of calibration certificates	100%	Mfr. Standard	Mfr. Standard	Mfr. Standard	Test Certificate	3	---	2,1										
			2. Marking	MA	Visual	100%	Mfr. standard	Mfr. standard	Mfr. standard	Records	3	---	2,1										
2.0 IN PROCESS INSPECTION																							
2.1	Body & Bonnet after machining, Plug with actuator stem		1. Surface flaws	MA	Visual & MT/PT	100% (on accessible surfaces)	ASME B 16.34	ASME B 16.34	ASME B 16.34	Test Records	2	---	1	Butt weld ends shall be included.									
			2. Dimensional checks	MA	Measurement	100%	Mfr. Standard	Mfr. Standard	Mfr. Standard	Records	2	---	1										
			3. Hard facing (wherever applicable)	MA	Hardness Measurement	One sample/Lot	Mfr. Standard	Mfr. Standard	Mfr. Standard	Records	2	---	1										
2.2	Lapping		Machining surface contact	MA	Blue Matching	One sample/lot	-----	Proper Physical Contact	Proper Physical Contact	Test Records	2												
3.0 TESTS ON COMPLETED VALVE																							
3.1	Actuator Chamber		Leakage & Strength	MA	Pneumatic test	100%	Mfr. Standard	Mfr. Standard	No Leakage	Test Certificate	2	1	1	Refer Note-4									
3.2	Body		Leakage and Pressure test (Body Mount Leakage)	MA	Hydro test	100%	ISA - S-75.19	ISA - S-75.19	No Leakage	Test Certificate	2	1	1	Refer Note-4									
3.3	Seat leakage test for completed valve		Seat Leakage	MA	Pneumatic Test	100%	FCI-70.2	FCI-70.2	FCI-70.2	Test Certificate	2	1	1	Refer Note-4									
4.0 OPERATION TEST ON COMPLETED VALVE (Final inspection)																							
	1. Valve Travel		Valve Travel	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4									
	2. Opening/Closing time		Opening/Closing time	MA	Measurement	100%	Approved drg. / data sheet	Approved drg. / data sheet	Approved drg. / data sheet	Test Report	2	1	1	Refer Note-4									

LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics				RT- Radiographic Test UT - Ultrasonic Test	PT - Dye penetrant Test MT- Magnetic Test	\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.	1 - BHEL 2 - Vendor 3 - Sub-vendor
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
		3. Linearity/cam characteristic	MA	Measurement	100%	Approved drg./ data sheet	Approved drg./ data sheet	Test Report	2	1	1	Refer Note-4
		4. Repeatability	MA	Measurement	100%	Approved drg./ data sheet	Approved drg./ data sheet	Test Report	2	1	1	Refer Note-4
		5. Hysteresis	MA	Measurement	100%	Approved drg./ data sheet	Approved drg./ data sheet	Test Report	2	1	1	Refer Note-4
		6. Sensitivity	MA	Measurement	100%	Approved drg./ data sheet	Approved drg./ data sheet	Test Report	2	1	1	Refer Note-4
		7. Accuracy (Overall)	MA	Measurement	100%	Approved drg./ data sheet	Approved drg./ data sheet	Test Report	2	1	1	Refer Note-4
		8. Control Valve characteristics / CV Test	MA	♦ Measurement (Press. vs. discharge and opening 0-100% in steps of 10%)	One per type	As per specs/ Approved drg./ data sheet	As per specs/ Approved drg./ data sheet	Test Certificate	2	--	1	♦ Size = Body & port size Or Body size & CV for non std port. Refer Note 1.
		9. Operation of limit switch & solenoids and other accessories	MA	Function	100%	Approved drg./ data sheet	As per specs/ Approved drg./ data sheet	Test Report	2	1	1	On assembled valve Refer Note-4
		10. Overall dimensions	MI	Visual and dimensional	100%	Approved drg./ data sheet	As per specs/ Approved drg./ data sheet	Records	2	1	1	Refer Note-4
		11. Pre defined valve position in case of air failure	MA	Visual	100%	As per spec & Appd drg	As per spec & Appd drg	Test Certificate	2	1	1	
		12. Cleanliness, painting, stamping (for direction of flow), Tag No.	MA	Visual and dimensional	100%	Approved drg./ data sheet	As per specs/ Approved drg./ data sheet	Test Certificate	2	1	1	
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics \$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. 1 - BHEL 2 - Vendor 3 - Sub-vendor												

 PEM :: C&I	STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)											
	QUALITY PLAN NO.: PE-QP-999-145-I 006											
	VOLUME IIB											
	SECTION D											
	REV. NO. 05 DATE: 24.07.2010											
SHEET 5 OF 6												
Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	

5.0 AUXILIARY ITEMS												
5.1	Positioner	Overall leakage after assembly including Nozzles leakage	MA	Leak Test (in the steady state input signal)	100 %	Mfr. Standard	No leakage	Test Certificate	3/2	---	1	Overall leakage including tubing
5.2	Air filter regulator	1. Normal air consumption	MA	Measurement	Each type	Mfr. Standard	No leakage	Test Certificate	3/2	---	1	
		2. Overall leakage	MA	Visual (soap solution)	100 %	Mfr. Standard	No leakage	Test Certificate	3/2	---	1	
5.3	Air lock relay	Performance Test	MA	Leakage test	100%	Mfr. Standard	No leakage	Test Certificate	3/2	---	1	
5.4	Electronic position transmitter(not applicable if provided integral to smart positioner)	1. Accuracy	MA	Operation	100%	Approved data sheet /	Approved data sheet /	Test Certificate	2	1	1	On completed valve
5.5	Current to Pneumatic converter(not applicable for smart positioner)	1. Physical Verification Make/Model	MA	Visual	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Certificate	2	---	2,1	
		2. Degree of Protection	MA	IP/NEMA test	Each type	Relevant Standard	Relevant Standard	Test Certificate	3	---	2,1	
		3. Linearity	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1	
		4. Hysteresis	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1	

LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics \$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test. 1 - BHEL 2 - Vendor 3 - Sub-vendor												
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STANDARD QUALITY PLAN FOR CONTROL VALVE (PNEUMATIC)													QUALITY PLAN NO.: PE-QP-999-145-I 006			
													VOLUME IIB			
													SECTION D			
													REV. NO. 05			
													DATE: 24.07.2010			
													SHEET 6 OF 6			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks				
									P	W	V					
5.6	Smart Positioner (As Applicable)	1. Physical Verification Make/Model	MA	Visual	100%	Approved drg. / data sheet	Approved drg. / data sheet	Test Certificate	2	---	2,1					
		2. Degree of Protection	MA	IP/NEMA test	Each type	Relevant Standard	Relevant Standard	Test Certificate	3	---	2,1					
		3. Linearity	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1					
		4. Hysteresis	CR	Measurement	100%	Approved drg. / data sheet / BHEL specn.	Approved drg. / data sheet / BHEL specn.	Inspection Report	2	---	1					
		5. Calibration with Hand Held Communicator	MA	Measurement	Each type	Approved data sheet / Mfr. Standard	Approved data sheet / Mfr. Standard	Test Certificate	2	1	1					
6.0	PAINTING	Soundness of Painting	MA	Visual and Measurement	100%	BHEL specn. / Mfr. Standard	BHEL specn. / Mfr. Standard	Inspection Report	2	---	1	Refer Note-2				
7.0	PACKING	Soundness of Packing against transit damage	MA	Visual	100%	Mfr. Standard	Mfr. Standard	Inspection Report	2	---	---	Refer Note-3				

NOTES:

1. Cv test will be conducted if Test Certificate for a similar Model / Size / Cv is not available. Validity of the certificate considered as last 3 years. Cv test conducted at IIT/FCRI/any govt. approved laboratory shall not be witnessed by BHEL.
2. In the absence of BHEL spec. for painting, vendor to obtain BHEL's approval on their painting specification / procedure.
3. Sea worthy packing, if applicable.
4. The quantum of check shall be 100% for manufacturer and 10% for BHEL/BHEL nominated inspection agency.
5. IBR certificates in Form III-C shall be submitted if called for in the specification/datasheet.
6. Copies of all TC's (Test Certificates) for materials duly correlated with Heat Nos., TC's for electrical items and mechanical tests (Leak/Operation) shall be submitted to BHEL for verification and acceptance.

LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics				RT- Radiographic Test UT - Ultrasonic Test	PT - Dye penetrant Test MT- Magnetic Test	\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.	1 - BHEL 2 - Vendor 3 - Sub-vendor
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SENSOR REDUNDANCY- PHILOSOPHY

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION : D5.3
Package: EPC	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT DESIGN, PERFORMANCE AND FUNCTIONAL REQUIREMENTS	SHEET 12 OF 55
<p>7.5 The Contractor shall submit a brief write up on CLCS function for all SG, TG and balance of plant controls along with the bid.</p> <p>8.0 OPEN LOOP CONTROL SYSTEM FOR SG & TG AND ITS AUXILIARIES</p> <p>8.1 The open loop controls shall be provided as per system requirement.</p> <p>8.2 The open loop control system shall be provided as per the guidelines given under clause 4.0 of this section.</p> <p>8.3 The Contractor shall submit a brief write up on OLCS function for all SG, TG and balance of plant controls along with the bid.</p> <p>9.0 REDUNDANCY AND AVAILABILITY REQUIREMENTS</p> <p>9.1 Measurement system (MS), Closed Loop Control System (CLCS) and Open Loop Control System (OLCS) shall all be configured with redundancy at processor modules, communication modules, data bus and power supply modules.</p> <p>9.2 Both CLCS & OLCS shall be configured with Redundant I/O channels for each sensor/signals. Where redundant sensors are provided redundant I/O channels shall be provided for each sensors/signals. (For eg. If two sensors are provided for a particular service, then totally 4 input channels are required.). All the outputs from the CLCS and OLCS shall be dual redundant.</p> <p>9.3 Boiler protection system & Turbine Protection system shall be with SIL3 certification for each unit.</p> <p>9.4 Redundant sensors shall be provided for all control applications.</p> <p>9.5 For all important and critical controls (CLCS) triple redundant sensors shall be provided. This will include sensors provided for compensation also. Similarly for critical protection logic requirements triple redundant sensors for 2 out of 3 logic shall be provided to avoid spurious tripping. For all other control application dual redundant sensors shall be provided. Critical closed loop controls are detailed in Clause 12.0 of this section.</p> <p>10.0 SENSOR REDUNDANCY- PHILOSOPHY</p> <p>10.1 Two out of three measurements philosophy shall be adopted for the control of all critical closed and open loop variables for reliability of operation. The control system shall select the median value for the normal control purpose.</p> <p>10.2 In case of deviation of one transmitter output from the other two, the same shall be automatically isolated and average output of the remaining transmitters shall be fed to the control and measurement system and the control loop in this case shall be</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION : D5.3
Package: EPC	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT DESIGN, PERFORMANCE AND FUNCTIONAL REQUIREMENTS	SHEET 13 OF 55
<p>maintained on auto, with an alarm on the operator's monitor as well as maintenance engineer's monitor. In case of failure of the two remaining transmitters in circuit, deviation of one transmitter output is more than the preset limit compared to the other transmitter, there shall be automatic bump less transfer and changeovers shall have suitable alarms.</p> <p>10.3 For all other control parameters the number of sensors / transmitters shall be two. One out of two selection logic and selection of average value of the two signals shall be followed.</p> <p>10.4 In the event of excessive deviation between two signals control system shall trip to manual and it shall be annunciated to bring operators attention and operator has facility to select any of the transmitters through VDU operation.</p> <p>10.5 In the event of failure of one of the two transmitters, it shall automatically select a healthy transmitter but control system shall remain in auto mode.</p> <p>10.6 Separate transmitters shall be used for measurement avoiding signal tapping from control loop/ control transmitter.</p> <p>10.7 For signal compensations, separate signals from separate transmitters shall be used for measurement and control.</p> <p>10.8 Sensor Redundancy For OLCS</p> <p>10.8.1 All sensors for the following causes of trips shall be triple.</p> <p>(a) Unit trips,</p> <p>(b) Boiler trips,</p> <p>(c) Turbine trips</p> <p>(d) Trip of any auxiliary which will lead to substantial (50%) loss of unit availability.</p> <p>10.8.2 All sensors for the following causes of trips shall be dual (requirement specified at Clause 10.8.1 will have priority of application).</p> <p>(a) All HT equipment trips.</p> <p>(b) All LT equipment trips.</p> <p>10.8.3 Single sensors shall be provided for the following:</p> <p>(a) Alarm</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION : D5.3
Package: EPC	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT DESIGN, PERFORMANCE AND FUNCTIONAL REQUIREMENTS	SHEET 14 OF 55
<p>(b) Permissive</p> <p>(c) Measurement</p> <p>10.9 Sensor Redundancy For CLCS</p> <p>11.0 CONTROLS INCLUDED IN DCS</p> <p>11.1 Steam Generators (SG) soot blowing controls, Fans, blowers (if applicable) controls for boiler and auxiliaries. All SG closed loop controls like combustion control (fuel flow / air flow), temperature & pressure, air flow, SA/PA pressure, SH/ RH steam temperature, furnace draft, drum level (if applicable) etc..</p> <p>11.2 All turbine analog controls including EHTC for TD BFP(except turbine integral system analog controls)</p> <p>11.3 Co-ordinated Master Control</p> <p>11.4 Regenerative cycle controls like heater drain, deaerator level, deaerator pressure, hotwell level, CEP controls, BFP controls, Hotwell makeup, Vacuum Bkr.vlv gland seal water pressure control.</p> <p>11.5 Balance of plant controls like auxiliary steam, CW & Circulating cooling water system, Emergency cooling water system (if applicable), etc.</p> <p>12.0 CRITICAL CONTROL LOOPS</p> <p>Following CLCS loops are considered critical, for which triple redundant sensors shall be provided for all involved parameters involved in the loop. Parameters involved will also include parameters used for compensation. For the balance control loops, only dual redundant sensors shall be provided.</p> <p>(a) Furnace draft</p> <p>(b) PA Flow Control,</p> <p>(c) SA Pressure control</p> <p>(d) SA Flow control</p> <p>(e) O2 correction control</p> <p>(f) Steam Temperature Control</p> <p>(g) Turbine Governor control</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION : D5.3
Package: EPC	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT DESIGN, PERFORMANCE AND FUNCTIONAL REQUIREMENTS	SHEET 53 OF 55
31.9	For all HT drives alarm and trip signals for bearing and winding temperatures shall be considered through soft LVM from temperature element signal only. No temperature transmitters are required for these signals.	
31.10	All Critical control valves shall be provided with anti-cavitation trim. Control valves / dampers shall be supplied with all accessories including non-contact type position transmitters and E/P Positioners. Combination of I/P + Pneumatic positioner is not acceptable. All inching valves shall be supplied with position transmitters integral with the valve positioner.	
31.11	All transmitters shall be SMART type with integral local LCD indication and HART protocol.	
31.12	All Temperature sensors shall be Duplex type and field mounted temperature transmitter shall be provided for all temperature measurement applications. Direct wiring of RTD or T/C to DCS or PLC is not preferred. (Except for Winding and bearing temperature sensors).	
31.13	Switches (pressure, temperature, level & flow etc.) shall be provided only for critical equipment trip such as BFP/ CEP trip etc. Wherever possible, transmitters shall be provided with required redundancies for all other purposes.	
31.14	Similar make and model shall be provided for same type of I&C system equipment. This shall specifically apply for field transmitters, control valves etc.	
31.15	Smart positioners shall be provided for all control valves/ dampers.	
31.16	Where multiple functions like monitoring /control/alarm etc. are sought to be performed based on a parameter value, in minimum dual sensor shall type be provided.	
31.17	All outdoor field equipment shall be provided with epoxy painting.	
31.18	Individual continuous purging shall be provided for all Air and Flue gas transmitters. The tap points for these services shall be "Y" shaped. The purging line shall be connected near the root valve only and not at the Transmitter end.	
31.19	All local cabinets / utility plant control panels with bottom cable entry shall be provided with suitable pedestals for easy cabling. The panels shall be designed for ease of operation of operating hardware and monitoring the indicators.	
31.20	All local panel indicating lamp/indicating type Push button should be of cluster LED type only. All local panels shall be of double door type instead of double leaf type to avoid ingress of dust in dust prone areas.	
31.21	All motorised bypass valves shall be inching type and shall be provided with position transmitters of non-contact type.	
		ISSUE R1

	TITLE: TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM 2X660 MW SURATGARH STPS STAGE V UNIT # 7& 8	SPEC. NO. PE-TS-392-154A-A001	
		VOLUME III	
		SECTION :	
		REV. NO. 00	DATE:
		SHEET	

SCHEDULE OF PRE-BID CLARIFICATION

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

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

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

SCHEDULE OF DEVIATIONS WITH COST OF WITHDRAWAL



PROJECT:-2X660 MW SURATGARH STPS STAGE V UNIT # 7 & 8

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 withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
- For directly dispatchable items, cost of withdrawal 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 withdrawal 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 withdrawal of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.
- 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 withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.
- In case nature of cost of withdrawal (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 TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM 2X660 MW SURATGARH STPS STAGE V UNIT # 7& 8	SPECIFICATION NO. PE-TS-392-154A-A001
		VOL III
		SHEET..... OF.....

COMPLIANCE CERTIFICATE

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

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

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	

	TITLE * SCHEDULE OF DECLARATIONS	BHEL DOCUMENTS NO.: PE-TS-392-154A-A001
		VOL III
		SHEET..... OF.....

* Bidder shall include this schedule both in technical and Price offers

DECLARATION

Icertify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated and there is no deviation to the specification (except indicated in the deviation sheet (with cost of withdrawal).

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

Bidders Company Name

Authorised representative's
Signature

Name

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

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

2X660 MW SURATGARH STPS STAGE-V									
PACKAGE:- CHEMICAL DOSING SYSTEM									
PRICE SCHEDULE									
Item S.No.	DESCRIPTION OF EQUIPMENT / ITEM	QTY.	UNIT PRICE EX WORKS (DULY PACKED) (Rs.)	TOTAL PRICE EX-WORKS (DULY PACKED) (Rs.)	EXCISE DUTY @ % (Rs.)	CST/VAT @ % (Rs.)	FREIGHT CHARGES (Rs.)	TOTAL FOR SITE PRICE (Rs.)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(10)	
1.0	Total lump sum price for design, engineering, manufacture, fabrication, assembly, p painting, packing, inspection and testing at manufacturer's works, mandatory spares, start up and commissioning spares, supply and dispatch to power station site of skid mounted L.P. Chemical Dosing System as specified for 2X660 MW SURATGARH STPS STAGE -V as per BHEL technical specification no. PE-TS-392-154A-A001, and subsequent clarifications confirmation, correspondences with the bidders till date.	1 SET			NIL AGAINST PAC				
	NOTES:								
	a) Bidder to note that total price indicated above at 1.0 shall be considered for evaluation and hence should be complete in all respect for the full scope defined and considering all terms and conditions agreed.								
	b) In case, price indicated above does not match with total of item wise break-up given at 2.0 , the higher price so calculated shall be considered for evaluation but in case of order, the same shall be placed at the lowest price.								
2.0	MAJOR BREAK UP OF PRICES QUOTED AT 1.0 ABOVE								
2.1	Total lump sum price quoted at Item S. No. 1.0 above excluding Mandatory Spares								
2.1.1	Ammonia dosing skid								
2.1.2	NaOH dosing skid								
2.1.3	Commissioning spares as per the following details:-								
2.1.3.1									
a)	Oil Seals for drive end. - 4 nos. per skid	8 nos.							
b)	Gaskets for drive end - 4 nos. per skid	8 nos.							
c)	Guide ring for plunger. - 4 nos. per skid	8 nos.							
d)	Teflon rings for valve/s. - 8 nos. per skid	16 nos.							
e)	Level gauge glass - 2 nos. per skid	4 nos.							
f)	Back up fuse - 3 nos. per skid	6 nos.							
g)	Pilot lamp - 2 nos. per skid	4 nos.							
h)	Push Button - 2 nos. per skid	4 nos.							
i)	Control fuse - 2 nos. per skid	4 nos.							
j)	Bulb for Annunciation - 4 nos. per skid	8 nos.							
2.1.3.2	NaOH dosing system:								
a)	Oil Seals for drive end. - 4 nos. per skid	8 nos.							
b)	Gaskets for drive end - 4 nos. per skid	8 nos.							
c)	Guide ring for plunger. - 4 nos. per skid	8 nos.							
d)	Teflon rings for valve/s. - 8 nos. per skid	16 nos.							
e)	Level gauge glass - 2 nos. per skid	4 nos.							
f)	Back up fuse - 3 nos. per skid	6 nos.							
g)	Pilot lamp - 2 nos. per skid	4 nos.							
h)	Push Button - 2 nos. per skid	4 nos.							

i)	Control fuse - 2 nos. per skid		4 nos.						
j)	Bulb for Annunciation - 4 nos. per skid		8 nos.						
	Total of 2.1.1, 2.1.2 and 2.1.3								
2.2	Mandatory Spares as per the following details:-								
2.2.1	Dosing pump complete(for each type, rating and size)								
2.2.2	Plunger diaphragm(for each type, rating and size)		1 number						
			2 Sets (1 set = One pump requirement)						
2.2.3	Driving motor(for each type, rating and size)		1 number						
2.2.4	Agitator with motor(for each type, rating and size)		1 Set (1 set = One system requirement)						
2.2.5	Plunger packing		4 Sets (1 set = One pump requirement)						
2.2.6	Oil Seals		4 Sets (1 set = One pump requirement)						
2.2.7	All pump and motor bearings		2 Sets (1 set = One pump & one Motor requirement)						
2.2.8	Agitator bearings		4 Sets (1 set = One pump & one Motor requirement)						
2.2.9	Complete valves (for each type, range and size)		5 % or minimum one whichever is higher.						
2.2.10	Level gauge (for each type, range and size)		10% or minimum 1 no whichever is higher for each						
2.2.11	Level transmitter (for each type, range and size)		10% or minimum 1 no whichever is higher for each						
2.2.12	Pressure gauge (for each type, range and size)		10% or minimum 1 no whichever is higher for each						
2.2.13	Pressure transmitter (for each type, range and size)		10% or minimum 1 no whichever is higher for each						
2.2.14	Differential pressure gauge (for each type, range and size)		10% or minimum 1 no whichever is higher for each						
2.2.15	Differential pressure transmitter (for each type, range and size)		10% or minimum 1 no whichever is higher for each						
2.2.16	Back up fuse		12 Nos.						
2.2.17	Pilot Lamp		8 Nos.						
2.2.18	Push Button		8 Nos.						
2.2.19	Control Fuse		8 Nos.						
2.2.20	Bulb for Annunciation		16 Nos.						
	Total of 2.2.1 to 2.2.20								
	Note: Bidder to include any other spares required for commissioning the skids, other than above.								

NIL
AGAINST
PAC