

ENGINEERING SERVICES

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	GENERAL
2.00.00	DESIGN COORDINATION MEETING
3.00.00	CO-OPERATION WITH OTHER CONTRACTORS AND CONSULTING ENGINEERS
4.00.00	GUIDELINES FOR ENGINEERING SERVICES
5.00.00	OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS
6.00.00	PLANT HANDBOOK
7.00.00	CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE
8.00.00	TENDER STAGE DOCUMENT SUBMISSION

ATTACHMENTS

ANNEXURE-1	DISTRIBUTION SCHEDULE
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ENGINEERING SERVICES

1.00.00 GENERAL

1.01.00 As part of the overall project management activity, the Contractor shall be responsible for proper engineering and co-ordination of activities during various phases of execution of the contract. The Contractor shall identify a person, designated as Project Manager, with whom the Owner, the Consulting Engineer or the Review Consultant shall interact on matters related to engineering as well as execution of the contract. The Project Manager shall be the single-point contact person on behalf of the Contractor and shall be responsible for all engineering co-ordination. The Owner/Consultant/Review Consultant shall interact with the Project Manager only on all matters of co-ordination between the Owner and the Contractor or on matters involving the Contractor, his manufacturing units and sub-vendors. For the purpose of expediting the Owner or his representative may sometimes interact with the manufacturing units or sub-vendors of the contractors. However such interaction will not, under any circumstance, dilute the responsibility of the Contractor to provide a fully engineered and co-ordinated package under this contract.

1.02.00 On finalization of the contract, a procedure for exchange of engineering information will be mutually agreed and finalized between the Owner and the Contractor.

2.00.00 DESIGN COORDINATION MEETING

The Contractor and his sub-vendors will be called upon to attend design co-ordination meetings with the Engineer, other Contractors and the Consultants of the Owner during the period of execution of contract. The Contractor including his sub-vendors shall attend such meetings at their own cost at Owner's or Consultant's office in Kolkata or at mutually agreed venue as and when required and fully cooperate with such persons and agencies involved during those discussions.

3.00.00 CO-OPERATION WITH OTHER CONTRACTORS AND CONSULTING ENGINEERS

The Contractor shall agree to cooperate with the Owner's other Contractors and Consulting Engineers and freely exchange with them such technical information as is necessary to obtain the most efficient and economical design and to avoid unnecessary duplication of efforts. The Engineer shall be provided with copies of all correspondences addressed by the Contractor to other Sub- contractors and Consulting Engineers in respect of such exchange of technical information.

4.00.00 GUIDELINES FOR ENGINEERING SERVICES

- 4.01.00 Prior to commencement of the engineering work as part of design submissions, all aspects of design viz., criteria for selection and sizing of all equipment and systems, design margins etc. including that for structural steel and civil work shall be outlined and these shall form the basis for the detailed engineering work.
- 4.02.00 Engineering work shall be performed on modern and proven concepts and internationally accepted good engineering practices but fully compatible with the Indian environments. Owner shall have the right to review and approve the engineering work by themselves and/or through consultant and ask for any clarifications and changes/modifications to the work performed by Contractor.
- 4.03.00 At any stage during the performance of assignment, the Contractor may be required to make certain changes/modification/improvements in design/drawing/other documents which are applicable to 800 MW Unit, which in the opinion of the Owner could result in better improved design, layout, operability, plant availability, maintainability, reliability or economy of the plant and its systems/sub-systems in view of revised and more accurate information/data available at a later date(s) or feedback(s) received during execution / operation of similar units. Such changes / modifications/improvements required could be identified by Owner and/or consultant and mutually discussed. Owner requires the Bidder to incorporate such action in the subject assignment appropriately without any additional cost liability and time implication to the Owner and same shall be within the responsibilities and scope of the Contractor.
- 4.04.00 During the course of review of detailed engineering stages, it may be essential in the opinion of Owner to obtain certain classified data for review purposes only. In case Owner so desires, the Bidder shall submit such data to Owner.
- 4.05.00 During the course of review of detailed engineering, it may be essential in Owner's opinion to obtain data and information on similar equipment and plants engineered by the Bidder. In case Owner so desires the Bidder shall submit such data and information to the Owner.
- 4.06.00 It is not the intent to give details of every single task covered in the total engineering work to be carried out by Contractor, however, all engineering work required for the satisfactory completion of the plant/systems as specified shall be carried out by the Contractor. Broadly, the following are the minimum requirements in respect of scope of major items of work:
- 4.06.01 Preparation, updating and finalisation of scheme drawings, control and interlock diagrams, detailed and fully dimensioned layout drawings (plant layout and equipment layout detailed plan, elevation and cross-sectional drawings at different elevations / floor levels) covering all mechanical, electrical, C&I, civil and structural items, equipment, systems and facilities. Drawings and Schedules prepared by the Contractor from time to time, as detailed designs are developed, shall be submitted for Owner's / Consultant's

approval before the work is taken up. Revisions, corrections, additions to drawings and schedules shall not be considered to change the scope of work.

- 4.06.02 Preparation of detailed technical specifications including data sheets, tender drawings and bill of material for all bought out items, as also finalisation of corresponding sub-contractors.
- 4.06.03 Review of sub-contractor's data, drawings, design calculations, schedules, bill of materials, instruction manuals etc. for all equipment, before forwarding them to Owner/Consultant for approval.
- 4.06.04 Preparation of civil construction drawings for all equipment showing foundation details and full details regarding equipment loads, floor openings, details of embedments etc. required for preparation of civil construction drawings and also as referred at relevant sections of Scope, Terminal Points & Exclusions. These documents shall be preceded by appropriate design calculations, static and dynamic analysis as necessary.
- 4.06.05 Preparation and finalisation of process piping and instrumentation diagrams and schematics, complete in all respects for all systems/packages of the power plant.
- 4.06.06 Preparation of consolidated schedules and bills of materials, including line numbers, tag numbers, source of supply, service conditions, specifications, materials, types and connections details, quantities for items of the plant including dampers, steam traps, strainers, instrumentations, ducting.
- 4.06.07 Sizing of all piping and equipment as per the stipulated design criteria; carrying out of flexibility analysis/dynamic analysis as necessary; hangers & support engineering.
- 4.06.08 Final revision of all documents including preparation and compilation of Instruction Manuals for installation, commissioning, operation and maintenance for all equipment and systems. Refer clause 5.00.00 for the specific requirement in this regard.
- 4.06.09 Certification and submission of final as-built drawings for all areas.
- 4.06.10 Preparation and compilation of all drawings, schedules and instructions which may be required at site, whether separately mentioned or not.
- 4.06.11 All erection and assembly drawings which may be required at site.
- 4.06.12 For all bought out item packages, the Contractor shall provide complete material / component list along with detail specification, drawings, component part no. etc. during detail engineering stage prior to final approval. Such approved drawing/document shall be made available at site in adequate number prior to commencement of work. Moreover, such document/drawing shall be provided in soft form (CD)
- 4.06.13 Preparation of necessary documentation, design calculations etc. required for submission to statutory authorities like IBR, Chief Electric Inspector, Factory Inspector etc.

5.00.00 **OPERATING MANUALS AND MAINTENANCE INSTRUCTIONS**

5.01.00 The Contractor shall provide at least six (6) months before the time of commissioning and before taking over of the plant and equipment, all necessary maintenance manuals and operating instructions. The instruction manual shall be submitted in the form of one (1) soft copy in CD and 15 hard copies as per distribution schedule (Annexure-1).

5.02.00 The information provided, which shall be contained in loose leaf stiff backed covers, shall include :

- a) A complete inventory of all main items of plant, with identification details.
- b) Service manuals for all plant and equipment giving full descriptions of the main items and auxiliary items such as power packs, hydraulic equipment, actuators, lubricating pumps, etc.
- c) A separate electrical manual covering items such as switchgear, cabling, instrumentation, controls, cabling layouts and wiring diagrams.
- d) A schedule of recommendations for routine maintenance of all electrical and mechanical equipment, recommended inspection point, information on detection, cause and rectifications of troubles & faults.
- e) A lubrication schedule with all necessary drawings diagrams to identify the lubrication points.
- f) Manufacturer's literature.

5.03.00 The instruction manual shall be subject to the approval of Owner.

6.00.00 **PLANT HANDBOOK**

The Contractor shall submit to the Engineer, a preliminary plant handbook preferably in A-4 size sheets which shall contain the design and performance data of various plant, equipment and systems covering the complete project including single line flow diagrams, within twenty four (24) months from the date of his acceptance of the Letter of Intent. The final plant handbook complete in all respects shall be submitted by the Contractor six (6) months before start-up and commissioning activities. The plant handbook shall be submitted as per distribution schedule.

7.00.00 **CONTRACT STAGE DOCUMENT SUBMISSION AND APPROVAL PROCEDURE**

7.01.00 Within fifteen (15) days to one month of issue of Letter of Intent (LOI) by the Owner, the Contractor shall furnish a schedule of drawings and design

document to be submitted by him to the Owner/Engineer indicating dates against each document.

The documents shall be divided into two categories : a) for approval and b) for information/further engineering and co-ordination by the Owner.

In preparing this schedule, the Contractor shall allow two (2) weeks from date of receipt for review and comments by the Owner/Engineer for each submission of a document.

This document submission schedule shall require approval by the Owner/Engineer.

7.02.00 All contract documents shall be marked, without fail, with the name of the Owner, the Project, the specification title and number and the unit designation.

All dimensions shall be in metric units.

All notes, markings etc. shall be in English.

7.03.00 Documents/Drawings, submitted during tender stage, shall be revalidated or revised as required and submitted as certified contract document for approval / information of the Owner/Engineer.

7.04.00 Unless specified otherwise, the following categories of documents/drawings would require approval of the Owner/Engineer:

- a) List of sub-vendors (from Owner only)
- b) System scheme and instrumentation diagrams
- c) Design basis justifying selection of equipment & process parameters where not specified in the Contract
- d) Equipment data sheets and general arrangement drawings
- e) Materials of construction
- f) Layout drawings.
- g) Operation logic diagrams.
- h) Typical control circuit.
- i) Drawings of Instrumentation and control.

7.05.00 Unless specified otherwise, the following categories of documents/ drawings would be treated for information/further engineering by the Owner/Engineer. The Contractor shall, however, incorporate all additional information and clarifications in these documents / drawings as and when desired by the Owner/Engineer.

- a) Equipment foundation drawings.
- b) Equipment cross-section drawings, product literature etc. which are of proprietary nature.
- c) Predicted performance curves of equipment.
- d) Various bills of quantity, schedules etc.
- e) Piping fabrication drawings, isometrics etc.
- f) Panel wiring diagrams.
- g) Instruction/Operation manuals.
- h) Service manuals and trouble shooting guide for C & I system including field instruments.
- i) Cable schedule and interconnection chart.
- j) Drive/feederwise control scheme showing all external interfaces.

In essence, the Contractor is solely responsible for corrections and adequacy of design & engineering for documents under this category.

7.06.00 Upon review, the Owner/Engineer shall put his remarks and one of the following action stamps on the drawing/document:

- a) A - Drawing submitted as approved, proceed with fabrication
- b) B - Drawing approved subject to comments noted, proceed with fabrication, considering our comments. Correct as necessary and resubmit for record.
- c) C - See attached memo.
- d) D - Correct your original drawing incorporating our comments and resubmit for approval.
- e) E - Information furnished is noted.
- f) F - Prints not enclosed

For action stamps in category (c) & (d), documents must be resubmitted for review by the Owner/Engineer. For action stamp in category (b), further review by Owner/Engineer would not be necessary provided the Contractor agrees & incorporates the comments made on the document.

Except for action stamp under category (c) & (d), the Contractor can proceed with manufacturing and other sequential activities for those areas of a drawing/document which do not have any review comment by the Owner/Engineer.

The Owner/Engineer may accord approval in category (c) or (d) in more than one submission of a document till he is satisfied that the intent of the specification has been fully complied with. The Contractor shall be responsible for delay in such cases and no extension of time shall ordinarily be allowed on such grounds. Approval of contract documents by the Owner/Engineer shall not relieve the Contractor of his responsibility for any errors and fulfillment of contract requirements.

The Contractor's work shall be in strict accordance with the finally approved drawings and no deviation shall be permitted without written approval of the Owner/Engineer.

7.07.00 Except key plan/general yard plan, any layout drawing requiring scrutiny shall not be drawn to a scale less than 1:50.

7.08.00 For review by the Consulting Engineer, the Contractor shall furnish soft copies of drawings & documents and three (3) prints of each drawing/document. Two (2) prints of such submission shall also be sent to the Owner. After review, comment/approval will be sent to the Contractor. Upon action under category (a) or (e), the Contractor shall directly distribute the documents to the various offices of the Owner and other agencies in number of copies as specified in the contract document. Such distribution copies shall be marked with the reference and date of the letter by which the Owner/Engineer has accorded his final approval. Penal action shall be taken against the Contractor for any unauthorised revision in the drawings so distributed from the drawings approved by the Owner/Engineer. The contractor shall furnish three (3) CDs of all as built/final drawings for Owner/Consultant site.

7.09.00 In case of contradiction between the stipulations above and those stated elsewhere in the specification, the stipulations herein shall prevail.

7.10.00 For details of documentation for Civil, Structural and Architectural works, VII-A, VII-B and VII-C may be referred.

8.00.00 **TENDER STAGE DOCUMENT SUBMISSION**

8.01.00 The Bidder shall submit along with his bid all documents/drawings as requested in respective specifications. The documents shall include but not be limited to the following :

- a) All Bid proposal sheets duly filled up.
- b) Detailed experience list and financial resources of the prime bidder his collaborators/associates in this bid as well as the sub-vendors proposed.
- c) Scheme drawings indicating scope of supply and service as offered by the Bidder indicating clearly exclusions, if any.
- d) List of terminal points of the package offered together with quality and quantity of various input (i.e. water, air, electricity etc.) as required from the Owner at such interfaces.

- e) Equipment GA, Layout, Design Calculations, interlock and other write-up, catalogues/literature etc. as required for clear understanding of the bid submitted.
- f) L-1 network indicating target dates for intermediate milestones and final commissioning of equipment supplied; This network shall be supplemented by a detailed write-up on proposal procedure of project implementation, deployment schedule for Key personnel with their bio-data, schedule of construction machinery etc.
- g) List of suppliers for all bought out items.

DISTRIBUTION SCHEDULE

S. No	Description	TSGENCO								CONSULTANT			Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/ KTPS	SE/ Civil KTPS	SE/E&M / KTPS	DE Constr. KTPS	Kolkata	HYD	KTPS		
A	Letter Of Intent or Contract Documents	1	1	1	S	1	2	2	1	1	1	1	2	
B	Vendor Drawings													
1.	Preliminary	1	1	1	2	1	1	2	2	12	1	-	S	
2.	Return preliminary with comments	-	-	1	2	1	1	1	1	S	1	-	1	
3.	Final and any revision thereof													
	a. Civil	1	1	6+1T	1	1	6+1T	1	-	2+1T	1	1	S	
	b. E&M	1	1	1	6+1T	1	1	6+1T	1	2+1T	1	1	S	
C.	Design Drawings													
1.	Preliminary													
	a. Civil	1	1	2	1	1	2	1	1	4	1	1	S	
	b. E&M	1	1	1	2	1	1	2	1	4	1	1	S	
2.	Released for construction													
	a. Civil	1	1	2	1	1	6	1	1	1	1	2	S	
	b. E&M	1	1	1	1	2	1	6	1	1	1	2	S	
3.	Return marked 'As built'													
	a. Civil	-	-	1	-	-	1	-	-	1	1	S	1	
	b. E&M	-	-	-	1	-	-	1	1	1	1	S	1	
4.	As built drawings													
	a. Civil	-	-	1+1T	-	2+1T	5+1T	-	1	1+1T	-	1	S	
	b. E&M	-	-	1	2+1T	2+1T	-	5+1T	1+1T	1+1T	-	1	S	

S. No	Description	TSGENCO								CONSULTANT			Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/ KTPS	SE/ Civil KTPS	SE/E&M / KTPS	DE Constr. KTPS	Kolkata	HYD	KTPS		
D	Progress Report Monthly													
1.	Equipment vendor	1	1	1	2	1	1	2	1	1	1	1	S	
2.	M/s DCPL, Kolkata	1	1	2	2	1	1	2	1	S	1	1	Nil	
E	Test & Inspection Reports													
1.	Equipment manufacturer													
	a. Civil	1	1	1	2	1	1	1	-	11	1	1	S	
s	b. E&M	1	1	-	2	1	-	1	1	11	1	1	S	
2.	M/s DCPL, Kolkata	1	1	-	2	1	-	1	1	S	-	1	-	
F	Instruction Manuals/Data Books													
1.	Equipment manufacturer													
	a. Civil	1	1	1+1T	1	1	6+1T	1	1	2+1T	1	1	S	
	b. E&M	1	1	-	3+1T	1	-	6+1T	2	3+1T	1	1	S	
2.	M/s DCPL, Kolkata	1	1	-	10+1T	1	-	15+1T	-	S	1	1	Nil	
G	M/s DCPL, Kolkata Criteria	1	1	1	8+1T	1	1	2	1	1	1	1	S	
H	Design Calculations	1	1	1	8+1T	1	1	2	1	1	1	1	S	
I	Final consulting Engineering Report	1	1	1	10	1	1	2	1	S	1	1	Nil	

S – Source, T – Transparency & Soft Copy on CD,

TSGENCO : Telangana State Power Generation Corporation Limited

Director, Projects, Hyd : Director/ Projects, TSGENCO, Vidyut Soudha, Hyderabad – 500 082

- a) Bidder shall apply in writing to Owner for handing over of the complete Control & Instrumentation System after successful demonstration of tests as specified up to "Availability Guarantee Test".
- b) Owner shall take over charge of the C&I system subject to fulfillment of the conditions enumerated hereunder :
- i) Site check-list prepared by Owner are fruitfully attended by Bidder and certified by Owner.
 - ii) Operation/ Instruction manuals are updated to incorporate changes made up to Availability Test Run.
 - iii) Drawings/ sketches are submitted as per Contract, on as- built basis.
 - iv) Close loop controls, Binary & Sequential controls should be working on auto and interlocks are demonstrated to be functional.
 - v) Equipment and system supplied by Bidder are in working condition.
 - vi) Short supply items, as per Contract, are refurbished by Bidder.
 - vii) The above conditions are in addition to fulfillment of any/all other contractual obligations of Bidder towards Owner. Partial handing-over of systems /equipments shall not be permissible, except if desired so by Owner in special cases.

11.00.00 TRAINING OF PERSONNEL

11.01.00 Bidder shall include in the proposal training of Owner's personnel of different categories for operation, maintenance and troubleshooting of the supplied equipment. Training courses shall be conducted by experienced personnel of Bidder. Course participants shall receive individual copies of technical manuals at the time the course is conducted. Upon completion of each course, training manuals shall be property of Owner. Bidder shall supply all updates and revisions to the manuals.

11.02.00 Training shall be provided to operating, programming and maintenance personnel. The training shall be conducted at original equipment designer / manufacturer's works. While the exact content and duration of such training shall be guided by Bidder's experience , following gives the basic and minimum requirement of operation and maintenance , troubleshooting training from Owner's point of view.

11.03.00 PLANT OPEARTION TRAINING

NO.OF PERSONNEL	CATEGORY OF PERSONNEL	SUBJECT	DURATION
12	Control Engineer	Main plant through DDCMIS OS	8 weeks each
16	Control Engineer	PADO System Usage	2 weeks each

NO.OF PERSONNEL	CATEGORY OF PERSONNEL	SUBJECT	DURATION
12	Control Engineer	Each type of utility plant through PLC OS	4 weeks each

11.04.00 SYSTEM MAINTENANCE TRAINING

NO.OF PERSONNEL	CATEGORY OF PERSONNEL	SUBJECT	DURATION
6	C&I Engineer	DCS Hardware and Software.	8 weeks each
6	C&I Engineer	PLC system Hardware and Software.	2 weeks each
8	Maintenance Engineer	CMIMS System Functioning and Maintenance.	2 weeks each
2	C&I Engineer	MIS Hardware and Software	1 week each
2	C&I Engineer	HART Management System	1 week each
2	C&I Engineer	SWAS Hardware and Software	1 week each
2	C&I Engineer	CEMS Hardware and Software	1 week each
2	C&I Engineer	Ambient Air Quality and Monitoring System Hardware and Software	1 week each
2	C&I Engineer	CCTV Hardware and Software	1 week each
2	C&I Engineer	Plant Telephone And PA System	1 week each
2	C&I Engineer	PADO Hardware and Software	1 week each

NO.OF PERSONNEL	CATEGORY OF PERSONNEL	SUBJECT	DURATION
4	C&I Engineer	RMCMAS Hardware and Software	2 weeks each
4	C&I Engineer	All other Instruments and Systems	Adequate Training

11.05.00 TRAINING ON TG SYSTEM

NO.OF PERSONNEL	CATEGORY OF PERSONNEL	SUBJECT	DURATION
4	C&I Engineer	Turbine Governing Control and protection system Hardware and Software.	2 weeks each
4	C&I Engineer	Turbine Supervisory Instruments	2 weeks each
4	C&I Engineer	TDBFP Governing and protection system	1 week each
4	C&I Engineer	All other Instruments and Systems	Adequate Training

11.06.00 TRAINING ON SG SYSTEM

NO.OF PERSONNEL	CATEGORY OF PERSONNEL	SUBJECT	DURATION
4	C&I Engineer	BMS / Boiler protection system Hardware and Software.	2 weeks each
4	C&I Engineer	Furnace Flame monitoring and Analysis System Hardware and Software.	1 week each

NO.OF PERSONNEL	CATEGORY OF PERSONNEL	SUBJECT	DURATION
4	C&I Engineer	Boiler tube leak detection System	1 week each
4	C&I Engineer	All other Instruments and Systems	Adequate Training

11.07.00 Training for the Engineers & operators shall be based on direct hands-on use of the offered system supported by lectures. Bidder shall train Owner's personnel in the programming and maintenance of the equipment to the extent that Owner's personnel can make corrections and changes to the system and maintain the systems hardware independently. Bidder shall include in his proposal a detailed description of the training course proposed by him (class-room lecture, audio-visual presentation, hands-on). If Bidder conducts Owner's training on regular periodic basis, a printed brochure of such program may be enclosed for reference.

11.08.00 Bidder shall provide all additional training deemed necessary by Owner , if there are modifications to Bidder's system and software after completion of the regular training period.



**CUSTOMER SPECIFICATION
FOR VENTILATION SYSTEM
5X800 MW YADADRI TPS**

DOCUMENT NO.: PE-TS-417-554-A001

REVISION 00

DATE: FEB 2020

**SECTION: I
SUB-SECTION: C 2C
CUSTOMER SPECIFICATION-PAINTING SPECIFICATION**

TECHNICAL SPECIFICATION
FOR
PROTECTIVE LINING AND PAINTING

SECTION-XIII
TECHNICAL SPECIFICATION
FOR
PROTECTIVE LINING AND PAINTING
C O N T E N T S

<u>CLAUSE NO</u>	<u>DESCRIPTION</u>	<u>PAGE NO.</u>
1.00.00	INTENT OF SPECIFICATION	1
2.00.00	CODES & STANDARDS	1
3.00.00	GENERAL REQUIREMENTS	2
4.00.00	EQUIPMENT, MATERIAL AND SERVICES TO BE FURNISHED BY THE BIDDER	4
5.00.00	COATING PROCEDURE AND APPLICATION	7
6.00.00	TEST REQUIREMENTS	8
7.00.00	INFORMATION / DATA REQUIRED	12

SECTION-XIII**TECHNICAL SPECIFICATION****FOR****PROTECTIVE LINING AND PAINTING****1.00.00 INTENT OF SPECIFICATION**

1.01.00 This specification addresses the requirements of all labour, material, and appliances necessary with reference to preparations for lining / painting, application as well as finishing of all lining / painting for all mechanical and electrical equipment, piping and valves, structures etc. included under the scope of this Package.

1.02.00 The Bidder shall furnish and apply all lining, primers including wash primers if required, under-coats, finish coats and colour bands as described hereinafter or necessary to complete the work in all respects.

2.00.00 CODES & STANDARDS

2.01.00 The Bidder shall follow relevant Indian and International Standards wherever applicable in cleaning of surface, selection of lining material / paints and their application. The entire work shall conform to the following standards / specifications (latest revision or as specified).

- a) SSPC SP 10 / NACE 2 / : Near White Blast Cleaning
- b) SSPC PA 2 : Measurement of dry film Coating Thickness with magnetic gauges.
- c) ASTM D 4541 : Method for pull off strength using portable Adhesion Tester.
- d) NACE RP 0274 – 2004 : High-Voltage Electrical Inspection of Pipeline Coatings
- e) NACE SP 0188 – 2006 : Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

- f) NACE RP 0169 – 2002 : Control of External Corrosion on Underground or Submerged Metallic Piping Systems
- g) AWWA C 210 – 2007 : Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
- h) IS 3589:2001 Annexure B : Steel Pipes for Water and Sewage Specification.
- i) AWWA C222-2000 : Polyurethane Coating for the Interior and Exterior of Steel Water Pipe and Fittings.
- j) IS 13213 : 2000 : Polyurethane Full Gloss Enamel (Two pack)

3.00.00 GENERAL REQUIREMENTS

- 3.01.00** The steel surface preparation prior to actual commencement of coating shall conform to SSPC SP 10 / NACE 2 / Sa2½ (near white metal) with sand blasting.
- 3.02.00** The contractor shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to Owner/Consultant for approval.
- 3.03.00** The contractor shall also provide copies of test reports from NABL approved laboratory (like National Test House, Kolkata) in support of the paint/primer materials to be used shall conform to the specification requirement.
- 3.04.00** The contractor shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) shall also be submitted prior to commencement of supply of material and field application.
- 3.05.00** Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.

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- 3.06.00 Applied coating shall be tested for dry film thickness, holiday (electrical inspection for continuity) and adhesion as per relevant standard such as SSPC PA 2, NACE RP 0274 and ASTM D 4541.
- 3.07.00 If necessary, the material may be heated and applied by airless spray / plural component spray system.
- 3.08.00 Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints.
- 3.09.00 In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a Purchaser approved method shall be adopted.
- 3.10.00 The colour scheme of the entire Plant, covered under this specification shall be approved by the Purchaser in advance before application.
- 3.11.00 All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by Purchaser.
- 3.12.00 Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti corrosive painting.
- 3.13.00 For vessels / tanks requiring lining and epoxy painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.
- 3.14.00 Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm.
- 3.15.00 Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore).
- 3.16.00 After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining.

3.17.00 All lining projecting outside of the vessel shall be protected adequately from mechanical damages during shipment, handling storage etc.

3.18.00 Suitable warnings, indicating the special care that must be taken with respect to these lined vessels shall be stenciled on their outside surface with the letters at least 12 mm high.

3.19.00 All insulated piping shall have aluminium sheet jacketing.

4.00.00 EQUIPMENT, MATERIAL AND SERVICES TO BE FURNISHED BY THE BIDDER

4.01.00 After erection at site, the outside surfaces of all equipment having a shop coat shall be given further priming coat and finished coats of paint as detailed in following clauses. However, if the painting system is such that the shop coat and primer coat to be applied at site are not compatible, then shop coat has to be removed from the surface of equipment before application of primer coat with prior blasting.

All factory finished paints shall be touched up at site as required.

All uninsulated piping shall be finished with final paintings after use of proper wash primer and primer. Aluminium sheet jacketed piping need not be painted. Colour bands of Purchaser's approved shade shall however be applied on jacketed piping near walls or partitions, at all junctions, near valves and all other places as instructed by the Purchaser. All structures shall be painted with approved paint.

4.02.00 Surface Preparation

4.02.01 Unless mentioned otherwise, all rust and mill scale shall be removed by blasting to Sa 2-1/2 Swiss Standard before applying the primer.

4.02.02 Special care shall be taken to remove grease and oil by means of suitable solvents like Trichloroethylene or Carbon Tetrachloride.

4.02.03 The minimum degree of surface preparations for all equipment, piping, fittings, valves, structures etc. shall be "Near White" according to Steel Structure, Painting Council-SSPC-SP-10 before application of any primer/paint.

4.03.00 Painting

- 4.03.01 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc. to be installed indoor shall be as follows :
- a) Surface preparation shall be done either manually or by any other approved method.
 - b) Primer Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based zinc phosphate.
 - c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based paint pigmented with Titanium Dioxide.
 - d) Top Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber paint of approved shade and colour with glossy finish.
 - e) Total DFT of paint system shall not be less than 150 microns.
- 4.03.02 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc to be installed **outdoor** shall be as follows :
- a) Surface preparation shall be done by means of sand blasting, which shall conform to Sa 2-1/2 Swiss Standard.
 - b) Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer.
 - c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.
 - d) Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade and colour with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided.
 - e) Total DFT of paint system shall not be less than 300 microns.
- 4.03.03 Specification for application of paints for external surfaces protection of steel pipes and fittings which are **buried underground / laid inside a huge pipe & or submerged Under Water and laid under Pipe Trenches** (in road/rail/pipe or trench crossings) shall be as follows :

External surface of the pipe, fittings, specialties etc. handling raw water/clarified water/filter water shall be painted with one coat of two part chemically cured polyurethane primer of min 50 micron dry film thickness followed by three or maximum four coats of two part solvent less polyurethane to build up coating of dry film thickness of 2000 micron including primer coat.

- 4.03.04 Specification for application of paints for **internal surface protection of large diameter pipes** (sizes above 600 mm NB and above) if any, shall be as follows :
- a) All Internal surfaces of steel pipes, fittings, specialties etc. buried underground or located within pipe trenches shall be given epoxy coating to protect them from (except for drinking water service, where the compatible painting shall be so selected to meet relevant quality standards) corrosion.
 - b) Internal surface of the pipe should be coated with one coat of two part epoxy primer with not less than 50 micron DFT (dry film thickness) followed by two part polyamide cured solvent less epoxy.
 - c) The minimum dry film thickness (DFT) of internal lining shall be 600 micron.
- 4.03.05 Specification for application of paints for protection of **internal surfaces of DM Water Storage Tank(s)** shall be as follows :
- a) Primer - One coat of epoxy primer containing high level of Zinc Phosphate anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.
 - b) Finish Paint - Three (3) coats Polyamine HB Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.
 - c) Total thickness of primer and paint should not be less than 500 microns.
- 4.03.06 All motors, local push button stations, cable racks, structures used for supports etc. are to be painted with acid proof paint.
- 4.03.07 The following surfaces shall not be painted - stainless steel, galvanized steel, aluminum, copper, brass, bronze and other nonferrous materials.
- 4.03.08 No painting or filler shall be applied until all repairs, hydrostatic tests and final shop inspection are completed.

4.03.09 All machined surfaces shall have two (2) coats of water repellant grease after thorough cleaning.

5.00.00 COATING PROCEDURE AND APPLICATION

5.01.00 Surface Preparation :

Pipe shall be blast cleaned by sand. The cleanliness achieved prior to application shall be in accordance with the requirement of SSPC SP 10 / NACE 2 / Sa2½ of ISO 8501 (near white metal)

- a) The blast pattern or profile depth shall be 40 to 100 micron and shall be measured by dial micrometer.
- b) Before sand blasting is started or during blasting or coating, temperature of the pipe surface should be more than 3°C above dew point temperature. Blast cleaned surface should be primed within 4 hours and shall be protected from rainfall or surface moisture and shall not be allowed to flash rust. If the rust occurs, the surface again to be prepared by sand blasting or wire brushing.

5.02.00 Application of Epoxy Coating

- a) Coating shall be applied when
 - i) When the pipe surface temperature shall be atleast 3°C above dew point temperature.
 - ii) The temperature of mixed coating material and the pipe at the time of application shall not be lower than 10°C or greater than 50°C.
- b) Material preparation shall be in accordance with manufacturer's recommendations.
- c) Application of epoxy coating system :

The epoxy coating system shall be applied as per recommendation of the manufacturer and shall be applied by airless spray / plural component spray machine. For more than one coat, the second shall be applied with the time limits as recommended by the manufacturer.

5.03.00 Application of PU Coating

- a) PU coating shall be applied when the pipe surface temperature atleast 3°C above dew point temperature (when R.H is more than 85%).
- b) Material preparation and application shall be done as per manufacturer recommendation.

6.00.00 TEST REQUIREMENTS :**6.01.00 Measurement of dry film thickness**

Measurement of dry film thickness of coating : Coating thickness shall be in the range of $\pm 20\%$ and as per SSPC PA 2.

6.01.01 Apparatus / Instrument:-

The instrument used for dry film thickness may be Type 1 pull of gauges or Type 2 electronic gauges.

6.01.02 Procedures:-

- a) Number of measurements:
For 100 square feet (9.29 square meters), five (5) spots per test area (each spot is 3.8 cm) in diameter. Three gauge readings per spot (average becomes the spot measurement).
- b) If the structure is less than 300 square feet, each 100 square feet should be measured.
- c) If the structure is between 300 and 1000 sq ft, select 3 random 100 square feet test areas and measure.
- d) For structure exceeding 1000 square feet, select 3 random 100 square feet testing areas for the first 1000 sq ft and select 1 random 100 square feet testing area for each additional 1000 square feet
- e) Coating thickness Tolerance: Individual reading taken to get a representative measurement for the spot are unrestricted (usually low or high readings are discarded). Spot measurements (the average of 3 gauge readings) must be within 80% of the minimum thickness and 120% of the maximum thickness. Area measurement must be within specified range.

6.02.00 Electrical Inspection (Holiday) Test

- 6.02.01 All the coated / lined pipes shall be tested with an approved high voltage holiday detector preferably equipped with an audio visual signaling device to indicate any faults, holes, breaks or conductive particles in the protective coating.
- 6.02.02 The applied output voltage of holiday detector shall have a spark discharge of thickness equal to at least twice the thickness of the coating to assure adequate inspection voltage and compensate for any variation in coating thickness. The electrode shall be passed over the coated surface at approximately half the spark discharge distance from the coated surface only one time at the rate of approximately 10 to 20m/min. The edge effect shall be ignored. Excessive voltage shall be avoided as it tends to induce holiday in the coated surface thereby giving erroneous readings.
- 6.02.03 While selecting test voltages, consideration should be given to the tolerance on coating thickness and voltage should be selected on the basis of maximum coating thickness likely to be encountered during testing of a particular pipe.
- The testing voltage shall be calculated by using following formula. (as per NACE 0274 : 2004)
- Testing Voltage $V = 7900 \sqrt{T} \pm 10$ percent where T is the average coating thickness in mm.
- 6.02.04 Any audio visual sound or spark leads to indicate pinhole, break or conductive particle.
- 6.03.00 Adhesion Pull off Test :**
- After holiday the coated surface is subjected to adhesion pull off test as per ASTM D 4541.
- 6.03.01 Apparatus / Instrument: Adhesion tester consists of three basic components:
- A hand wheel, a black column containing a dragging indicator pin and scale in the middle and a base containing three legs and a pulling "Jaw" at the bottom and also dollies.
- 6.03.02 Prepare the test surface :
- Once test area is selected, test area shall be free of grease, oil, dirt, water. The area should be flat surfaces and large enough to accommodate the specified number of replicate test.
- 6.03.03 Prepare Dolly (Test Pull Stub) :

The dolly is a round, two sided aluminium fixture. Both sides of the dolly looks same, however, one side sloped on top surface while flat on bottom surface. As the surface of the dolly is polished aluminium, roughen the same using a coarse sand paper.

6.03.04 Select an adhesive:

Use araldite, a 100% solid epoxy adhesive. This adhesive requires at least 24 hours at room temperature to cure.

6.03.05 Attach the dolly to the surface.

- a) Using a wooden stick, apply an even layer of adhesive to the entire contact surface area of the dolly.
- b) Carefully remove the excessive adhesive by using a cotton swab. Allow the adhesive to fully cure before performing the adhesion test.
- c) Attach the dolly to the coated surface and gently push downward to displace any excessive adhesive.
- d) Push the dolly inward against the surface, then apply tape across the head of the dolly.

6.03.06 Adhesion Test Procedure

- a) Attach the adhesion tester to the dolly by rotating the hand wheel counter clockwise to lower the jaw of the device.
- b) Slide the jaw completely under the head of the dolly. Position the three legs of the instruments so that they are sitting flat on the coated surface.
- c) Slide the dragging indicator pin on the black column to zero by pushing it downward.
- d) Firmly hold the base of the instrument in one hand and rotate the handwheel clockwise to raise the jaw of the device that is attached to the head of the dolly. The dragging indicator pin will move upward on the black column as the force is increased and will hold the reading. Apply the tension using a moderate speed. Continue to increase the tension on the head of the dolly until (a) the minimum PSI/MPa/Kg/cm² required by project specification is exceeded and the test is discontinued, (b) the maximum PSI/MPa/Kg/cm² of adhesion tester has been achieved and dolly is still attached, (c) The force applied by the adhesion tester causes the dolly to dislodge.

e) Read the scale and record the adhesion value.

6.04.00 Coating Repair

Defective Coating shall be repaired in accordance with the following subsections.

6.04.01 Surface Preparation:

Accessible areas of pipe requiring coating repairs shall be cleaned to remove debris and damaged coating using surface grinders or other means. The adjacent coating shall be feathered by sanding, grinding or other method. Accumulated debris shall be removed by blowing with contaminant free air or wiping with clean rags.

6.04.02 Areas not accessible for coating repair such as interior surfaces of small diameter pipe shall be reprocessed and recoated.

6.04.03 Coating Application :

The coating system shall be applied to the prepared areas in accordance with procedure.

6.04.04 Repair Inspection :

Repaired portion shall be electrically inspected using a holiday detector.

6.05.00 Welded Field Joints

6.05.01 Preparation :

The weld joints shall be cleaned so as to be free from mud, oil, grease, welding flux, weld spatter and other foreign contaminants. The cleaned metal surfaces of the weld joint shall then be blasted or abraded using rotary abrading pads. The adjacent liquid Epoxy / PU coating shall be feathered by abrading the coating surface for a distance of 25 mm.

6.05.02 Electrical Inspection :

After curing the coating system applied to the welding joints shall be holiday tested. Any holidays indicated by the detector shall be marked with chalk to identify the area of repair.

7.00.00 INFORMATION/DATA REQUIRED

The Bidder shall submit complete list of paints and primers proposed, giving detail information, such as, chemical composition, drying time etc. and also unit rates for application of each type of paint along with supply shall be furnished.



**TECHNICAL SPECIFICATION
FOR VENTILATION SYSTEM
5X800 MW YADADRI TPS**

DOCUMENT NO.: PE-TS-417-554-A001

REVISION 00

DATE: FEB 2020

**SECTION: I
SUB-SECTION: C3
TECHNICAL SPECIFICATION (ELECTRICAL PORTION)**

**TELANGANA STATE POWER GENERATION
CORPORATION LTD
TELANGANA STATE, INDIA**

5x800 MW YADADRI TPS

**VENTILATION SYSTEM TECHNICAL SPECIFICATION
(ELECTRICAL PORTION)**



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



TITLE: VENTILATION SYSTEM TECHNICAL SPECIFICATION (ELECTRICAL PORTION) 5X800 MW YADADRI TPS	SPECIFICATION NO.
	VOLUME NO. : II-B
	SECTION: I
	REV NO. : 00 DATE: 03/04/2020 SHEET: 1 OF 1

CONTENTS

TITLE	NO OF SHEETS
COVER SHEET	1
CONTENT	1
SPECIFIC TECHNICAL REQUIREMENTS FOR LV MOTORS	3
BASIC TECHNICAL FEATURES OF LV MOTORS	7
ELECTRICAL SCOPE BETWEEN BHEL & VENDOR	2
ELECTRICAL LOAD DATA FORMAT	1
DATASHEET-A	1
DATASHEET-C	2
CABLE SCHEDULE FORMAT	1
EXPLANATORY NOTES FOR CABLE LISTING	2
TOTAL	21

NOTE: THE REQUIREMENTS MENTIONED IN SECTION-I SHALL PREVAIL AND GOVERN IN CASE OF CONFLICT BETWEEN THE SAME AND THE CORRESPONDING REQUIREMENTS MENTIONED IN THE DESCRIPTIVE PORTION IN SECTION-II.



**TECHNICAL SPECIFICATION FOR
VENTILATION SYSTEM
5X800 MW YADADRI TPS
(ELECTRICAL PORTION)**

SPECIFICATION NO.
VOLUME NO. : **II-B**
SECTION : **I**
REV NO. : **00** DATE: 03/04/2020
SHEET : 1 OF 3

**SPECIFIC TECHNICAL REQUIREMENTS
FOR LV MOTORS (ELECTRICAL)**

SECTION-I

	TECHNICAL SPECIFICATION FOR VENTILATION SYSTEM 5X800 MW YADADRI TPS (ELECTRICAL PORTION)	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION : I
		REV NO. : 00 DATE: 03/04/2020
		SHEET : 1 OF 3

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

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

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

Refer “Electrical Scope between BHEL and Vendor” Annexure - I.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc., is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

	TECHNICAL SPECIFICATION FOR VENTILATION SYSTEM 5X800 MW YADADRI TPS (ELECTRICAL PORTION)	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION : I
		REV NO. : 00 DATE: 03/04/2020
		SHEET : 1 OF 3

4.0 List of enclosures:

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

(FOR BHEL-PEM SCOPE PACKAGES)

Page 235

	5 x 800 MW YADRADRI TPS BASIC TECHNICAL FEATURES FOR LT MOTORS (FOR BHEL-PEM SCOPE PACKAGES)	Doc. No.	PE-DC-417-565-E003
		Rev. No.	02
		Dated	16-08-2018
		Page	2 of 7

1.0 This document covers the basic technical features of low tension (LT) squirrel cage induction AC motors employed for driving auxiliaries of BHEL-PEM scope packages in **5 x 800 MW YADRADRI TPS**.

2.0 CODES AND STANDARDS

All motors shall conform to the latest applicable standards as listed below;

- 1) Three phase induction motors: IS: 12615, IEC: 60034
- 2) Single phase AC motors: IS: 996, IEC: 60034
- 3) Crane duty motors: IS: 3177, IEC: 60034
- 4) Energy Efficient motors: IS 12615 or IEC: 60034-30 with Efficiency class IE3

3.0 DESIGN REQUIREMENTS

3.1 Service Conditions

The motors will be installed in hot, humid and tropical atmosphere highly polluted at places with coal dust and/or fly ash. For motor installed outdoor and exposed to direct sunrays, the effect of solar heat shall be considered in the determination of the design ambient temperature.

The design ambient temperature shall be 50 deg C.

3.2 Supply system and rated voltage of motors

KW rating	Supply system	Rated voltage of motor
Upto 0.2 kW	240V/415 V	240V/415 V
Above 0.2 kW & up to 175kW	415 V	415 V

3.2.1 Supply voltage & variations shall be as follows:-

Voltage variation (AC Supply): (+/-) 10%

Frequency variation : (+) 3% to (-) 5%

Combined V & F variation : 10% (sum of absolute values)

During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance.

3.2.2 Motors shall be capable of running continuously at rated output for each of the conditions specified.

3.3 Motor Rating

All motors shall be rated for continuous duty. They shall also be suitable for long period of inactivity. LT motor rating at 50 degree C shall have at least 15% margin over the input power requirement of the driven equipment at rated duty point unless stated otherwise in driven equipment specification. The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating, pull up, break down and full load torques are available for the intended service.

3.4 Starting Requirements

3.4.1 Motor shall start smoothly and rapidly. 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

	5 x 800 MW YADRADRI TPS BASIC TECHNICAL FEATURES FOR LT MOTORS (FOR BHEL-PEM SCOPE PACKAGES)	Doc. No.	PE-DC-417-565-E003
		Rev. No.	02
		Dated	16-08-2018
		Page	3 of 7

accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

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

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 of 85 (eighty five) percent rated voltage.

- 3.4.3 Continuous duty LT motors up to 175 KW Output rating (at 50 deg. C ambient temperature), shall be Premium efficiency (IE3) as per IEC: 60034-30/ IS: 12615 and the locked rotor current of motors shall as per IS 12615.
However, as per system requirement drives rated in the range of 160-210 KW may be considered in either 415V or 3.3 KV

- 3.4.4 Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction. The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage.

- 3.4.5 The following frequency of starts shall apply

- i) Three cold starts in succession with the motor being initially at a temperature not exceeding the ambient temperature.
- ii) Two hot starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- iii) 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)

- 3.4.6 Locked motor withstand time of hot motors at 110% rated voltage shall be as follows:

- a) For motors with starting time upto 20 sec.
- at least 3 sec. more than starting time.
- b) For motor with starting time above 20 secs but not exceeding 45 secs.
- at least 5.0 sec. more than starting time.
- c) For motors with starting time above 45 secs.
- at least 10%. more than starting time.

The starting time of the motor referred above is at minimum permissible voltage. Wherever the above requirements are not complied with, speed switches of approved make & type shall be provided to bypass the locked rotor protection for a pre-selected time during starting of motors. The speed switches shall have one NO & one NC contacts having maximum interrupting capacity of 5 Amps at 240V AC and 0.25 amps at 220 V DC.

Hot thermal withstand curve shall have a margin of at least 10% over the full load current of the motor to permit relay setting utilising motor rated capacity.

	5 x 800 MW YADRADRI TPS BASIC TECHNICAL FEATURES FOR LT MOTORS (FOR BHEL-PEM SCOPE PACKAGES)	Doc. No.	PE-DC-417-565-E003
		Rev. No.	02
		Dated	16-08-2018
		Page	4 of 7

3.5 Running Requirements

- 3.5.1 Motor shall run continuously at rated output over the entire range of voltage and frequency variations as given above.
- 3.5.2 The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals.
- 3.5.3 The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.

3.6 Stress during bus Transfer

- 3.6.1 The motor may be subjected to sudden application of 150% rated voltage during bus transfer, due to the phase difference between the incoming voltage and motor residual voltage.
- 3.6.2 The motor shall be designed to withstand any torsional and/or high current stresses, which may result, without experiencing any deterioration in the normal life and performance characteristics.

4.0 SPECIFIC REQUIREMENTS

4.1 Enclosure

All motor enclosures for outdoor, semi-outdoor & indoor application shall conform to the degree of protection IP-55 unless otherwise specified. Motor for outdoor or semi-outdoor service shall be of weather-proof construction with canopy. For hazardous area approved type of increased safety enclosure shall be furnished.

4.2 Cooling

- 4.2.1 The motor shall be self-ventilated type, either totally enclosed fan cooled IC 411(TEFC), totally enclosed tube ventilated IC 511(TETV) or closed air circuit air- cooled IC 611(CACA).

4.3 Winding and Insulation

All insulated winding shall be of copper. All motors shall have class F insulation but limited to class B temperature rise. Windings shall be impregnated to make them non-hygroscopic and oil resistant.

Tropical Protection

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

All fittings and hardware shall be corrosion resistant.

4.4 Bearings

- 4.4.1 Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be rated for minimum service life of 40,000Hrs.
- 4.4.2 Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred.

	5 x 800 MW YADRADRI TPS BASIC TECHNICAL FEATURES FOR LT MOTORS (FOR BHEL-PEM SCOPE PACKAGES)	Doc. No.	PE-DC-417-565-E003
		Rev. No.	02
		Dated	16-08-2018
		Page	5 of 7

- 4.4.3 Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.
- 4.4.4 Sleeve bearings shall be split type, ring oiled, with permanently aligned, close running shaft sleeves.
- 4.4.5 Grease lubricated bearings shall be pre-lubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication. LT motors 15kW and above shall be provided with external greasing arrangement.
- 4.4.6 Oiled bearing shall have an integral self-cooled oil reservoir with oil ring inspection ports, oil sight glass with oil level marked for standstill and running conditions and oil fill and drain plugs.
- 4.4.7 Forced lubricated or water cooled bearing shall be used as per requirement.
- 4.4.8 Lubricant shall not deteriorate under all service conditions. The lubricant shall be limited to normally available types with IOC equivalent.
- 4.4.9 Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.

4.5 **Noise & Vibration**

- 4.5.1 For 415V motors, maximum double amplitude vibrations upto 1500 rpm shall be 40 microns and 15 microns upto 3000 rpm.
- 4.5.2 The noise level shall not exceed 85db (A) at 1.5 meters from the motor.

4.6 **Motor Terminal Box**

- 4.6.1 Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation
- 4.6.2 Terminal box shall be capable of being turned 360 deg in steps of 90 Deg. for LT motors unless otherwise approved.
- 4.6.3 The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.
- 4.6.4 The terminal box shall have sufficient space inside for termination/connection of XLPE insulated armoured aluminium cables.
- 4.6.5 Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame.
- 4.6.6 The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
- 4.6.7 The terminal box shall be capable of withstanding maximum system fault current for a duration of 0.25 sec.
- 4.6.8 Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used.
- 4.6.9 The gland plate for single core cable shall be non-magnetic type. A suitable cable adopter box shall be provided if the cable size does not allow the direct termination in the main TB.

	5 x 800 MW YADRADRI TPS BASIC TECHNICAL FEATURES FOR LT MOTORS (FOR BHEL-PEM SCOPE PACKAGES)	Doc. No.	PE-DC-417-565-E003
		Rev. No.	02
		Dated	16-08-2018
		Page	6 of 7

4.6.10 Minimum clearances to be provided between phase to phase and phase to earth shall be as under-

Voltage Rating of Motor Minimum Ph-Ph & Ph-Earth clearance

0.415 kV : 25 mm

Note: In case it is not possible to maintain these clearances, the live parts shall be totally insulated from earth and other Phases. Adequate clearances shall be provided for cable connections.

4.7 **Grounding**

The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer.

The cable terminal box shall have a separate grounding pad.

4.8 **Rating Plate**

In addition to the minimum information required by IS, the following information shall be shown on motor rating plate:

- Temperature rise in Deg.C under rated condition and method of measurement.
- Degree of protection.
- Bearing identification no. and Type of lubrication, Quantity and frequency/ time interval
- Location of insulated bearings.

5.0 **ACCESSORIES**

5.1 **SPACE HEATERS**

Motor of rating 30 kW and above shall be provided with space heaters, suitably located for easy removal or replacement. The space heater shall be rated 240 V, 1 Phase, 50Hz and sized to maintain the motor internal temperature above dew point when the motor is idle. The minimum cable size for space heater shall be 2.5 sq.mm copper cable.

5.2 **DELETED**

5.3 **INDICATOR/ SWITCH**

5.3.1 Dial type local indicator with alarm contacts shall be provided for the following:

Hot and cold air temperature of the closed air circuit for CACA motor.

5.3.2 Alarm switch contact rating shall be minimum 2.0 A at 220V D.C. and 10A at 240V A.C.

5.4 **ACCESSORY TERMINAL BOX**

5.4.1 All accessory equipment such as space heater, temperature detector, current transformers etc., shall be wired to and terminated in terminal boxes, separate from and independent of motor (power) terminal box.

5.4.2 Accessory terminal box shall be complete with double compression brass glands and pressure type terminals to suit owner's cable connections.

DRAIN PLUG

	5 x 800 MW YADRADRI TPS BASIC TECHNICAL FEATURES FOR LT MOTORS (FOR BHEL-PEM SCOPE PACKAGES)	Doc. No.	PE-DC-417-565-E003
		Rev. No.	02
		Dated	16-08-2018
		Page	7 of 7

Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.

5.5 LIFTING PROVISIONS

Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.

5.6 DOWEL PINS

The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment.

7.0 PAINTING

Colour scheme for motors shall be shade 631 of IS-5.

8.0 TESTING

8.1 Type Tests

For LT Motors, type test reports for type tests as per IS: 12615/ IEC: 60034 conducted on equipment similar to those proposed to be supplied shall be submitted. The type Test should have been conducted within last 5 years from enquiry date.

8.2 Routine Tests

All motors shall be subjected to routine tests as per IS: 12615/ IEC: 60034 in the presence of customer or customer representative.

9.0 Variable Frequency Drive motor details:

- i) The motor shall be suitable for operation with a solid-state power supply consisting of an adjustable frequency inverter for speed control.
- ii) The motor shall be suitable for the current waveforms produced by the power supply including the harmonics generated by the drive.
- iii) The Motor shall be designed to operate continuously at any speed over the range 20-100 % of rated speed.
- iv) The permitted voltage variation should take into account the steady state voltage drop across the AC drive and all other system components upstream of the motor.
- v) Motors required to be transferred to DOL, by-pass mode shall be rated for specified variations in system line voltage and frequency. Starting current of motor in DOL, bypass mode shall be limited to value in motor specifications.
- vi) The motor shall be constructed to withstand torque pulsations resulting from harmonics generated by the solid-state power supply.
- vii) The motor insulation shall be designed to accept the applied voltage waveform, within the Vpeak and dv/dt limits as per IEC-61800-4.
- viii) The drive manufacturer shall be solely responsible for proper selection of the motor for the given load application and the output characteristics of the drive.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**PACKAGE: VENTILATION SYSTEM****PROJECT: 5 x 800 MW YADADRI TPS**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
8	Conduit and conduit accessories for cabling between equipments supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**PACKAGE: VENTILATION SYSTEM**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
15	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable and electronic earthing cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish Electrical equipment layout & cable tray layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Cabling arrangement of the same (wherever overhead cable trays, trenches, cable ducts, conduits etc.) shall be decided during contract stage. Electrical equipment layout & cable tray layout drawing shall be subjected to BHEL/ customer approval without any commercial implications to BHEL.
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ 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 commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.

	TITLE LV MOTORS <u>DATA SHEET-A</u>	SPECIFICATION NO.	
		VOLUME	II B
		SECTION	C
		REV NO. 00	DATE 19.01.2018
		SHEET 1	OF 1

1.0	Design ambient temperature	:	50 °C
2.0	Maximum acceptable kW rating of LV motor	:	Above 0.2 kW & below 175 kW will be fed from 415V, however as per system requirement drives rated in the range of 160-210 kW may be considered in either 415V or 3.3. kV with due approval from BHEL/TSGENCO
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Degree Of Protection	:	IP55
5.0	Details of supply system		
	a) Rated voltage (with variation)	:	240V, 415V ± 10%
	b) Rated frequency (with variation)	:	50 Hz (Variation: +3% TO –5%)
	c) Combined voltage & freq. variation	:	10% (sum of absolute values)
	d) System fault level at rated voltage	:	50 kA for 1 sec
	e) Short time rating for terminal box	:	50 kA for 0.25 sec
	f) LV System grounding	:	Solidly
6.0	Class of insulation	:	Class ‘F’,with temp rise limited to class B.
7.0	Minimum voltage for starting (As percentage of rated voltage)	:	80% of rated voltage
8.0	Power cables data	:	Shall be given during detailed engg.
9.0	Earth Conductor Size & Material	:	Shall be given during detailed engg.
10.0	Space heater supply (30KW & ABOVE)	:	240 V, 1Φ , 50 Hz
11.0	Rating up to which Single phase motor	:	Acceptable below 0.20 Kw
12.0	TYPE OF STARTER PROVIDED IN MCC	:	DOL
13.0	Locked rotor current		
	a) Limit as percentage of FLC	:	As per IS-12615
	b) Permissible tolerance, if any	:	As per IS-12615
14.0	Terminal box	:	Suitable to rotate at 90 degrees
15.0	Paint shade	:	Shade 631 of IS-5

Page 245

	TITLE	MOTOR DATA SHEET – C 5 X 800 MW YADADRI TPS	SPECIFICATION NO.	
			VOLUME	II B
			SECTION D	
			REV NO. 00	DATE
			SHEET	1 OF 2

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

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE	MOTOR DATA SHEET – C 5 X 800 MW YADADRI TPS	SPECIFICATION NO.	
			VOLUME	II B
			SECTION D	
			REV NO. 00	DATE
			SHEET 2	OF 2

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

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

CABLE SCHEDULE FORMAT

ANNEXURE III

[illegible]

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
 - a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
 - b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
 - e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
 - f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
 - g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
Cable	No. of cores	Cable code	Cable size
Voltage	(e.g. 01,03,3H, 07)	(See C below)	(e.g. 035,185,2.5, 0.5)
Code (see B below)			

(A) **SYSTEM VOLTAGE CODES:**

(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V

(dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) **CABLE VOLTAGE CODES:**

A = 11KV (Power cables)

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

B = 6.6KV (Power cables)
C = 3.3KV (Power cables)
D = 1.1KV (LV & DC system power & control cables)
E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

A = Armoured FRLS	B = Armoured Non-FRLS
C = unarmoured FRLS	D = Unarmoured Non-FRLS

PVC Aluminium

E = Armoured FRLS	F = Armoured Non-FRLS
G = unarmoured FRLS	H = Unarmoured Non-FRLS

XLPE Copper

J = Armoured FRLS	K = Armoured Non-FRLS
L = unarmoured FRLS	M = Unarmoured Non-FRLS

XLPE Aluminium

N = Armoured FRLS	P = Armoured Non-FRLS
Q = unarmoured FRLS	R = Unarmoured Non-FRLS

S = FIRE SURVIVAL CABLES
T = TOUGH RUBBER SHEATH
U = OVERALL SCREENED
V = PAIRED OVERALL SCREENED
W = PAIRED INDIVIDUAL SCREENED
Y = COMPENSATING CABLES
I = PRE-FABRICATED CABLES
Z = JELLY FILLED CABLES

6. Once a cable list has been given to PEM for routing, any subsequent changes required in the cable list (which may be in the form of addition of cables, deletion of cables, change of type or size of cable, etc.) must be informed as specific changes (as a separate file MS Excel of the same format as the original file) to the cable list given earlier if the cable list has been routed and cable schedule generated. The routing status of the cable list shall be got confirmed from PEM by the agency that has prepared the cable list before the changes are intimated. In case PEM confirms that the cable list in question has not been taken up for routing, and the revised cable list is acceptable, the same may be sent. Since cable routing through the program involves adding each cable list to the project cable schedule database, the original cable schedule shall not be furnished to PEM with revisions incorporated within.



**TECHNICAL SPECIFICATION
FOR VENTILATION SYSTEM
5X800 MW YADADRI TPS**

DOCUMENT NO.: PE-TS-417-554-A001

REVISION 00

DATE: FEB 2020

**SECTION: I
SUB-SECTION: C3
TECHNICAL SPECIFICATION (C&I PORTION)**



Technical specification for
Ventilation system

5X800 MW YADADRI TPS

REV. NO. 00 DATE : 18.05.2018

C&I TECHNICAL SPECIFICATION FOR VENTILATION SYSTEM



Technical specification for
Ventilation system

5X800 MW YADADRI TPS

REV. NO. 00 DATE : 18.05.2018

Table of Contents

SECTION	DESCRIPTION
C	Specific Technical Requirement
D	Instrumentation datasheet & Checklist
	LCP, Junction box specification and LCP Quality plan
	C&I Cable BOQ
	KKS Philosophy
	Actuator specification & Datasheet
	Drive control philosophy Erection Hardware Instrument Stub Detail



Technical specification for
Ventilation system

5X800MW YADADRI TPS

SECTION C

REV. NO.

00

DATE : 18.05.2018

SECTION -C

SPECIFIC TECHNICAL REQUIREMENT



Technical specification for
Ventilation system
5X800MW YADADRI TPS

SECTION C

REV. NO.

00

DATE : 18.05.2018

1. The bidder shall provide complete Instrumentation for control, monitoring and operation of entire Ventilation system. Items not specifically mentioned however required for the completeness of the system shall be supplied by bidder.
2. A common PLC based control system cum Annunciation panel with solid state annunciation windows along with product integrated microprocessor panel for the chiller unit shall be provided for the operation of Air Conditioning and Ventilation plant.
3. Common PLC for Air-Conditioning and Ventilation System is being provided and PLC shall be supplied by Air-conditioning supplier. PLC based controls in the ventilation system is provided only for the air washers of the powerhouse building and UAF for ESP control building and FGD control building.
4. Supply air fans, exhaust air fans / roof extractor units of each area shall be provided with their local starter panel in BHEL's scope.
5. The ventilation system shall be controlled from this common Air Conditioning system PLC panel. Bidder to furnish the list of drives/motors/fans/pumps etc., Input/output Lists, Instrument list, Control philosophy etc. to be hooked up to the PLC panel and other necessary inputs so that necessary provision and hardware requirement can be ensured at PLC panel by the AC system bidder for designing and fabrication of its panel.
6. All transmitters shall be smart type and shall have 4-20mA DC signal with superimposed digital communication (HART). Each Temperature element shall be provided with compensating cable, JB/rack & other erection hardware. All transmitters shall be fitted with a local analog/digital indicator displaying appropriate physical units which may be read clearly from an easily accessible position.
7. Bidder to note that all the transmitters/instruments supplied by Bidder shall be rack mounted. The racks shall be preassembled and provided by Bidder. Also no instruments / analysers & JBs/Racks should be protruding on the walkway.
8. All field instruments/motor/pump/blowers shall be terminated on Junction box / Local control panel in field. All erection hardware including junction boxes/Local control panel, canopies, structural steel, LIE, LIR, system cabinets are in bidder's scope. Number of junction boxes shall be sufficient and positioned in the field to minimize local cabling and trunk cable. 20% spare terminals shall be provided in Junction Boxes.
9. Each instrument/ equipment shall have a unique KKS Tag No. Field instrument specification and respective data sheet are given elsewhere in this specification. Each valve/instrument shall be fitted with a stainless steel or aluminium nameplate indicating the valve/instrument service and reference number in accordance with the approved equipment coding system.
10. Instruments must have separate tapping points. Sharing of the same tapping points for redundant instruments or various different instruments is not acceptable.
11. The scope of C&I cables and their erection & commissioning shall be as per Electrical scope sheet defined in Electrical specification.
12. Bidder shall provide Cable Schedule in BHEL excel format which shall be provided during detailed engineering. Also, Cable Interconnections for Complete System shall be in Bidders' scope as per



Technical specification for
Ventilation system

5X800MW YADADRI TPS

SECTION C

REV. NO.

00

DATE : 18.05.2018

Electrical scope between BHEL and Bidder.

13. The solenoid operated valves/Dampers/Gates shall have limit switches for open/close feedback. Operating coil voltage of solenoid valve shall be 24 V DC.

14. Instrument installation and accessories required shall be in Bidder's scope. Bidder shall submit 'Instrument Installation Diagram' and same shall be subject to customer approval during detail engineering without any commercial and time implication.

15. All manual valves at pump discharge shall be provided with Open and Close Limit Switches.

16. All the root valves shall be in bidder's scope. Double root valve shall be provided for all pressure tapping where the pressure exceeds 40kg/cm².

17. Electrical Actuators shall be with integral starter. Datasheets and specifications are given elsewhere in the specification.

18. Redundancy of sensors shall be provided by bidder as given below, irrespective of the instrumentation shown in P&ID:

Two out of three measurements philosophy shall be adopted for all CLCS and Protection for reliability of operation. The control system shall select the median value for the normal control purpose. 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 maintained on auto, with an alarm on the operator's work station as well as engineer's station. 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 bumpless transfer to manual and changeovers shall have suitable alarms in the operator's work station as well as engineer's station. For signal compensations, separate signals from separate transmitters other than used for measurement & control shall be used. For OLCS all sensors used for the protection shall be triple redundant. All sensors for permissive and interlock shall be dual redundant.

19. The bidder shall provide critical group alarms to be hardwired to plant DCS.

20. All the fire dampers offered by the bidders shall have the necessary provisions to accept the fire signals so as the damper gets closed in the event of fire.

21. Bidder to furnish electrical/ UPS load data in his proposal.

22. Interface of MCC, field instruments, Solenoid valve/actuators etc. with PLC/ DDCMIS based control system shall be as per Drive Control Philosophy enclosed in Section-D.

23. 230 V AC UPS supply/ 415 V AC shall be provided by BHEL at a single point as per 'Electrical scope split sheet' in Electrical portion of the specification. Further distribution to various instruments/Equipment shall be in Bidder's scope. Bidder to include the necessary power distribution board in his scope. Any power supply other than the above, if required for any instrument/equipment has to be derived from the above supply & all the necessary hardware for the same shall be in Bidder's scope.

24. The quantity of instruments for the system shall be as per tender P & ID 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



Technical specification for
Ventilation system
5X800MW YADADRI TPS

SECTION C

REV. NO.

00

DATE : 18.05.2018

bidder, even if the same is not specifically appearing in the P & ID and as per detailed specification. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.

25. The specifications for instruments mentioned in the specification are minimum requirements. Datasheets of instrument shall be subject to customer/owner approval.

26. The requirements given below are to be read in conjunction with detailed Technical specification enclosed.

27. The equipment shall be of modern, compact design incorporating the latest developments in proven technology. All instruments whether for local indication or remote transmission shall be of good quality and shall have an accuracy and repeatability appropriate to their duty.

28. The make/model of various instruments/items/systems shall be from approved sub-vendor list subject to approval of owner/purchaser. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.

29. Generally, equipment shall be supplied from one composite range of measurements and control equipment as marketed by a reputable manufacturer of international standing and shall have a minimum of three years' operational use on similar projects.

30. Drawings/Documents and data to be furnished after award of the contract shall be in line with MDL furnished elsewhere in the specification.

31. The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards eg. ANSI, ASME, IEEE, ISO, IEC, IGCI, AWS, NFP A, AISI, IGS, SAMA, UBC, UL, NESC, NEMA, ISA, DIN, VDE, IS etc.

32. Bidder shall provide the signal exchange list, to Plant DCS in BHEL prescribed format to be furnished during detailed engineering.

NOTES:

1. All equipment items shall be of latest design with proven on track record from reputed experienced manufacturers of specified type and range of equipment. The make/model of various instruments/items/systems and instrument sub-vendor shall be subject to approval of BHEL/Customer during detailed engineering stage.

2. The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.

3. Documents of C&I System shall be submitted to end user/owner for approval during detail engineering. Changes, if any, shall be accommodated by the bidder without any price/time implication.



Technical specification for
Ventilation system

5X800 MW YADADRI TPS

SECTION-D

REV. NO.

00

DATE : 18.05.2018

INSTRUMENTATION DATASHEET & CHECKLIST

1.00.00 SPECIFICATION FOR ELECTRONIC TRANSMITTERS

1.01.00 PRESSURE TRANSMITTER

1. Working Principle : Smart (HART Compatible)
2. Type : Microprocessor based, 2 – Wire
3. Output Signal : 4-20 mA DC along with superimposed digital signal
4. Measuring Element : Capsule / Diaphragm
5. Element material : SS-316 (Stainless Steel) or better
6. Static Pressure : 150 % of maximum span continuously, without affecting the calibration
7. Turn-down ratio : 100: 1
8. Span and Zero : Continuous, tamper proof, remote as well locally adjustable with zero elevation and suppression by 100% of span
9. Enclosure Class : IP-65 (Explosion proof for NEC Class-1, Division 1 area)
10. Output Indicator : LCD (Integral indicator of 5 digit display)
11. Nameplate : Tag number, service engraved in SS tag plate
12. Body : SS
13. Operating Voltage : 24V DC
14. Load : 600 Ohms (min.) at 24 Volts D.C.
15. Ambient Temperature : 0 - 50 °C
16. Performance: :
 - i. Accuracy : $\pm 0.075\%$ of Span or better

- | | | |
|-----|-------------------------------------|--|
| ii. | Repeatability | ± 0.05% of Span or better |
| 17. | Sealing/Isolation | : Extended diaphragm (Silicon oil/ Fluorolub filled) with 5 meters SS armoured capillary for corrosive/viscous/solid bearing or slurry type fluid applications |
| 18. | Accessories | : <ul style="list-style-type: none"> a. Universal mounting bracket suitable for 2" pipe mounting b. High tensile carbon steel U-bolts c. Siphon for steam and hot water services d. ½" NPT 2-valve stainless steel manifold, constructed from SS316 bar stock e. Companion flange with nuts, bolts and gaskets f. ½" NPT cable gland g. Handheld calibrator |
| 19. | Adjustment/Calibration/ Maintenance | : From handheld calibrator/ HART management system |

Notes: For primary air/ secondary air/ flue gas applications, DP type transmitters shall be provided for pressure measurement.
LVDT type is not acceptable.

1.02.00 DIFFERENTIAL PRESSURE TRANSMITTER / FLOW TRANSMITTER

- | | | |
|----|-------------------|---|
| 1. | Working Principle | : Smart (HART Compatible) |
| 2. | Type | : Microprocessor based, 2 – Wire |
| 3. | Output Signal | : 4-20 mA DC along with superimposed digital signal |
| 4. | Measuring Element | : Capsule / Diaphragm |

5. Element material : SS-316 (Stainless Steel) or better
6. Static Pressure : 150 % of maximum span continuously, without affecting the calibration
7. Turn-down ratio : 100: 1
8. Span and Zero : Continuous, tamper proof, remote as well locally adjustable with zero elevation and suppression by 100% of span
9. Enclosure Class : IP-65 (Explosion proof for NEC Class-1, Division 1 area)
10. Output Indicator : LCD (Integral indicator of 5 digit display)
11. Nameplate : Tag number, service engraved in SS tag plate
12. Body : SS
13. Operating Voltage : 24V DC
14. Load : 600 Ohms (min.) at 24 Volts D.C.
15. Ambient Temperature : 0 - 50 °C
16. Performance:
 - i. Accuracy : $\pm 0.075\%$ of Span or better
 - ii. Repeatability : $\pm 0.05\%$ of Span or better
17. Sealing/Isolation : Extended diaphragm (Silicon oil/ Fluorolub filled) with 5 meters SS armoured capillary for corrosive/viscous/solid bearing or slurry type fluid applications
18. Accessories :
 - a. Universal mounting bracket suitable for 2" pipe mounting
 - b. High tensile carbon steel U-bolts

- c. Siphon for steam and hot water services
- d. ½" NPT 5-valve stainless steel manifold, constructed from SS316 bar stock
- e. Companion flange with nuts, bolts and gaskets
- f. ½" NPT cable gland
- g. Handheld calibrator

19. Adjustment/Calibration/ Maintenance : From handheld calibrator/ HART management system

~~1.03.00 Displacer Type Level Transmitters~~

- ~~1. Type : Smart (HART Compatible)~~
- ~~2. Stages of operation : Continuous~~
- ~~3. Material :~~
- ~~4. i. Displacer SS-316~~
- ~~5. ii. Suspension wire SS-316~~
- ~~6. iii. Torque tube housing SS~~
- ~~7. iv. Torque tube Inconel~~
- ~~8. v. Displacer chamber SS~~
- ~~9. vi. Transmitter Housing SS~~
- ~~10. Operating Voltage : 24 V DC~~
- ~~11. Transmission : Microprocessor based, 2-wire~~
- ~~12. Output Signal : 4-20 mA DC along with superimposed digital signal~~
- ~~13. Static / overload : Maximum static pressure without~~

~~transmitters. The hand held calibrator shall be suitable for all types of transmitters supplied in the package. If one type of hand held type calibrator is not suitable for communicating with all types of transmitters then separate hand held calibrator will be provided.~~

3.00.00 **PROCESS ACTUATED SWITCHES**

3.01.00 PRESSURE SWITCH

1. Type :
 - i. Piston for high pressure application
 - ii. Bellow / Diaphragm for low pressure application
2. Sensing element : SS-316.
material All other wetted part SS316
3. Case Material : SS
4. Setter Scale : Black graduation on white linear scale.
Graduation 0-100% with red pointer for set points
5. Over range : 150 % of maximum pressure
6. Adjustments :
 - a) Internal Set Point
 - b) Differential adjustment
7. End Connection : 1/2" NPT bottom connected
8. Switch configuration : Two SPDT (240V, 5A AC/220V, 0.5A DC)
9. Switch Type : Snap acting, shock & vibration proof
10. Terminal Block : Suitable for full ring lugs
11. Enclosure Class : IP-65 (Explosion proof for NEC Class-1, Division 1 area)
12. Performance :
 - a) Repeat accuracy $\pm 1.0\%$
 - b) Accuracy of Setting Indication of $\pm 1.5\%$
13. Ambient temperature : 0 – 50 Deg.C

14. Nameplate : Tag number, service engraved in SS tag plate
15. Accessories :
 - a) Silicon oil/ Fluorolub filled Remote diaphragm seal with SS-316 capillary for corrosive/ viscous/ solid bearing or slurry type fluid applications
 - b) Snubbers for pulsating fluid applications
 - c) Siphons for steam and hot water services
 - d) Retention ring and screws for surface mounting
 - e) 1/2" NPT 2 Valve SS-316 barstock manifold
 - f) 1/2" NPT cable gland
16. Applications : During Detail Engineering on Owner's approval

3.02.00 DIFFERENTIAL PRESSURE SWITCH

1. Type :
 - i. Piston for high pressure application
 - ii. Bellow / Diaphragm for low pressure application
2. Sensing element : SS-316.
material All other wetted part SS316
3. Case Material : SS
4. Setter Scale : Black graduation on white linear scale. Graduation 0-100% with red pointer for set points
5. Over range : 150 % of maximum pressure

-
- | | | | |
|-----|----------------------|---|---|
| 6. | Adjustments | : | a) Internal Set Point |
| | | : | b) Differential adjustment |
| 7. | End Connection | : | 1/2" NPT bottom/ back connected |
| 8. | Switch configuration | : | Two SPDT (240V, 5A AC/220V, 0.5A DC) |
| 9. | Switch Type | : | Snap acting, shock & vibration proof |
| 10. | Terminal Block | : | Suitable for full ring lugs |
| 11. | Enclosure Class | : | IP-65 (Explosion proof for NEC Class-1, Division 1 area) |
| 12. | Performance | : | a) Repeat accuracy $\pm 1.0\%$
b) Accuracy of Setting Indication of $\pm 1.5\%$ |
| 13. | Ambient temperature | : | 0 – 50 Deg.C |
| 14. | Nameplate | : | Tag number, service engraved in SS tag plate |
| 15. | Accessories | : | a) Silicon oil/ Fluorolub filled Remote diaphragm seal with SS-316 capillary Diaphragm seals for corrosive/ viscous/ solid bearing or slurry type fluid applications
b) Snubbers for pulsating fluid applications
c) Siphons for steam and hot water services
d) Retention ring and screws for surface mounting
e) 1/2" NPT 5 Valve SS-316 barstock manifold
f) 1/2" NPT cable gland |
| 16. | Applications | : | During Detail Engineering on Owner's |

approval

3.03.00 LEVEL SWITCH

3.03.01 FLOAT OPERATED

1. Float material : SS-316
2. Wetted parts : SS-316
3. Float chamber : Stainless steel/Carbon steel,
construction welded
4. Float chamber : Side mounted
mounting
5. Fluid connection : Side – Side
6. Fluid connection size : 1" ANSI RF Flange (rubber line, if
required)
7. Drain : ½ inch NPT with Plug
8. Pressure rating of
chamber : Minimum 1.5 times of design pressure
9. Repeatability : +/- 1.5 mm or better
10. Switch housing : Stainless Steel
11. Switch housing type : IP- 65
12. Type of switch : Snap acting magnetically operated
hermetically sealed
13. Switch configuration : 2 SPDT (5A, 240 V AC, 0.5A, 220V DC)
14. Accessories : a) Counter flange, nuts
& bolts, suitable
gasket etc.
b) Steel globe type
drain valve
c) ½"NPT cable gland

d) Stainless steel nameplate with alpha-numeric engraved for service and tag

15. Application : During Detail Engineering on Owner's approval

3.04.00 FLOW SWITCH

1. Type : Paddle /Piston/Disk
2. Wetted part material : Stainless steel or Hastelloy for acidic application
3. End connection :
 - a) Threaded upto 1" line size with integral Tee
 - b) Flanged for line size > 1 ½"
4. Enclosure material : Stainless Steel
5. Enclosure class : IP 65
6. Switch configuration : 2 SPDT (5A, 240 V AC, 0.5A, 220V DC)
7. Repeatability : 2%
8. Cable connection : ½"NPTF
9. Accessories :
 - a) Tee, Counter flange, nuts & bolts, suitable gasket etc
 - b) ½"NPT cable gland
 - c) Stainless steel nameplate with alpha-numeric engraved for service and tag

3.05.00 RF LEVEL SWITCH

1. Type : RADIO FREQUENCY
Sensing probe
2. Material : SS-316
3. Mounting : Threaded
4. Application : 250°C (Max.)
Temperature
Electronic Controller
5. Input Supply Voltage : 240V AC ±10%, 50 Hz.
6. Relay Output : 2 SPDT (240V AC, 5A)
7. Ambient Temperature : 50 °C
8. Enclosure Protection : IP-66
9. Enclosure Housing : SS
Normal Level
10. Local LED Indication : Power On
Alarm Level
Probe Healthy
11. Switching Repeatability : ±0.5%
Co-axial cable for probe connection to
controller
12. Accessories : SS Tag plate
½" NPT Cable Glands
13. Application : Solid level

3.06.00 CONDUCTIVITY TYPE LEVEL SWITCH

1. Type : Conductivity discrimination
2. Probe MOC : SS-316
3. Mounting : Flanged on external cage
4. Application : 250°C (Max.)
Temperature
5. Test Pressure : Two times rated pressure

6. Input Supply Voltage : 240V AC $\pm 10\%$, 50 Hz.
Four independent channel with
7. Input : selectable switching threshold for water conductivity
8. Relay Output : 2 SPDT (240V AC, 5A)
9. Ambient Temperature : 50 °C
10. Enclosure Protection : IP-65 (Explosion proof for NEC Class-1, Division-1 area)
11. Enclosure Housing : SS
HI,LO, HIGH-HIGH, LOW-LOW
12. Local LED Indication : Power
Fault
13. Accessories :
 - a) Interconnecting cable from probe to electronics
 - b) Mounting accessories
 - c) External cage
 - d) Washer & Gasket
 - e) $\frac{1}{2}$ " NPT Cable Glands
 - f) SS Tag Plate
14. Application : During Detail Engineering on Owner's approval

~~3.07.00~~ TEMPERATURE SWITCH

1. Type : Bimetallic or gas filled
2. Sensing Element : SS-316
Material
3. Bulb Material : SS-316
4. Capillary : Stainless Steel armored

approval

4.00.00 **LOCAL INSTRUMENTS**

4.01.00 PRESSURE GAUGE AND DIFFERENTIAL PRESSURE GAUGE

1. Type : Bourdon/Bellows/Diaphragm
2. Sensing & Socket : SS-316
3. Movement Material : SS-316
4. Case Material : Stainless steel. IP-65 (Explosion proof for NEC Class-1, Division 1 area)
5. Dial Size : Generally 150 mm
6. Scale : Black lettering on white in 270 O arc.
7. Window : Shatterproof glass
8. Range Selection : Normal process pressure: 50~70 % of range
9. Over-range Protection : 125% of maximum range by internal stop. External stop at zero
For Zero adjustment (Micrometer screw external)
10. Adjustment : For Range adjustment (Micrometer screw internal).
11. Element Connection : Argon welding
12. Process Connection : 1/2" NPT (M) Bottom for local, back for panel mounting
13. Performance : Accuracy of ± 1.0 % of span or better
14. Operating ambient : 0 - 50 °C
15. Safety Feature : Blow out disc /diaphragm at the back
16. Accessories :
 - a) Snubbers for pulsating fluid application.discharge
 - b) Stainless steel Diaphragm seals

		for corrosive/ viscous/ solid bearing or slurry type fluid applications
	c)	3-Way SS316 Gauge cock for pressure gauges
		5-valve SS316 manifold from
	d)	barstock for differential pressure gauge
	e)	Siphons for steam and hot water services
17. Nameplate	:	Tag number, service engraved in stainless steel tag plate
4.02.00	LEVEL INDICATOR (FLOAT & BOARD TYPE)	
1. Type	:	Float and Board
2. Float Material	:	SS-316
3. Float Cable	:	SS-316
4. Indicator Assembly	:	Epoxy painted Aluminium
5. Guide wire spring assembly	:	SS-316 (2 Nos.)
6. Guide Wire Anchor	:	SS-316
		Anodized Aluminium with engraved marking (Minimum graduation 10mm),
7. Scale Board	:	mounting brackets and suitable hardware required as per tank height
8. Elbow Assembly	:	Anodized Aluminium
9. Flanges	:	RF , ANSI 150 , SS (3 Nos.)
10. Accuracy	:	± 10 mm or better
11. Accessories	:	All mounting accessories including counter flange, nuts & bolts, suitable

- | | | |
|------------------------|---|--|
| 10. Test Pressure | : | 200% of maximum operating pressure |
| 11. Scale | : | 250 mm nominal length |
| 12. Graduation | : | Direct reading |
| 13. Process Connection | : | Flanged (RF) to line size as per ANSI standards (150#) |
| 14. Tapping | : | D & D/2 |
| 15. Accuracy | : | +/- 2% of full scale reading |
| 16. Reproducibility | : | Within 0.5% of instantaneous reading |
| 17. Accessories | : | SS Tag Plate, orifice plate |

5.00.00 TEMPERATURE ELEMENTS & ACCESSORIES

5.01.00 RESISTANCE TEMPERATURE DETECTOR

- | | | |
|----------------------------------|---|--|
| 1. Type | : | Platinum (Duplex), Ungrounded |
| 2. Platinum (Duplex), Ungrounded | : | 100 ohm at 0 °C |
| 3. Base | : | Wound on ceramic (anti-inductive) |
| 4. Wiring | : | 3 Wire |
| 5. Protecting Tube | | |
| a) O.D. | : | 6 mm |
| b) Material | : | SS-316, Seamless |
| c) Filling | : | Magnesium oxide (Purity above 99.4%). |
| 6. Response time | : | a) 15 sec. (bare).
b) 30 sec. (with thermowell) |
| 7. Calibration | : | DIN 43760 |
| 8. Accuracy | : | ± 0.5% |
| 9. Head | | |
| a) Type | : | IP-65 universal screwed type |

-
- b) Material : Stainless Steel
- c) Terminal blocks : Nickel plated Brass-screw type / silver plated
- d) Cable connection : ½" NPT gland and grommet
- e) Others : Terminal head cover with SS chain and suitable gasket.
- Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable).
- Adjustable nipple-union-nipple [1/2" Sch 80 X ½" NPT] with thermowell connection
10. Accessories : a)
- b) Compression fittings/unions
- c) Flanges etc. (for flanged connections only)
- d) Thermowell (As specified below)
11. Thermowell connection : ½" NPT (M) or 150 RF Flanged
- Tag number, service engraved in
12. Nameplate : stainless steel tag plate

Note: The specifications for RTDs of winding/ bearing of motor/pump, can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However, the type of RTD shall be Pt-100.

5.02.00 THERMOCOUPLES

1. Type :
 - a) 16 SWG wire of Chromel AlumeI) (Type-K)
 - b) Duplex
 - c) Ungrounded
2. Protecting Tube
 - a) O.D. : 6 mm
 - b) Material : SS-316, Seamless
 - c) Filling : Magnesium oxide (Purity above 99.4%).
3. Response time :
 - a) < 20 seconds for measurement
 - b) < 10 seconds for control
4. Accuracy : $\pm 1.1^{\circ}\text{C}$ up to 300°C & 0.4% of measured temperature range above 300°C
5. Head
 - a) Type : IP-65 universal screwed type
 - b) Material : Stainless Steel
 - c) Terminal blocks : Nickel plated Brass-screw type / silver plated
 - d) Cable connection : $\frac{1}{2}$ " NPT gland and grommet
6.
 - e) Others : Terminal head cover with SS chain and suitable gasket.

Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable).

- | | | | |
|----|-----------------------|---|--|
| 7. | Accessories | : | <p>a) Adjustable nipple-union-nipple [1/2" Sch 80 X 1/2" NPT] with thermowell connection</p> <p>b) Compression fittings/unions</p> <p>c) Flanges etc. (for flanged connections only)</p> <p>d) Thermowell (As specified below)</p> |
| 8. | Thermowell connection | : | 1/2" NPT (M) or 150 RF Flanged |
| 9. | Nameplate | : | Tag number, service engraved in stainless steel tag plate |

5.03.00 TEMPERATURE GAUGE

- | | | | |
|----|-----------------------------|---|--|
| 1. | Type | : | Expansion type (Liquid filled system) |
| 2. | Sensing Element Material | : | Bourdon – SS-316 |
| 3. | Bulb and Capillary Material | : | SS-316 |
| 4. | Capillary Tubing | : | <p>Inner sheath - solid drawn Material</p> <p>copper tube</p> <p>Outer sheath - PVC tube</p> |
| 5. | Movement Materials | : | Stainless Steel / Direct Bourdon tip connection to pointer spindle |
| 6. | Case Material | : | Stainless Steel stove enameled, black finish, threaded bezel ring, clear glass |

		cover conforming to IP 65.
7.	Dial size	: 150 mm
8.	Scale	: Black lettering on white background in 270 Deg.C arc
9.	Over range protection	: 125 percent of FSD
10.	Capillary Glanding	: 1/2" NPT(M) x compression fitting (SS) to suit capillary
11.	Instrument Connection	: Bottom connection for local mounting, back connection for panel mounting
12.	Process Connection	: 1/2" NPT (M) or 150 RF Flanged
13.	Extension Neck Length	: 50 mm
14.	Compensation	: a) Capillary compensation
15.		: b) Case compensation
16.	Performance	: a) Accuracy : + /- 1.0 percent of full scale Deflection
		: b) Repeatability : Less than 0.5 percent of full range
		: c) Response time: 15 seconds (max.).
17.	Capillary length	: 3.0 meters (local) / 15.0 metres (local panel)
18.	Other features	: Shatter proof glass
19.	Nameplate	: Tag number, service engraved in stainless steel tag plate
20.	Accessories	: SS316 Thermowell
5.04.00	THERMOWELL	
1.	Material	: SS-316
2.	Manufacture	: Drilled from bar stock, Hex Head, Tapered design (As per ASME PTC 19.3)

3. Process connection : M33x2
4. Certification : Not applicable
5. Bore concentricity : +5% of wall thickness
6. Identification mark : Tag number punched on head
7. Surface treatment : Polish after machining
8. Element connection : ½" NPT (M) or 150 RF Flanged
9. Head : Hex
10. Length of the hex head : 31.75 mm (min.)
11. Accessories : SS Plug and chain for test thermo wells
SS Nameplate, Flange with companion
flange & all required accessories for
flanged connections.

Note: Wake frequency calculations shall be furnished for all thermowells for approval.

Thermowells shall be designed such that the resonant frequency is above the exciting frequencies generated by vortex shedding in the process fluid.

5.05.00 METAL TEMPERATURE THERMOCOUPLE

1. Measuring medium : Metal temperature
2. Type : Chromel Alumel (Type-K)
Duplex, Ungrounded
3. Insulation : Mineral Insulation Magnesium Oxide
4. Wire gauge : 16 AWG
5. Protective sheath : SS
6. Protective sheath diameter : 8 mm O.D.
7. Characteristics : Special limits of error as in ANSI thermocouple MC 96.01
8. Accessories : ½" BSP SS sliding end connector, weld pad, clamps of heat resistant steel

1. Type : Hydrometer Type
2. Mounting : On line
3. Accuracy : +/- 2% of range
4. Scale : Black letter on white scale
5. End connection : PVC flange

9.06.00 DENSITY/ CONCENTRATION METER

1. Wetted Part : Stainless Steel
2. Enclosure : Stainless Steel (IP-65)
3. Power Supply : 24 V DC
4. Output signal : 4-20 mA DC (isolated) into 600 ohms
5. Accuracy : ± 0.001 g/cc
6. Indication : LCD display
7. Temp. Compensation : Integral
8. Accessories : Mounting hardware, integral amplifier
(if required), cable glands, tag plate
etc.

10.00.00 SOLENOID VALVES

1. Operating Principle : Electromagnetic (noiseless)
2. Coil voltage rating : 240 V AC /24 V DC (as required)
3. Ways : 2/3/4 way
4. Port size : 1/4" NPT all ports
5. Body : SS bar stock
- Trim : SS-316
6. Duty : Suitable for continuous energization
7. Sealing : Airtight and leak proof
8. Ambient Temperature : 0 - 50 ° C

-
- | | | | |
|-----|-------------------|---|--|
| 9. | Fluid Temperature | : | 0-150 ° C (approx.) |
| 10. | Coil Enclosure | : | Stainless Steel |
| 11. | Insulation | : | Class-H |
| 12. | Coil Casing | : | IP-65 (Explosion proof for NEC Class-1, Division-1 area) |
| 13. | Mounting | : | On pipe or on panel |
| 14. | Cable Connection | : | ½" NPT |
| 15. | Accessories | : | Cable glands, SS Tag plate |



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

CHECK LIST FOR PRESSURE SWITCH

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

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

Note :

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



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

CHECK LIST FOR TRANSMITTER

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

Legend :

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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 :

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Note :

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



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

CHECK LIST FOR ANNUNCIATORS

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

Legend :

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

Note :

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



Technical specification for
Ventilation system

5X800 MW YADADRI TPS

SECTION-D

REV. NO.

00

DATE : 18.05.2018

LCP & JUNCTION BOX SPECIFICATION

- 1.00.00 **GENERAL REQUIREMENT**
- 1.01.00 ENCLOSURES FOR INSTRUMENTS AND OTHER EQUIPMENT
- 1.01.01 All panels, cabinets, distribution boxes, junction boxes, terminal boxes and all other field mounted equipment / enclosures shall have suitable environmental protection as detailed in Section-I of this volume of the specification.
- 1.02.00 SURFACE PREPARATION & PAINTING
- 1.02.01 All sheet metal panel/ desk exterior steel surfaces shall be sand blasted, ground smooth and painted as specified below.
- 1.02.02 Suitable filler shall be applied to all pits, blemishes and voids in the surface. The filler shall be sanded so that surfaces are level and flat; corners are smooth and even. Exposed raw metal edges shall be ground burr-free. The entire surface shall be blast clean to remove rust and scale and all other residue due to the fabrication operation. Oil, grease and salts etc. shall be removed from the panels by one or more solvent cleaning methods prior to blasting.
- 1.02.03 Two spray coats of inhibitive epoxy primer surfacer shall be applied to all exterior and interior surfaces, each coat of primer surfacer shall be of dry film thickness of 1.5 mil. A minimum of two spray coats of final finish color (Catalyzed epoxy or polyurethane) shall be applied to all surface of dry film thickness 2.0 Mil. The finish colors for exterior and interior surfaces shall conform to the following shades:
- Exterior – Opaline green shade 275 of IS: 5 or equivalent international code..
 - Interior - Brilliant White.
- 1.02.04 Paint films, which show sags, cheeks, blisters, teardrops, fat edges or other painting imperfections, shall not be acceptable.
- 1.03.00 WIRING
- 1.03.01 All spare contacts of relays, switches and push buttons shall be wired up to the terminal blocks. All intercommunications between sections of panels/desks shall be furnished.
- 1.03.02 Each wire shall be identified at both ends with wire designation as per approved wiring diagram. Heat shrinkable type ferrules with indelible computerized ink print shall be used with cross-identification.
- 1.03.03 All wire termination shall be made with insulated sleeve and crimping type lugs. Wire shall not be spliced or tapped between terminals. Open-ended terminal lugs will not be accepted. Wires shall not be looped around the terminal screws or studs.

- 1.03.04 Internal wiring should be terminated uniformly on one side of the terminal block leaving the other side available for termination of outgoing cables. Internal wiring shall be grouped so that all outgoing wiring to each particular remote location is terminated on adjacent terminal blocks. Interior wiring and jumperings shall be arranged so that external connections can be made from internal side of terminal blocks. Common connections shall be limited to two (2) wires per terminal.
- 1.03.05 Wiring shall be arranged to ensure free access to all instrument or devices for maintenance. No wire shall be routed across the face or rear of any device in a manner, which will impede the opening of covers or obstruct access to leads, terminals or devices
- 1.03.06 Wires shall be dressed and run in trays or troughs with clamp-on type covers. Wirings may be neatly bunched in groups by non-metallic cleats or bands. Each group shall be adequately supported along its run to prevent sagging or strain on termination.
- 1.03.07 Shield wires shall be terminated on separate terminal blocks. Common connections shall be limited to two wires per terminal. Signal circuit shields shall be grounded at the power supply end only or as recommended by manufacturer.
- 1.03.08 All low level signal cables shall be separately bundled to from control cable and maintained at 300 mm minimum spacing from control bundles.
- 1.03.09 Panel internal wiring shall follow distinct color-coding to segregate different voltage levels viz. 24V DC, 48V, 110V AC, 240V AC, 220V DC etc.
- 1.03.10 Thermocouple lead wires, analyzer measuring lead wires, or any other lead wires carrying measuring signal of the order of low milli volt or micro volt shall be electrically and physically isolated from other AC and DC wiring. Shielded wires used in such cases for panel internal wiring shall be continuous and ungrounded with the shield terminated individually and separately in panel terminal block.
- 1.03.11 Wiring to door mounted devices shall be provided with multi-strand wires of (49 strands minimum) adequate loop lengths of hinge-wire so that multiple door openings will not cause fatigue failure of the conductor.
- 1.03.12 Internal wiring in factory pre-wired electronic systems cabinets may be installed according to the Contractor's standard wire size, insulation, and method of termination on internal equipment. Insulation for all wiring, including circuit board wiring, back panel wiring, power supply wiring and interconnecting cables between devices shall pass the vertical flame test per IPCEAS-1981. Identification of conductors may be done by insulation color-coding identified on drawings or by printed wiring lists.

1.04.00 TERMINAL BLOCKS

- 1.04.01 All terminal blocks shall be rail mounted/ post mounted type, cage clamp type with high quality non-flammable insulating material of melamine suitable for working temperature of 105 Deg C. The terminal blocks in field mounted junction boxes, instrument enclosures racks etc. shall be suitable for cage clamp connections. The terminal blocks in Control Equipment Room termination/ marshalling cubicles shall be suitable for post mounted cage clamp connection at the field input end. The exact type of terminal blocks to be provided by Bidder shall be subject to Owner.
- 1.04.02 All terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, small partitions, transparent covers, support brackets, distance sleeves, warning level, marking etc. For RTDs ring - tongue type lugs shall be used at Junction Boxes.
- 1.04.03 The characteristics of the terminal blocks shall be as follows.
- i) High contact force, independent of conductor cross-section and large contact surface area.
 - ii) Integrated self-loosening protection to avoid shifting of contact surface that may allow contamination of connection point.
 - iii) Inspection and maintenance free (resistant to thermal aging and vibration)
 - iv) Low and constant voltage drop
- 1.04.04 The insulation of the terminal blocks shall be of suitable thermoplastic material.
- 1.04.05 The spacing between Terminal blocks channels in panels and cubicles shall be adequate for routing the cable troughs and to allow adequate free workspace for termination and removal of wires. The terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks and junction box walls.
- 1.04.06 Signals of different voltage levels shall be clearly segregated by providing separate rows to each type of signal and by using terminal blocks of different color for each type of signal and by providing barrier strips between them.
- 1.04.07 Terminal blocks shall be provided with white marking strips / self-adhesive marker cards and where permitted by the safety codes and standards, shall be without covers. Power terminals and high voltage (above 48 volts) terminals shall have protection covers. All terminals shall be provided with permanent terminal identification numbers on both sides.
- 1.04.08 At least 20% spare unused terminals shall be provided on each terminal block for circuit modifications and for termination of all conductors in a multi-conductor control cable.

- 1.04.09 The bottom of the terminal block shall be at least 200 mm above the cable gland for bottom entry type panels.
- 1.04.10 For extending 24 V DC supply to panels, the size of the terminals shall be decided based on voltage drop and not based on current.
- 1.04.11 Other requirements of the terminal blocks are as follows:
- i) The last terminal in a rail-mounted assembly shall be closed with an end plate and end bracket.
 - ii) For visual and electrical separation of terminal groups, partition plates shall be provided, which can be push fitted after forming an assembly.
 - iii) Design shall permit testing of incoming and outgoing signals by using suitable test plug and socket without disconnecting the cable connections.
 - iv) It shall be possible to use jumper plugs through the above test plug socket to connect adjacent terminals. Adequate number of short circuit jumper plugs shall be provided for the purpose.
 - v) Where more than one connection to a terminal block is required, two tier terminals shall be used.

1.05.00 GROUNDING

- 1.05.01 Separate Protective and Electronic system ground as required shall be provided.
- 1.05.02 All panels, desks, cabinets shall be provided with a continuous bare copper ground bus (Frame ground), bolted to the panel structure at bottom on both sides and effectively ground the entire structure. The bolts shall face inside of panels.
- 1.05.03 For electronic system cabinets the electronic system ground bus (Electronic ground) shall be similar but insulated from the cabinet and shall be separately connected to the system ground. The same ground may be used to earth the shield of shielded signal cables, otherwise a separate ground bus shall be provided for connecting the signal cable shields. Cable shields shall be grounded at the panel end only and shall never be left open. The electronic ground between panels of a shipping section shall be firmly looped.

2.00.00 ~~CONTROL DESKS & PANELS~~

2.01.00 GENERAL

- 2.01.01 All control desk, panels etc. shall be furnished fully wired with necessary provision for convenience outlets, internal lighting, utility receptacles, grounding, ventilation, space heating, anti-vibration pads, internal piping &

be mounted on the back up panels.

2.04.00 PANELS /CABINETS

2.04.01 All DDCMI S system modules, power supply components and other Local Control panels (PLC/Relay based) shall be housed in cabinets as specified below.

2.04.02 The cabinet mounted equipments shall be fully assembled, installed in mounting racks, wired and fully tested as per specification requirements and Owner approved drawings prior to shipment to the project site.

2.04.03 The Bidder shall ensure that the cabinets are complete & ready for installation before dispatch from manufacturing works. The installation work at project site for these cabinets shall only involve connections through multi-pair cables from marshalling cabinets (wherever provided) to system cabinets and inter-cabinet/cabinet to Control Desk/ Back up Panel.

2.04.04 All electronic cards, network components, power supply modules etc. located shall be suitably housed in cabinets and shall be neatly arranged in sub-racks. Network components shall be visible in door closed condition (e.g. Glass doors etc.) as approved by Owner.

2.04.05 Bidder shall design the cabinet internal arrangement, floor cutout and cable gland plate such that all the cables entering or leaving the cabinet can be properly glanded in the gland plate.

2.04.06 The packaging density of panels shall be such that the temperature rise within the panels shall never exceed 10°C above ambient even under worst operating conditions. Cooling Fans shall be provided wherever required and this shall be of industrial grade.

2.04.07 TECHNICAL PARTICULARS

1. Material of Construction : Cold Rolled Coil Annealed (CRCA) steel sheet
2. Thickness of Sheet : a) 2.0 mm for faces supporting instruments / terminals
: b) 1.6 mm for other sides and top
3. Construction : Welded throughout as per approved National Standards
4. Post welding operation : a) Grounding of all welds to smoothness
: b) Rounding of corners

- : c) Cleaning of weld spatters
- 5. Panel height : 2300 mm (approx)
- 6. Corners : 7 mm inner radius
- 7. Dimensional Tolerances :
 - a) In height & length - 3 mm
 - b) In height between adjacent sections - 2 mm
 - c) Total for a group - 6 mm
- 8. Doors : Double, recessed, turned back edges, full height front & rear
 - i) Thickness of Sheet : 2 mm
 - ii) Hinges : Stainless steel
 - iii) Door latches : Three point type
 - iv) Door gaskets : Neoprene rubber on fixed frame to result dust proof/weatherproof enclosure
 - v) Opening of the doors : Outward
 - vi) Louvers : With removable wire mesh to ensure dust and vermin proof
- 9. Gland plates : Removable in sections
4 mm thick (bottom)
- 10. Cable entry : Bottom
- 11. Hardware :
 - a) Anti vibration pad- 15 mm
 - b) Predrilled base channel IS MC – 100 or equivalent for all sides
 - c) Stainless steel buff- finished 2 mm thick kick plate for all sides
 - d) Stainless steel scratch strips along desk edges fixed with pan-head recessed screws
 - e) Rubber strips to ensure air

- tightness between kick plate and finished floor
- f) Lifting hook / Eye bolt
- g) Drawing pocket
- h) Door switch, lamps, thermostat, heaters and industrial grade cooling fans,, illumination fixtures
12. Name Plate : Both at front and back surface of the panel
13. Fixing of name plate : Stainless steel pan head screws
14. Name plate material : Laminated phenolic (3 layers)
15. Lettering : Black with white engraved
16. Mounting of terminal blocks : Vertical angle support bracket welded on sheet steel plate, screwed on internal wall of enclosure

2.05.00 FURNITURE

All the furnitures in the Central / Local control Room (s), Engineers' rooms, Instrument Laboratory, SWAS Room & any other rooms with C&I equipments located in different plant buildings under Bidder's scope shall be included in Bidder's scope of supply. Bidder shall provide following industrial grade furniture items as a minimum from reputed manufacturers/suppliers meeting International Standards. The furniture shall be modular and latest with ease of operational features. The furniture shall be modern, aesthetically designed, modular, flexible, space saving and future safe.

2.05.01 WORK STATION FURNITURE

Modular workstation furniture, suitable for mounting servers & historians, programmer stations, PC based systems, printers (A4/A3 color laserjet) etc. shall be provided.

2.05.02 PC RACK

PC Racks shall be provided to mount CPUs of workstations/PCs of OWS/LVS etc. in control room. For each PC / workstation / monitor at least one chair shall be included.

2.05.03 CHAIRS

- clearly brought out by the Contractor in his offer, along with all relevant details/basis.
- 3.03.00 Any other requirement for proper LVS mounting & functioning & viewing shall also be specifically brought out by the Contractor in his offer, along with all relevant details.
- 4.00.00 **LOCAL INSTRUMENT RACK (LIR) & LOCAL INSTRUMENT ENCLOSURE (LIE)**
- 4.01.00 GENERAL
- 4.01.01 Devices (Transmitters/ Switches) located in the field shall be suitably grouped together to the extent possible and installed in the LIE (Closed Rack) and LIR (Open Rack) in Boiler/TG Building and Off-site plant areas.
- 4.01.02 Racks and enclosure shall be factory prefabricated & painted and shall complete with internal piping, tubing, manifold, isolation valves, blowdown valves, integral junction box, illumination etc.
- 4.01.03 No more than six instruments shall be grouped in a single rack / enclosure.
- 4.01.04 Racks shall be installed above the tapping points for air, flue gas and coal air mixture application whereas for applications such as for water and steam, racks to be installed below the source point.
- 4.01.05 Attention shall be paid in the layout to avoid air traps in liquid piping and water accumulation in air/gas piping.
- 4.01.06 Racks used for furnace, flue gas and air application shall be provided with intermittent & continuous air purging
- 4.01.07 Welding of impulse lines shall comply with the provisions of the latest applicable ANSI Code for Pressure Piping.
- 4.01.08 Earth stud shall be furnished at rack for safety grounding.
- 4.02.00 **LOCAL INSTRUMENT ENCLOSURE (LIE)**
- 4.02.01 Enclosure shall be free standing type. Racks shall be adequately reinforced to ensure true surfaces and to provide support. Major load-bearing posts shall be suitably supported by gusset plates or moment members.
- 4.02.02 Enclosure outer shall be constructed from at least 3 mm thick steel plate and epoxy painted to shade gray. Base frame shall be made of ISMC 100 and black colour finish.
- 4.02.03 2" NB galvanized pipes shall be laid horizontally and supported at two end channels to mount transmitters at accessible height. Center posts or any

- member, which would reduce access, shall be avoided.
- 4.02.04 Double leaf interlocking front opening doors with three point locking shall be provided and shall be arranged for maximum possible access to the interior. Key shall be of identical for all enclosures.
- 4.02.05 Doors shall have concealed quick removal type pinned stainless steel hinges and locking handles. Gaskets shall be used between all mating sections to achieve dust and weather proof enclosure rated for IP -65 including the internal junction box. All enclosures shall have access doors on front side.
- 4.02.06 Removable type bulk head plates of thickness not less than 6 mm shall be mounted at the racks with suitable high temperature gasket. Impulse lines within the enclosures shall be properly clamped.
- 4.02.07 All internal wirings between the instruments and junction box shall run through flexible conduits. No exposed wirings within transmitter racks both open and closed type, is admissible.
- 4.02.08 Racks shall have a common blowdown drain header, which will connect individual instrument blowdown line after suitable pressure breaking through regulating globe type blowdown valves. Covered funnels shall be used for saturated liquid and steam service, whereas, open funnels may be used for cold liquid services. Header (2" NB ASTM A 106, Sch -80 Gr. C) shall be suitably sloped and shall have one end flanged and extending beyond the rack for connection to plant drain header..
- 4.02.09 Each rack shall be provided with one receptacle, light fixtures with wire guard and one lighting switch each at instrument & Junction box compartments with wire guard. Lighting switches may be door actuated & mounted inside the panel. Outlet box, switch box and device covers shall be of galvanized stamped steel. Light switches and receptacles shall be installed inside the enclosure on the wall near the latch side of the enclosure door. Light fixtures shall be installed on the ceilings of the enclosures.
- 4.02.10 Power supplies for miscellaneous devices shall be provided with MCB located within the enclosures. MCB shall be mounted in fuse blocks. Nameplates shall be furnished above the MCB blocks, identifying the devices being served.
- 4.02.11 Vibration dampeners shall be installed for supporting each enclosure. The loading at each corner of the enclosure shall be determined by actual test weighting when construction is complete to determine the correct length of each dampener for proper loading of the dampener in accordance with manufacturer's recommendations
- 4.03.00 LOCAL INSTRUMENT RACK (LIR)
- 4.03.01 Rack shall be free standing type constructed from 6 mm thick steel channel frame provided with a canopy to protect the instrument from dripping water or

falling objects and shall be epoxy painted. Canopy shall be of CR CA steel sheet of at least 3 mm thickness.

4.03.02 Rack Major load-bearing posts shall be suitably supported by gusset plates or moment members. Suitable fenders grill shall be welded to the end-posts of the rack to outline a boundary beyond which no mounted equipment shall project to protect instrument from accidental contact during personnel movement. Center posts or any member, which would reduce access, shall be avoided.

4.03.03 2" NB galvanized pipes laid horizontally and supported at two end channels shall be employed at working accessible height for mounting of instruments.

4.03.04 All internal wirings between the instruments and junction box shall run through flexible conduits. No exposed wirings are admissible.

4.03.05 Racks shall have a common blowdown drain header, which will connect individual instrument blowdown line after suitable pressure breaking through regulating globe type blowdown valves. Covered funnels shall be used for saturated liquid and steam service, whereas, open funnels may be used for cold liquid services. Header (2" NB ASTM A 106, Sch -80 Gr. C) shall be suitably sloped and shall have one end flanged and extending beyond the rack for connection to plant drain header..

Each rack shall be provided with one receptacle, one light fixture with wire guard and one lighting switch. Outlet box, switch box and device covers shall be galvanized stamped steel. Light fixtures shall be installed on the canopy of the rack

4.03.06 Power supplies for miscellaneous devices shall be provided with MCB located within the enclosures. MCB shall be mounted in fuse blocks. Nameplates shall be furnished above the MCB blocks, identifying the devices being served.

4.04.00 JUNCTION BOX

- | | | |
|----------------------|---|--|
| 1. Type of Enclosure | : | Dust tight & weatherproof conforming to IP 65 |
| 2. Material | : | 3 mm sheet steel / fibreglass reinforced polyester(UV stabilized) |
| 3. Type of Cover | : | Solid unhinged with retention chain / Screwed at all four corners |
| 4. Paint | : | i) Exterior : Opaline green shade 275 of IS: 5
ii) Interior - Brilliant Glossy White. |

- Surface / Two (2) inch Pipe stanchion
5. Mounting : (At a dry compartment at one side of the enclosure / rack with front opening type door)
6. Cable Entry : 3 mm (min) Bottom / side Gland plate
7. Gasket : Neoprene
8. Grounding : Brass earth lug with green screw head
External-2 nos , Internal-1no. (M6)
9. Number of Drain Holes : Two at bottom capped
10. Identification : Label for JB and Tags for cable
11. Accessories :
- a) Rail mounted cage clamp type screwless terminals (suitable for conductor size up to 2.5sq.mm of suitable voltage grade) with markers and 20% spare terminals
 - b) Cable gland (Brass) & raceways
 - c) Ferrules & lugs (Brass)
 - d) Aluminum back panel
 - e) Canopy at top
 - f) Mounting brackets
 - g) bolts and nuts made of brass etc.



SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A

VOLUME II B

SECTION D

REV. NO. 03

DATE : 16-09-2013

SHEET 1 OF 6

1.0 SCOPE

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

2.0 CODES AND STANDARDS

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

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

- a) IS-6005 : 1998 : Code of practice for phosphating of iron and steel.
- b) IS-5 : 2007 : Colors for ready mixed paints and enamels.
- c) IS-1248:2 003 : Direct Acting Indicating Analog Elec Measuring Instruments.
- d) IS/IEC 60947:Part 1:2004 : Low Voltage switchgear & control gear: Part-I (General Rules)
- e) IS-8828:1996 : Circuit breaker for household and similar installations.
- f) IS-13947 (Part-I):1993 : Low Voltage switchgear & control gear : Part-I (General Rules)
- g) ISA-18.1:1979 : Annunciator Sequences and Specification
- h) NFPA-496:2003 : Purged & Pressurised Enclosure for Electrical Equipment in Hazardous Locations.

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

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

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

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

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel

Frame thickness: Not less than 3.0mm

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

Panel Height: Not less than 2365 mm (Refer data sheet-A (No. PES-145A-DS1-0)

Gland plate thickness: 3.0mm

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

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

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



SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A

VOLUME II B

SECTION D

REV. NO. 03

DATE : 16-09-2013

SHEET 2 OF 6

- 3.1.7 The class of protection shall be in accordance with IP-42 unless otherwise specified in the data sheet – A (No. PES-145-54A-DS1-0).
- 3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as given in data sheet-A (No. PES-145A-DS1-0). Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.
- 3.1.9 The cable glands of the required size and type as given in data sheet-A (No. PES-145A-DS1-0) shall be supplied alongwith the Panel.
- 3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function. No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.
- 3.1.11 Single / dual control power supply feeders of voltage class as specified in data sheet-A (No. PES-145A-DS1-0) shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.
- 3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm² size. AC & DC wires shall be kept separate from each other. Separate coloured wires to be used for AC and DC circuits. All wires shall be properly numbered and identified with ferrules as per the Control scheme / wiring diagram. Wires shall be routed and run through PVC troughs.
- 3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm² to 2.5mm² external cables. The TB points in terminal block shall be cage clamp type / screw type. The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm height from finished floor. The panel shall have ten (20) percent spare terminal.
- 3.1.14 The interior of each panel shall be suitably illuminated through fluorescent lamps / tube lights with shrouded cover of minimum 15W operable on 240V 50 Hz AC power supply through panel door switch. A 15 Amp. 3-pin Power receptacle shall be provided.
- 3.1.15 Suitable space heaters operable on 240 Volts 50 Hz AC power system shall be provided at the panel bottom. These shall be designed to maintain the panel temperature five (5) deg. C above the ambient temperature during maintenance shutdown. Suitable isolating and control devices comprising of MCB, thermostat etc. shall be provided for the space heater.
- 3.1.16 The panel shall be provided with a copper earth bus of 25 x 6 mm size running throughout the width of the panel. It shall be terminated internally with 10 mm bolts at extreme ends for connection to; main station earth. The panel mounted equipments / devices shall be connected to earth bus through green coloured PVC insulated stranded copper conductor of 2.5 mm² size.
- 3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte



SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A

VOLUME II B

SECTION D

REV. NO. 03

DATE : 16-09-2013

SHEET 3 OF 6

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

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

3.2 Hazardous Area Panel Requirement

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

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

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

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

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

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

3.3 Control & Monitoring devices

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

3.3.2 Alarm Annunciator System

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

3.3.3 Relays

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

3.3.4 Timers

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



SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A

VOLUME II B

SECTION D

REV. NO. 03

DATE : 16-09-2013

SHEET 4 OF 6

3.3.5 Control / Selector Switches

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

3.3.6 Push Buttons / Indicating Lights

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

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

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

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

3.3.7 Ammeters

Ammeter shall be 96 x 96 mm size, 90 deg. deflection, 1.5% accuracy, 1 Amp. CT operated or with 4-20mA input and Flush mounting type as called for in the data sheet -A (No. PES-145-54A-DS1-0). Ammeters for motors shall have six (6) times folded scale at upper end to enable motor starting current indication

3.3.8 Miniature Circuit Breaker (MCB)

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

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

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

4.0 TESTING AND INSPECTION

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

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



SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A

VOLUME II B

SECTION D

REV. NO. 03

DATE : 16-09-2013

SHEET 5 OF 6

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

4.3.1 Routine Tests

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

4.3.2 Type Tests

1. Enclosure Class Test



SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A

VOLUME II B

SECTION D

REV. NO. 03

DATE : 16-09-2013

SHEET 6 OF 6

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

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

5.2. Mandatory Spares

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

5.3. Recommended Spares

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

6.0 DRAWINGS AND DOCUMENTS

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

1. Data Sheet no. PES-145A-DS1-0
2. General Arrangement Drawing.
3. Catalogue and technical information for instruments and devices.
4. Quality Plan.

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

1. Data Sheet No. PES-145A-DS2-0
2. GA Drawing indicating layout of instruments, construction details, foundation details, cable gland plate along with cable glands and all details mentioned in this specification.
3. Control Schematic Diagram along with grouping of different terminals for various functions.
4. Catalogue and technical information for instruments and devices with selected options clearly marked.
5. O&M Manuals.
6. "As Built" Drawing.
7. CDs.

7.0 MARKING AND PACKING

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

8.0 APPLICABLE DATA SHEET FORMS

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

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



DATA SHEET FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS-999-145-054A

VOLUME

SECTION

REV. NO.

02

DATE: 16.09.2013

SHEET

1 OF

4

TAG No. Qty.....

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

Data Sheet A & B

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

DATA SHEET-B
(TO BE FILLED-UP BY
BIDDER)

GENERAL

MANUFACTURER

CONSTRUCTION

☐ FOLDED☐ WELDED

ENCLOSURE SHEET THICKNESS

FRONT

■ 2.0 mm

OTHER

■ 2.0 mm

DOOR

■ 1.6 mm

HEIGHT

■ 2365 mm for stand-alone panels. ☐ Other

OTHER

■ Load bearing sheet front shall have 3mm thickness

TECHNICAL

INPUT POWER SUPPLY *

(ANY OTHER POWER REQUIREMENT
TO BE DERIVED FROM THIS SUPPLY ONLY)☐ 240V 50 Hz AC☐ 220V DC☐ 415V 3 PHASE 3W☐ 415V 3 PHASE 4W

Refer Electrical scope sheet

NO. OF FEEDERS

☐ ONE☐ TWO

Refer Electrical scope sheet

STARTER WITH MCC

■ REQUIRED (in Bidder's scope) ☐ NOT
REQUIRED

IPR POSITION

☐ MCC

■ RELAY PANEL

CONTACT RATING OF RELAY

☐ 5 Amp, 230 V AC☐ 0.25 Amp, 220V DC

CONTROL SUPPLY

☐ 110V AC☐ 220V AC☐ 220V DC☐ Other.

(As per requirement)

ALARM ANNUNCIATOR WINDOW

(EXCLUDING SPARES)

____ NOS. (AS REQUIRED)

TEMP SCANNER

☐ REQUIRED

■ NOT REQUIRED

PAINT TYPE

☐ EPOXY ENAMEL☐ EPOXY POWDER COATEDMIMIC (TYPE OF MIMIC- MATERAIL, THICKNESS
TO BE SPECIFIED DURING DETAILED ENGG.)☐ REQUIRED☐ NOT REQUIRED

PANEL COLOUR (EXTERNAL)

☐ LIGHT GREY (Shade 631 IS-5)

■ OPALINE GREEN (Shade 275 of IS:5)

FINISH (EXTERNAL)

☐ MATT☐ GLOSSY☐ SEMI GLOSSY

PANEL COLOUR (INTERNAL)

■ BRILLIANT WHITE

☐ CREAM☐ OFF WHITE

FINISH (INTERNAL)

☐ MATT☐ GLOSSY☐ SEMI GLOSSY

CLASS OF PROTECTION

☐ IP-42 (FOR INDOOR SERVICE)☐ IP-55 (FOR OUTDOOR SERVICE) ☐ ANY
OTHER

CONTROL HARDWARE

■ RELAY BASED

FOUNDATION ARRANGEMENT

☐ FOUNDATION BOLTS ☐ ANCHOR
FASTENERS

	DATA SHEET FOR LOCAL PANELS		SPECIFICATION NO.: PE-SS-999-145-054A	
			VOLUME	
			SECTION	
			REV. NO. 02	DATE: 16.09.2013
TAG No. Qty.....		SHEET 2 OF 4		
Data Sheet No.: PES-145A-DS1-0				
Data Sheet A & B				
DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
	WEIGHT OF PANEL (Kg.)		(Vendor to specify)	
	PANEL TYPE		☐ PRESSURISED ☐ UNPRESSURISED As per Requirement	
	CABLE GLAND		☐ DOUBLE COMPRESSION	
	AMMETER (TYPE OF INPUT) *		☐ 1 Amp CT ☐ 4-20 mA	
	SCOPE OF SUPERVISION FOR ERECTION & COMMISSIONING		☐ APPLICABLE ☐ NA Refer electrical scope sheet	
	* TO BE CO-ORDINATED WITH PEM ELECTRICAL			
NAME DESIGNATION SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	
			COMPANY SEAL	
			NAME:	
			SIGNATURE:	
			DATE:	



DATA SHEET FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS-999-145-054A

VOLUME

SECTION

REV. NO.

02

DATE: 16.09.2013

SHEET

3 OF

4

TAG No. Qty.....

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

Data Sheet C

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

GENERAL	MANUFACTURER			
	CONSTRUCTION		☐ FOLDED ☐ WELDED (As per requirement EDN)	
	ENCLOSURE SHEET THICKNESS	FRONT		
		OTHER		
		DOOR		
		HEIGHT		
	OTHER			
TECHNICAL	INPUT POWER SUPPLY			
	NO. OF FEEDERS			
	CONTACT RATING OF RELAY			
	TEMP SCANNER			
	CONTROL SUPPLY			
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)			
	PAINT TYPE			
	PANEL COLOUR (EXTERNAL)			
	FINISH (EXTERNAL)			
	TYPE OF MIMIC MATERIAL OF MIMIC THICKNESS OF MIMIC			
	PANEL COLOUR (INTERNAL)			
	FINISH (INTERNAL)			
	CLASS OF PROTECTION			
	CONTROL HARDWARE			
	FOUNDATION ARRANGEMENT			
	WEIGHT OF PANEL (Kg.)			

	DATA SHEET FOR LOCAL PANELS		SPECIFICATION NO.: PE-SS-999-145-054A	
			VOLUME	
			SECTION	
			REV. NO. 02	DATE: 16.09.2013
			SHEET 4 OF	4
TAG No. Qty.....			Data Sheet No.: PES-145A-DS1-0	
Data Sheet C				
DATA SHEET-C FOR LOCAL PANEL (TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)				
	PANEL TYPE			
	CABLE GLAND			
	AMMETER (TYPE OF INPUT)			
	SCOPE OF SUPERVISION			
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	
			COMPANY SEAL	
			NAME:	
			SIGNATURE:	
			DATE:	



STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: **PE-QP-999-145-I056**

VOLUME I IB

SECTION D

REV. NO. **01** DATE: **22-02-2008**

SHEET 1 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks
									P	W	V	
1.0	INCOMING Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample IS:1079	IS:1079	IS:1079	Test Certificate	3	---	2	
		2. Bend Test	CR	Mech. test	Sample IS:513	IS:513	IS:513	Log Book	2	---	---	
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---	
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---	---	
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec. Log	Book	2	---	---	
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	1	
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	IS:2062	IS:2062 Log	Book	2	---	---	
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---	
		3. Straightness	MA	Measurement	100%	Factory Std.	Factory Std.	Log Book	2	---	---	
		4. Mill marking	MA	Visual	100%	IS:2062	IS:2062	Log Book	2	---	1	
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---	
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---	

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

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

1 - BHEL
2 - Vendor
3 - Sub-vendor



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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: **PE-QP-999-145-I056**

VOLUME I IB

SECTION D

REV. NO. **01** DATE: **22-02-2008**

SHEET 2 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks
									P	W	V	
		3. Conductor a) Resistance b) Size c) Sheath 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	BHEL Spec. and IS:1554 or IS:694	Log Book	3	---	2	
4.0	Electrical Components like	1. Verification at make and Type	CR Visual		Sample	BHEL Spec. and BOM	BHEL Spec. and BOM	Log Book	2	---	---	
2	Annunciator	. Verification of Test Certificates	CR Scrutiny of Type / Routine T.Cs.		100%	Relevant IS	Relevant IS	Log Book	2	---	---	
3.	Transformers	Operation / Functional check	CR Electrical		Sample+ 100% @	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	+ for relay & contactors only
4	Lamps	. I.R.	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	@ for all components except relays & contactors.
5	Switches	. H.V.	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	
	PBs	6. Calibration	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	1	
	Contactors	7. Pick up / Drop off Voltage	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	
	Relays											
	Timers											
	Space Heaters											
	Thermostat											
	Indicating meters etc.											

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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: **PE-QP-999-145-I056**

VOLUME I IB

SECTION D

REV. NO. **01** DATE: **22-02-2008**

SHEET 3 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks
									P	W	V	
5.0 M	isc. 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 Vi	sual	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 F	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	

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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: **PE-QP-999-145-I056**

VOLUME I IB

SECTION D

REV. NO. **01** DATE: **22-02-2008**

SHEET 4 OF 7

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

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

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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: **PE-QP-999-145-I056**

VOLUME I IB

SECTION D

REV. NO. **01** DATE: **22-02-2008**

SHEET 6 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks
									P	W	V	
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2 1		1	At Random by BHEL, based on 100 % internal test reports by Mfr.
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2 1		1	
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2 1		1	
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2 1		1	
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2 1		1	
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2 1		1	
		11. Wire Termination	MA	Pulling manually	Sample ----		Firm termination	Inspection Report	2 1		1	
		12. Continuity	MA	Electrical	100%	----- C	ontinuity OK	Inspection Report	2 1		1	

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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: **PE-QP-999-145-I056**

VOLUME I IB

SECTION D

REV. NO. **01** DATE: **22-02-2008**

SHEET 7 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks
									P	W	V	
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	Type Test Certificate	3 ---		1	
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant IS.	BHEL approved spec., drg., BOM & relevant IS.	Test Report	2	1	1	
15	FUNCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2 1		1	
		2. Instrument Calibration	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2 1		1	
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant IS.	BHEL approved spec/drg & relevant IS.	Inspection Report	2 1		1	

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

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

1 - BHEL
2 - Vendor
3 - Sub-vendor



Technical specification for
Ventilation system

5X800 MW YADADRI TPS

SECTION-D

REV. NO.

00

DATE : 18.05.2018

CABLE BOQ

CABLE SIZES FOR 5X800 MW YADADRI TPS	
Sl no.	Cable Type
	G-TYPE
1	2P X 0.5 sqmm
2	4P X 0.5 sq mm
3	8P X 0.5 sqmm
4	12P X 0.5 sqmm
	F-TYPE
1	4P X 0.5 sqmm
2	8P X 0.5 sqmm
3	12P X 0.5 sqmm
4	20P X 0.5 sqmm
	CONTROL CABLE
1	5C x 2.5 sq mm
2	12C x 2.5 sqmm



Technical specification for
Ventilation system

5X800 MW YADADRI TPS

SECTION-D

REV. NO.

00

DATE : 18.05.2018

KKS PHILOSOPHY

**KKS NUMBERING PHILOSOPHY**

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

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

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

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

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

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

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

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

- 1) Air Conditioning System: QKA, QKB,..... QKZ
- 2) Ventilation System: SAA, SAB, SAZ

ANNEXURE-2**Standard Equipment Codes:**

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

Standard Apparatus Codes:

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

Standard Measuring Circuits Codes:

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

	DOCUMENT TITLE	
	KKS NUMBERING PHILOSOPHY	
	5X800 MW YADADRI TPS	

CQ

CS

CT

CY

Analysis (SWAS)

Speed, Velocity, Frequency

Temperature

Vibration, Expansion

ANNEXURE-3

Numerical Keys

A) Numerical Keys at System Code Level

i)

Use 10, 20, 30... To distinguish between main systems having same Alpha Codes. Examples:

a)

Main Steam (Left) and Main Steam (Right)

b)

BFP – A/B/C

c)

ID Fan – A/B, FD Fan A/B, AH – A/B

ii)

For branch off from main system path having code say 10, keep the same alpha code and use 11, 12, 13 etc. Similarly for other branch off from main system path having code say 20, keep the same alpha code and use 21, 22, 23 etc and shall carry on further in the same way.

iii)

If the branch off from main system / sub system path is used for some other system, where different alpha codes can be applied, then in that case the said branch line will be designated by the alpha codes of the system to which it is providing the input.

B) Numerical keys at Equipment Code level:

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

i)

Valves and Dampers

Equipment Code – AA

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

	DOCUMENT TITLE		
	KKS NUMBERING PHILOSOPHY		
	5X800 MW YADADRI TPS		
NRV (Without actuation)		- 4	01 to 99
Manual		- 5	01 to 99
Manual		- 6	01 to 99
Relief & Safety Valves		- 7	01 to 99
Reserve		- 8	01 to 99
Reserve		- 9	01 to 99
ii) Field Instruments			
Field Transmitters & Analog Signals		- 0	01 to 99
Field Switches & Binary Signals		- 1	00 to 99
PG Test Point		- 4	00 to 99
Gauges		- 5	00 to 99
Automatic Turbine Tester (ATT)-HWR		- 2	00 to 99
(Reserved for protection Signals used by Hardwar)			
Example of Numerical Key Usage:			
In line with the philosophy adopted for Valves / Dampers /instruments etc. pumps and fans in the main systems (having different system code) can be numbered as AP/N100 and as AP/N101, 102, Where system code is same.			



Technical specification for
Ventilation system

5X800 MW YADADRI TPS

SECTION-D

REV. NO.

00

DATE : 18.05.2018

ACTUATOR SPECIFICATION & DATASHEET

VOLUME: V-A

SECTION-III

**TECHNICAL SPECIFICATION
FOR
ELECTRIC MOTOR ACTUATORS**

1.00.00 SCOPE

- 1.01.00 This Section covers the general requirements of Electric Motor Actuators for valves/dampers.
- 1.02.00 All electric motor actuators shall be furnished in accordance with this general specification and the accompanying driven equipment specification. All the electrical actuators shall be INTEGRAL type only.

2.00.00 STANDARDS

- 2.01.00 All electrical equipment shall conform to the latest applicable IS, ANSI and NEMA Standards, except when stated otherwise herein or in driven equipment specification.
- 2.02.00 Major standards, which shall be followed, are listed below. Other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed
- i) IS -9334
 - ii) IS-325

3.00.00 SERVICE CONDITIONS

- 3.01.00 The actuator shall be suitable for operation in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.
- 3.02.00 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the general specification.
- 3.03.00 For actuator motor installed outdoor and exposed to direct sun rays, the effect of solar heat shall be considered in the determination of the design ambient temperature.

4.00.00 RATING

- 4.01.00 For isolating service, the actuator shall be rated for three successive open-close operation of the valve/damper or 15 minutes, whichever is longer.
- 4.02.00 For regulating service, the actuator shall be suitably time-rated for the duty cycle involved with necessary number of starts per hour, but in no case less than 150 starts per hour.

5.00.00 **PERFORMANCE**

The actuator shall meet the following performance requirements:

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

6.00.00 **SPECIFIC REQUIREMENT**

6.01.00 **Construction**

- 6.01.01 The actuator shall essentially comprise the drive motor, torque/ limit switches, gear train, clutch, hand wheel, position indicator/ transmitter, in-built thermostat for over load protection, space heater and internal wiring.
- 6.01.02 The actuator enclosure shall be totally enclosed, dust tight, weather-proof suitable for outdoor use without necessity of any canopy. Degree of protection of enclosure for motor actuator shall be IP-65.
- 6.01.03 All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.
- 6.01.04 The actuator shall be designed for mounting in any position without any lubricant leakage or operating difficulty.

6.02.00 **Motor**

- 6.02.01 The drive motor shall be three phase, squirrel cage, induction machine with minimum class B insulation and IPW-55 enclosure, designed for high torque and reversing service. Canopy shall be provided for outdoor service.
- 6.02.02 The motor shall be designed for full voltage direct on-line start, with starting current limited to 6 times full-load current.
- 6.02.03 The motor shall be capable of starting at 85 percent of rated voltage and running at 80 percent of rated voltage at rated torque and 85 percent rated voltage at 33 percent excess rated torque for a period of 5 minutes each.
- 6.02.04 Motor leads shall be terminated in the limit switch compartment.
- 6.02.05 Motor actuators for valves/dampers shall be with integral starter with 3phase/3wire, 415V AC and operable from remote.

- 6.02.06 Earthing terminals shall be provided on either side of the motor.
- 6.03.00 **Limit Switches**
- Each actuator shall be provided with following limit switches: -
- 6.03.01 2 torque limit switches, one for each direction of travel, self-locking, adjustable torque type.
- 6.03.02 4 end-of-travel limit switches, two for each direction of travel.
- 6.03.03 2 position limit switches, one for each direction of travel, each adjustable at any position from fully open to fully closed positions of the valve/damper.
- 6.03.04 Each limit switch shall have 2 NO + 2 NC potential free contacts. Contact rating shall be 5A at 240V A.C. or 0.5A at 220V D.C.
- 6.04.00 **Hand Wheel**
- Each actuator shall be provided with a hand wheel for emergency manual operation. The hand wheel shall de-energize automatically when the motor is energized.
- 6.05.00 **Position Indicator/Transmitter**
- The actuator shall have:
- 6.05.01 One (1) built-in local position indicator for 0-100% travel.
- 6.05.02 One (1) position transmitter, 4-20 mA current signal as position feedback, for remote indicator.
- 6.06.00 **Space Heater**
- A space heater shall be included in the limit switch compartment suitable for 240V, 1 phase, 50 Hz supply.
- 6.07.00 **Wiring**
- All electrical devices shall be wired up to and terminated in a terminal box. All wiring shall be done with 1100 V grade fire resistance PVC insulated stranded copper conductor of not less than 2.5 Sq.mm cross section. All wiring shall be identified at both ends with ferrules. All the electrical actuators shall have uniform wiring.
- 6.08.00 **Terminal Box**
- The terminal box shall be weather proof, with removable front cover and cable glands for cable connection. The terminal shall be suitable for connection of 2.5 Sq.mm copper conductor.
- 7.00.00 **ACCESSORIES**

As required for the driven equipment, the actuator shall be furnished with starting equipment mounted on the actuator. This shall include:

- 7.01.00 One (1) triple pole MCCB
- 7.02.00 One (1) reversing starter with mechanically interlocked contactors, 3 thermal overload relays, 2 NO + 2 NC auxiliary contacts for each contactor.
- 7.03.00 One (1) remote-local selector switch.
- 7.04.00 CLOSE-STOP-OPEN oil tight push buttons with indication lights.
- 7.05.00 415/240 V control transformer with primary & secondary fuses.

8.00.00 **TEST**

The actuator and all components thereof shall be subject to tests as per relevant Standards. In addition, if any special test is called for in equipment specification, the same shall be performed.

9.00.00 **DRAWINGS, DATA & MANUALS**

- 9.01.00 Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

9.02.00 **To be submitted with Bid**

Data sheet for each type of actuator shall be furnished along with internal wiring diagram, suggested control schematic and torque limit switch contact development and manufacturer's catalogues. Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

9.03.00 **To be submitted for Owner / Purchaser's Approval and Distribution**

All relevant drawings and data pertaining to the equipment like GTP, GA drawing, foundation plan, BOM, control & schematics, QAP, etc. shall be submitted by the Bidder for approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A : Technical Specifications for Electrical Equipment & Accessories.

ANNEXURE-A

DESIGN DATA

1.0 AUXILIARY POWER SUPPLY

S	upply	Description	Consumer
	L.V. Supply (i)	415V, 3Ø, 3W, 50 Hz Effectively earthed	u Motors above 0.2kW pto less than 175kW.
		Fault level 50 kA symm. for 1 sec.	
	(ii)	240V AC/415V AC	Motors upto 0.2kW.
		240V, 1Ø, 2W, 50 Hz effectively earthed	o Lighting, Space heat- ing , A.C supply for Contr- l & protective devices.
	D.C. Supply	220V, 2W, unearthed	& D.C. alarm, control protective devices
		Fault level 25* kA. for 1 sec.	

* Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation.

2.0 RANGE OF VARIATION

A.C. Supply :

V	oltage	:	± 10%
	Frequency	:	+3% to -5%.
	Combined Volt + frequency	:	10% (absolute sum)

During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance.

D.C. Supply :

Voltage	:	187 to 242
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Technical specification for
CONTROL & INSTRUMENTATION
 5x800 MW YADADRI TPS, NALGONDA

SPEC NO.: **PE-TS-417-145-I**

VOLUME

SECTION

REV. NO. 00

DATE : 03.04.2018

SHEET OF

ACTUATOR SPECIFICATION

5.00.00 **PERFORMANCE**

The actuator shall meet the following performance requirements:

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

6.00.00 **SPECIFIC REQUIREMENT**

6.01.00 **Construction**

- 6.01.01 The actuator shall essentially comprise the drive motor, torque/ limit switches, gear train, clutch, hand wheel, position indicator/ transmitter, in-built thermostat for over load protection, space heater and internal wiring.
- 6.01.02 The actuator enclosure shall be totally enclosed, dust tight, weather-proof suitable for outdoor use without necessity of any canopy. Degree of protection of enclosure for motor actuator shall be IP-65.
- 6.01.03 All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.
- 6.01.04 The actuator shall be designed for mounting in any position without any lubricant leakage or operating difficulty.

6.02.00 **Motor**

- 6.02.01 The drive motor shall be three phase, squirrel cage, induction machine with minimum class B insulation and IPW-55 enclosure, designed for high torque and reversing service. Canopy shall be provided for outdoor service.
- 6.02.02 The motor shall be designed for full voltage direct on-line start, with starting current limited to 6 times full-load current.
- 6.02.03 The motor shall be capable of starting at 85 percent of rated voltage and running at 80 percent of rated voltage at rated torque and 85 percent rated voltage at 33 percent excess rated torque for a period of 5 minutes each.
- 6.02.04 Motor leads shall be terminated in the limit switch compartment.
- 6.02.05 Motor actuators for valves/dampers shall be with integral starter with 3phase/3wire, 415V AC and operable from remote.

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- 6.04.00 **Hand Wheel**
- Each actuator shall be provided with a hand wheel for emergency manual operation. The hand wheel shall declutch automatically when the motor is energized.
- 6.05.00 **Position Indicator/Transmitter**
- The actuator shall have:
- 6.05.01 One (1) built-in local position indicator for 0-100% travel.
- 6.05.02 One (1) position transmitter, 4-20 mA current signal as position feedback, for remote indicator.
- 6.06.00 **Space Heater**
- A space heater shall be included in the limit switch compartment suitable for 240V, 1 phase, 50 Hz supply.
- 6.07.00 **Wiring**
- All electrical devices shall be wired up to and terminated in a terminal box. All wiring shall be done with 1100 V grade fire resistance PVC insulated stranded copper conductor of not less than 2.5 Sq.mm cross section. All wiring shall be identified at both ends with ferrules. All the electrical actuators shall have uniform wiring.
- 6.08.00 **Terminal Box**
- The terminal box shall be weather proof, with removable front cover and cable glands for cable connection. The terminal shall be suitable for connection of 2.5 Sq.mm copper conductor.
- 7.00.00 **ACCESSORIES**

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- 7.03.00 One (1) remote-local selector switch.
- 7.04.00 CLOSE-STOP-OPEN oil tight push buttons with indication lights.
- 7.05.00 415/240 V control transformer with primary & secondary fuses.

8.00.00 TEST

The actuator and all components thereof shall be subject to tests as per relevant Standards. In addition, if any special test is called for in equipment specification, the same shall be performed.

9.00.00 DRAWINGS, DATA & MANUALS

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ANNEXURE-A

DESIGN DATA

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S	upply	Description	Consumer
	L.V. Supply (i)	415V, 3Ø, 3W, 50 Hz Effectively earthed	u Motors above 0.2kW pto less than 175kW.
		Fault level 50 kA symm. for 1 sec.	
	(ii)	240V AC/415V AC	Motors upto 0.2kW.
		240V, 1Ø, 2W, 50 Hz effectively earthed	o Lighting, Space heat- ing , A.C supply for Contr- l & protective devices.
	D.C. Supply	220V, 2W, unearthed	& D.C. alarm, control protective devices
		Fault level 25* kA. for 1 sec.	

* Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation.

2.0 RANGE OF VARIATION

A.C. Supply :

V	oltage	:	± 10%
	Frequency	:	+3% to -5%.
	Combined Volt + frequency	:	10% (absolute sum)

During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance.

D.C. Supply :

Voltage	:	187 to 242
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Technical specification for
CONTROL & INSTRUMENTATION
 5x800 MW YADADRI TPS, NALGONDA

SPEC NO.: **PE-TS-417-145-I**

VOLUME

SECTION

REV. NO. 00

DATE : 03.04.2018

SHEET OF

Actuator Data Sheet

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		DOCUMENT NO. : PE-ID-417-145-I902	
			VOLUME II B	
			SECTION D	
			REV. NO. 00	DATE:15/05/2019
			SHEET 1	OF 4
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL *	* PROJECT	5 X 800 MW YADADRI TPS, NALGONDA		
	OFFER REFERENCE			
	* TAG NO. SERVICE			
	* DUTY	☐ ON / OFF ** ☐ INCHING		
	* LINE SIZE (inlet/outlet): MATERIAL			
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY		
	* OPENING / CLOSING TIME			
	* WORKING PRESSURE			
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%		
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY		
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY		
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY		
	CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, IP:68	
MECHANICAL POSITION INDICATOR		TO BE PROVIDED FOR 0-100% TRAVEL		
BEARINGS		DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.		
GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION		METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.		
SIZING		OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING SERVICE - 150 STARTS/HR MINIMUM & FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM.		
HANDWHEEL as per standard EN 12570:2000	* REQUIRED	☒ YES ☐ NO		
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED		
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.			
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY		
	MOTOR MAKE / MODEL / TYPE / RATING (KW) (REFER NOTE NO. 6 & 7)	BIDDER TO SPECIFY		
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT-INCLUSIVE OF I.S. TOLERANCE		
	ACTUATOR APPLICABLE WIRING DIAGRAM	☒ ENCLOSED (BIDDER TO CONFIRM) DRG. NO. 3-V-MISC-24227 R00		
	COLOUR SHADE	☐ BLUE (RAL 5012) ☐		
	PAINT TYPE (## Refer Notes)	☐ ENAMEL ☐ EPOXY CONFIRMING TO CORROSION CATEGORY C5-I		
	SHAFT RPM	BIDDER TO SPECIFY		
	OLR SET VALUE	BIDDER TO SPECIFY		
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY		
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY		
	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC		
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V		
	@ ENCLOSURE CLASS OF MOTOR	☐ IP 67 ☐ IP 68 ☐ FLAME PROOF		
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B		

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		DOCUMENT NO. : PE-ID-417-145-I902		
			VOLUME II B		
			SECTION D		
			REV. NO. 00	DATE:15/05/2019	
			SHEET 2	OF	4
Data Sheet A & B					
DATA SHEET-A (TO BE FILLED BY PURCHASER)				DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
	@ WINDING TEMP PROTECTION	☒ THERMOSTAT (3 Nos.,1 IN EACH PHASE) ☐ -----			
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED (THERMISTOR PTC)			
INTEGRAL STARTER	INTEGRAL STARTER	☒ REQUIRED ☐ NOT REQUIRED			
	TYPE OF SWITCHING DEVICE	☐ CONTACTORS ☐ THYRISTORS			
	TYPE	☐ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)			
	IF SMART (REFER BELOW POINT a – h)				
	a) SERIAL LINK INTERFACE	☐ INTEGRAL ☐ FIELD MOUNTED			
	b) SERIAL LINK PROTOCOL	☐ FOUNDATION FIELD-BUS ☐ PROFI-BUS ☐ DEVICE NET ☐			
	c) SERIAL LINK MEDIA	☐ TWISTED PAIR Cu-CBL ☐ CO-AXIAL Cu-CBL ☐ OFC			
	d) HAND HELD PROGRAMMER	☐ REQUIRED ☐ NOT REQUIRED			
	e) TYPE OF HAND HELD PROGRAMMER	☐ BLUETOOTH ☐ INFRARED ☐			
	f) MASTER STATION	☐ REQUIRED ☐ NOT REQUIRED			
	g) MASTER STN INTRFACE WITH DCS	☐ MODBUS ☐ TCP/IP			
	h) DETAILS OF SPECIAL CABLE	☐ ENCLOSED ☐ NOT REQUIRED			
	STEP DOWN CONT. TRANSFORMER	☒ REQUIRED			
	OPEN / CLOSE PB	☒ REQUIRED ☐ NOT REQUIRED			
	STOP PB	☒ REQUIRED ☐ NOT REQUIRED			
	INDICATING LAMPS	☒ REQUIRED ☐ NOT REQUIRED			
	LOCAL REMOTE S/S	☒ REQUIRED ☐ NOT REQUIRED			
	STATUS CONTACTS FOR MONITORING	☒ REQUIRED ☐ NOT REQUIRED			
	INTEGRAL STARTER DISTURBED SIGNAL(Refer Note 14)	REQUIRED (O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY,)			
	ACTION ON LOSS OF EXTERNAL ELECTRIC POWER	☐ STAYPUT ☐ FAIL SAFE			
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter) DATASHEET & WIRING DIAGRAM OF ISOLATION DEVICE TO BE PROVIDED	TYPE OF ISOLATING DEVICE	☒ INTERPOSING RELAY ☐ OPTO COUPLER TO BE DECIDED DURING DETAILED ENGINEERING			
	QUANTITY	☐ 2 NOs. ☐ 3 NOs.			
	DRIVING VOLTAGE	☒ 20.5 – 24V DC ☐ _____ V DC			
	DRIVING CURRENT	☒ 125mA MAX ☐ _____ mA MAX			
	LOAD RESISTANCE	☒ > 192 ohms - <25 k ohms ☐ > _____ ohms - < _____ ohms			
TORQUE SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY			
	OPEN / CLOSE	☒ 1 No. ☐ 2Nos. / ☒ 1 No. ☐ 2Nos			
	CONTACT TYPE	2 NO + 2 NC			
	RATING	5A 240V AC AND 0.5A 220V DC			
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE			
	ACCURACY	+3% OF SET VALUE			
LIMIT SWITCH (Not Applicable for Smart	MFR & MODEL NO.	BIDDER TO SPECIFY			
	OPEN : INT : CLOSE	☐ 1 No. ☒ 2 Nos.	2 Nos. (ADJ.)	☐ 1 No. ☒ 2Nos.	

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		DOCUMENT NO. : PE-ID-417-145-I902	
			VOLUME II B	
			SECTION D	
			REV. NO. 00	DATE:15/05/2019
			SHEET 3	OF 4
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
Actuator) (\$ Refer Notes)	CONTACT TYPE	2 NO + 2 NC		
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC		
	ACCURACY	2% OF SET VALUE		
POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)	☒ REQUIRED ☐ NOT REQUIRED		
	MFR & MODEL NO.	BIDDER TO SPECIFY		
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ☒ ELECTRONIC (2 WIRE) CONTACTLESS		
	SUPPLY	☒ 24V DC ☐		
	OUTPUT	☒ 4-20mA		
	ACCURACY	± 1% FS		
SPACE HEATER	@SPACE HEATER	REQUIRED		
	@ POWER SUPPLY (NON INTEGRAL)	230V AC, 1 PH., 50 Hz		
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY		
	@ RATING			
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED		
	ENCL CLASS ACTUATOR/MOTOR T.B.	@ ☐ IP 68 @ ☐		
	@ EARTHING TERMINAL	REQUIRED		
	PLUG & SOCKET	☐ REQUIRED ☐ NOT REQUIRED		
	NO. OF PINS REQUIRED (TO BE CHECKED AS PER SIGNALS IN DRIVE CONTROL PHILOSOPHY)			
	NOS. OF PLUG & SOCKET	☐ 1 Nos. for ON/OFF ☐ 2 NOS. (for inching duty) ☐ OTHER (TO BE SPECIFIED INLINE WITH DRIVE CONTROL PHILOSOPHY)		
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:-----		
	@ SPACE HEATER CABLE GLAND	SIZE:-----		
	CONTROL CABLE GLANDS-1	INSTRUMENT CABLE SIZE FOR ON/OFF DUTY VALVES SHALL BE 8PX0.5 SQMM. ONE CABLE GLAND OF OD SIZE 20 MM. INSTRUMENT CABLE SIZE FOR INCHING DUTY TYPE VALVES SHALL HAVE TWO NO. CABLES (ONE NO. 8PX0.5 SQMM AND 2ND 2PX0.5 SQMM) - TWO NO. GLANDS OF OD SIZES 20 MM & 15 MM.		
	CONTROL CABLE GLANDS-2			
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY		_____ Kg.

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	DOCUMENT NO. : PE-ID-417-145-I902			
		VOLUME		II B	
		SECTION		D	
		REV. NO.		00	DATE:15/05/2019
		SHEET		4	OF 4

Data Sheet A & B

DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
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NOTES:

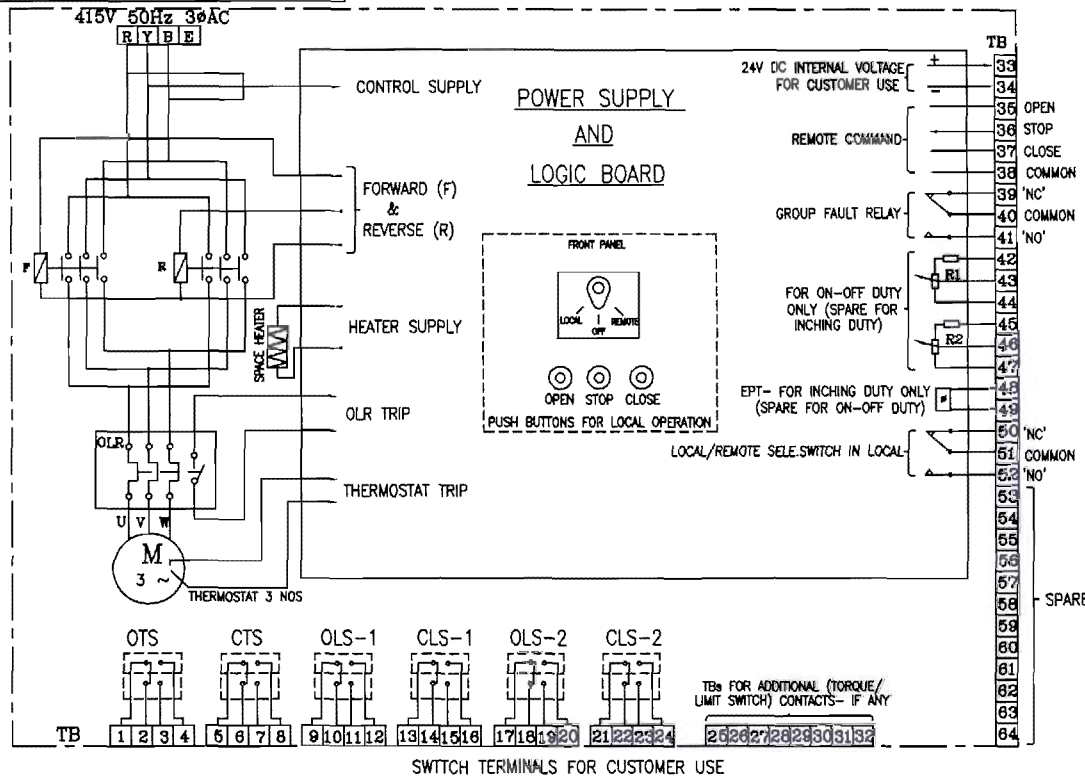
1. **SCOPE:** DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
 2. **CODES & STANDARDS:** DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691, IS-4722, IEC 60947-5-1 AND EN 15714-3 :2010 OR LATEST VERSION.
 3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
 4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.
 5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
 6. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.
 7. THE MOTOR SHALL BE CAPABLE OF STARTING AT 85 PERCENT OF RATED VOLTAGE RUNNING AT 80 PERCENT OF RATED VOLTAGE AT RATED TORQUE AND 85 PERCENT RATED VOLTAGE AT 33 PERCENT EXCESS RATED TORQUE FOR A PERIOD OF 5 MINUTES EACH.
 8. IN ADDITION TO ABOVE REQUIREMENTS FOR LIMIT/TORQUE SWITCH, **MECHANICAL END STOP** WITH ACCURACY OF 2% SHALL BE SUPPLIED.
 9. IT SHOULD BE POSSIBLE TO OPERATE THE ACTUATOR LOCALLY. LOCKABLE LOCAL/REMOTE SELECTION SHALL BE PROVIDED ON THE ACTUATOR.
 10. LOCAL POSITION INDICATOR SHALL BE PROVIDED FOR 0 TO 100 % TRAVEL.
 11. CONTROL WIRING SHALL BE SUITABLE VOLTAGE GRADE COPPER WIRE 1.5 SQ. MM.
 12. ENDURANCE: RATED TORQUE RANGE SHOULD BE BASED ON ISO 5211, ISO5210.
 13. TAG PLATE SHALL BE CONFIRMING TO STANDARD BS-15714.
 14. INTEGRAL STARTER/ACTUATOR DISTURBED SIGNAL SHALL BE CHECKED AND INCLUDE AS PER DRIVE CONTROL PHILOSOPHY.
 15. **** VALVES WITH 10 DEGREE/20DEGREE FEEDBACK REQUIREMENT FOR APPLICATIONS SUCH AS CW/ACW/PLANT WATER SYSTEM ETC SHALL BE CONSIDERED AS INCHING DUTY VALVES. ACCORDINGLY, POSITION FEED BACK TRANSMITTER, PLUG & SOCKET REQUIREMENT SHALL BE CONSIDERED.**
- \$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.**
- ## EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.**

	PREPARED BY	CHECKED BY	APPROVED BY	VENDOR COMPANY SEAL
NAME	RINKY	RAVINDER K RAINA	SHIVRAJ SINGH BANSALA	NAME
SIGNATURE				SIGNATURE
DATE	15.05.2019	15.05.2019	15.05.2019	DATE

NOTES* = TO BE FILLED BY MPL (LEAD AGENCY).

@ BE FILLED BY ES

3-V-MISC-24227
DRAWING NO.



CONTACT DEVELOPMENT DIAGRAM				
OTS	1-2	OPEN AT OVER TORQUE DURING OPENING TRAVEL		
	3-4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL		
CTS	5-6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL		
	7-8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL		
OLS-1	9-10			
	11-12			
CLS-1	13-14			
	15-16			
OLS-2	17-18			
	19-20			
CLS-2	21-22			
	23-24			
SWITCH	TERMINAL NO.	FULL OPEN	INTERMEDIATE	FULL CLOSE
		VALVE POSITION		
————		INDICATES CONTACT CLOSED		
-----		INDICATES CONTACT OPEN		
CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC				

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

NOTE:-

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

REV	DATE	ALTERED
		CHD & APPD

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS (DRAWN FOR INTERMEDIATE POSITION OF VALVES)			
DEPT	VL	SCALE	WEIGHT (KG)	REFERENCE INFORMATION	NO. OF
CODE					VAR.
TITLE WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER		CARD CODE U 01	DRAWING NO. 3-V-MISC-24227		REV 0



Technical specification for
CONTROL & INSTRUMENTATION
 5x800 MW YADADRI TPS, NALGONDA

SPEC NO.: **PE-TS-417-145-I**

VOLUME

SECTION

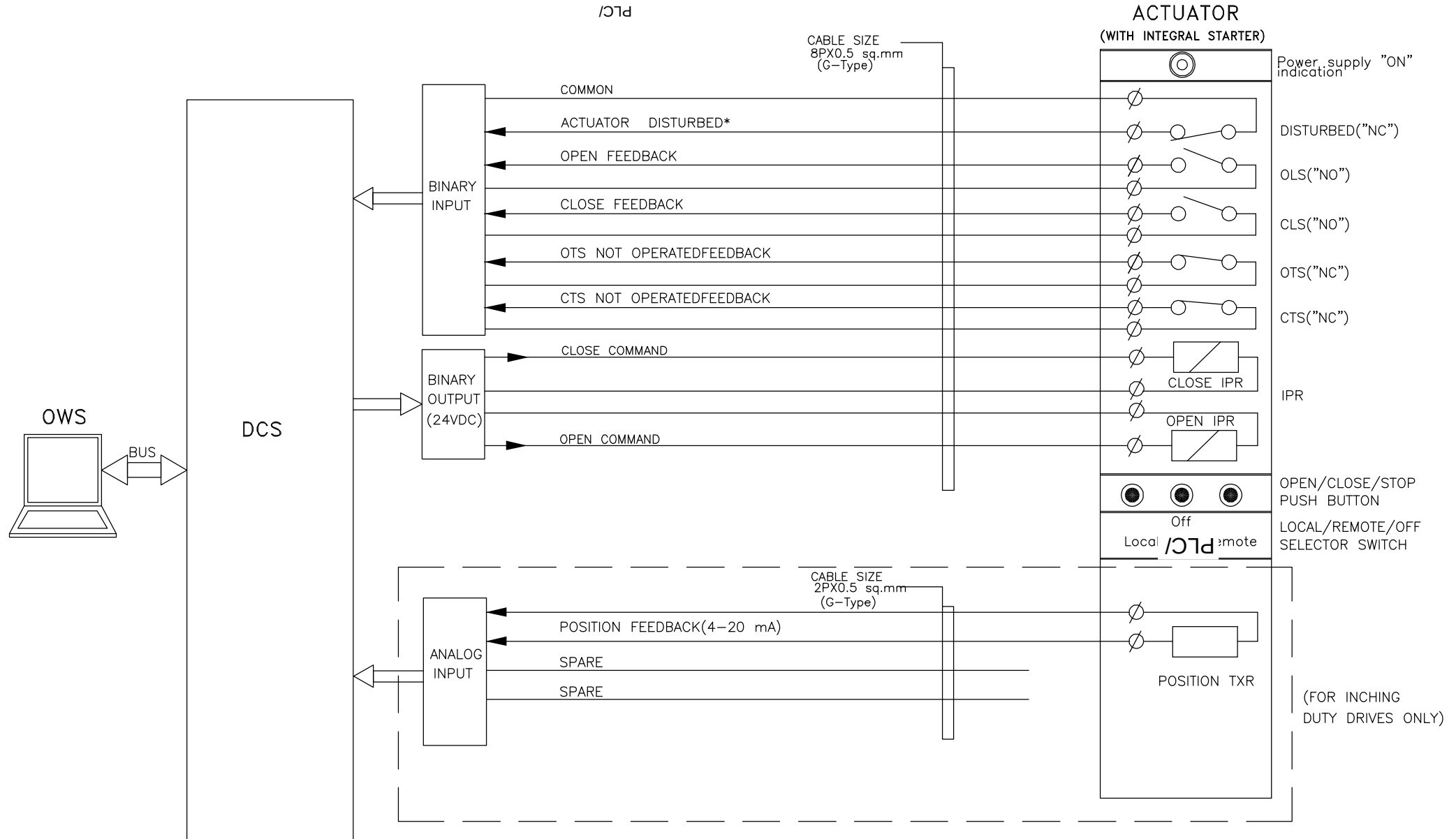
REV. NO. 00

DATE : 03.04.2018

SHEET OF

Drive Control Philosophy

DCS INTERFACE FOR BIDIRECTIONAL DRIVE (WITH INTEGRAL STARTER)



NOTE:

* DISTURBED= Loss of Power supply (1 Phase/3 Phase)/
Loss of control supply/ Motor thermostat trip/
Thermal over load/Torque open/close cutoff
Local/Off/Remote Sel. switch
Stop PB optd.



Page 399

PROJECT:

5X800 YADADRI THERMAL POWER STATION
UNIT # 1 TO 5

DRG.NO. PE-DM-417-145-I002

DATE 06.12.2019

TITLE:

DDCMS INTERFACE FOR
BIDIRECTIONAL DRIVE

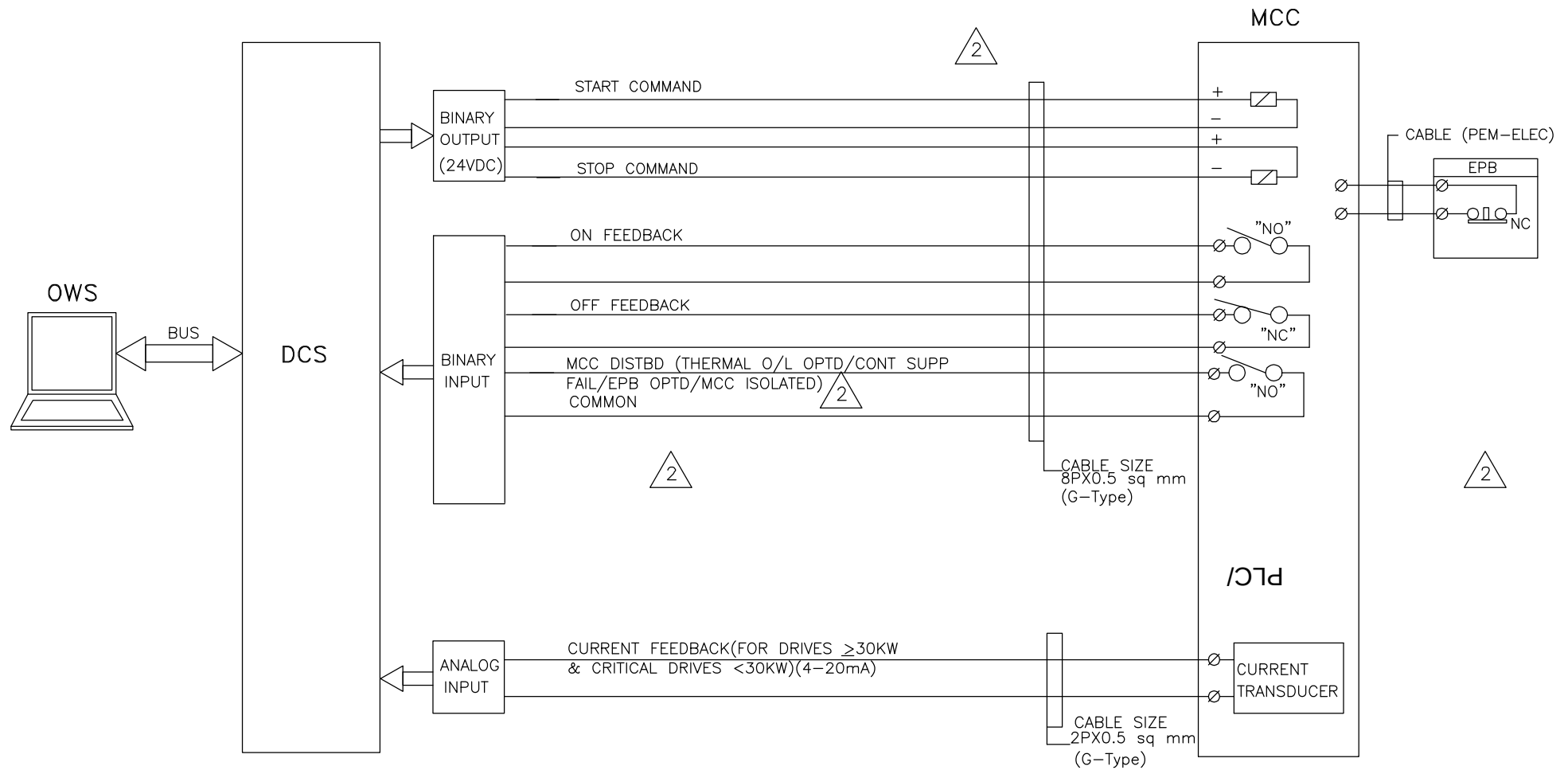
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REV.NO.

03

SHT 7 OF 11

DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE



NOTE:-

1) EPB OF RESPECTIVE DRIVE WILL BE MOUNTED NEAR TO DRIVE ONLY.

2) 4-20mA CURRENT TRANSDUCER SHALL BE CONSIDERED. FOR LTUDs >30 KW AND IMPORTANT DRIVES, LUBE OIL PUMPS (REFER CLAUSE D, SHEET 6 OF 11)



Page 340

PROJECT:

5X800 YADADRI THERMAL POWER STATION
UNIT # 1 TO

TITLE:

DDCMIS INTERFACE FOR
UNIDIRECTIONAL LT DRIVE

DRG.NO.

PE-DM-417-145-I002

DATE

06.12.2019

REV.NO.

03

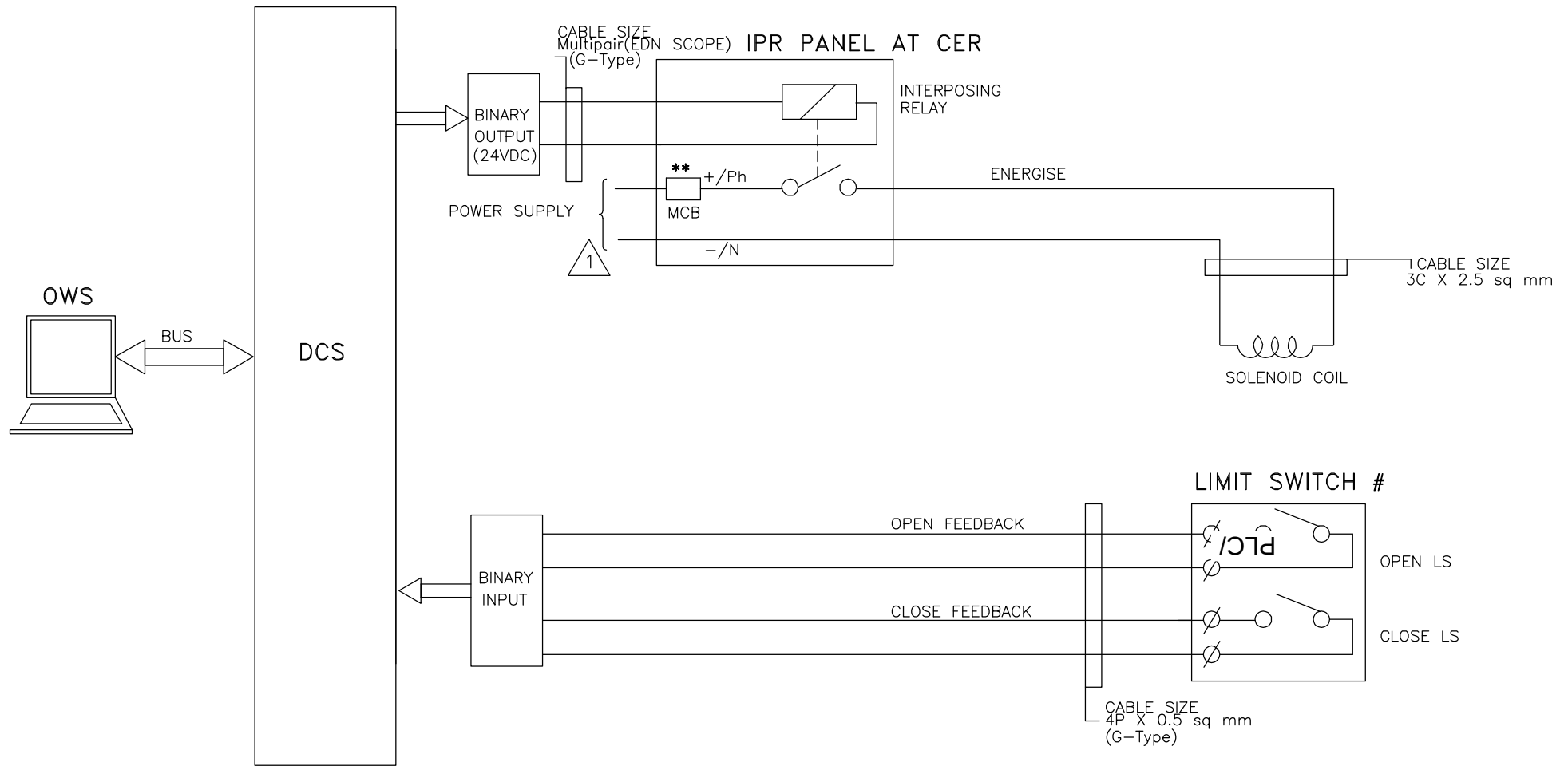
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OF

11

DCS INTERFACE FOR SOLENOID DRIVE (24V DC / 240V AC UPS)



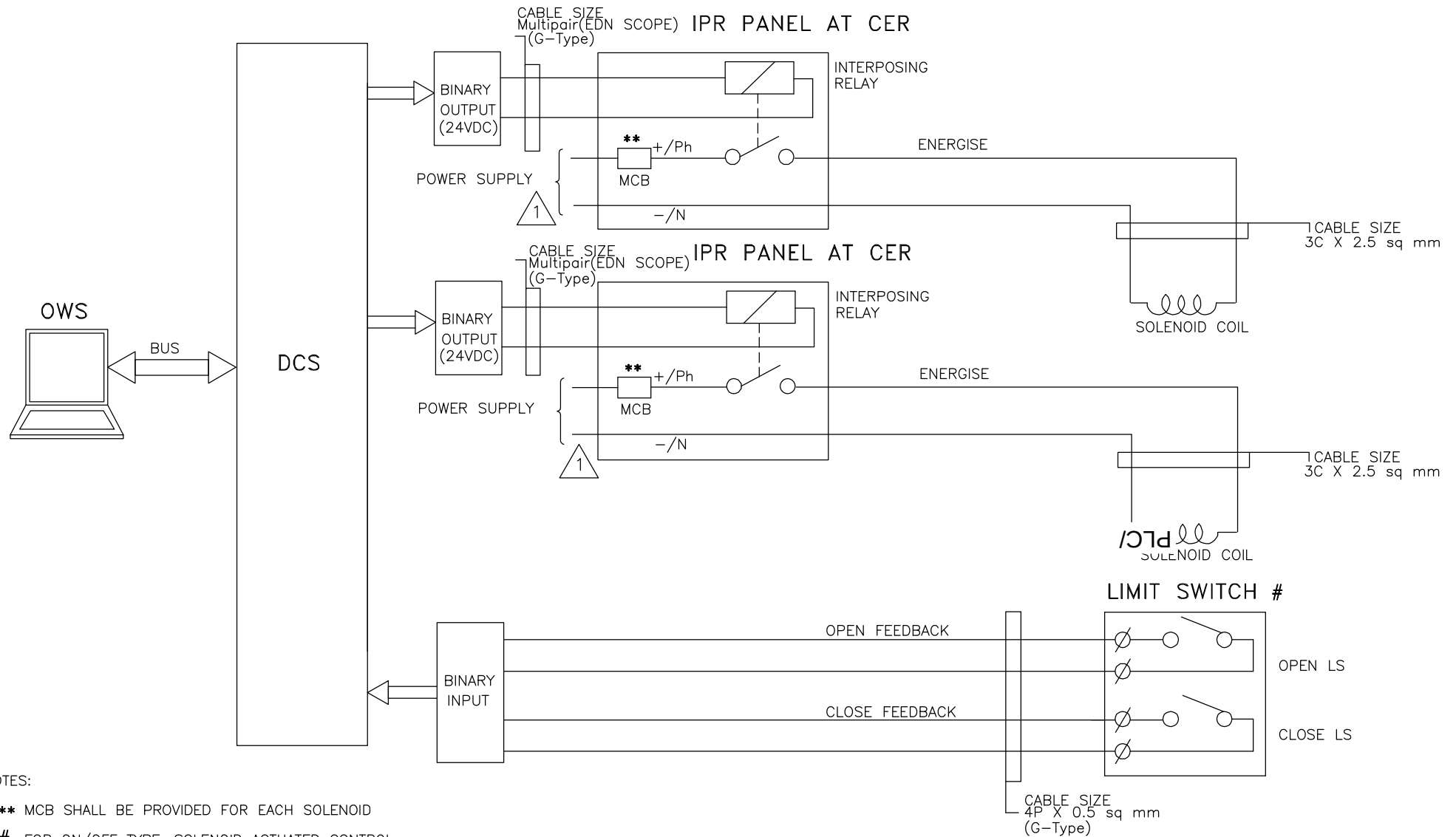
NOTES:

- ** MCB SHALL BE PROVIDED FOR EACH SOLENOID
- # FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.



PROJECT:	5X800 YADADRI THERMAL POWER STATION		DRG.NO.	PE-DM-417-145-I002
	UNIT # 5		DATE	06.12.2019
	TITLE:		REV.NO.	03
	DDCMIS INTERFACE FOR SOLENOID DRIVE (SINGLE COIL)		SHT	9 OF 11

DCS INTERFACE FOR SOLENOID DRIVE (24V^{PLC} / 240V AC UPS)



NOTES:

** MCB SHALL BE PROVIDED FOR EACH SOLENOID

FOR ON/OFF TYPE, SOLENOID ACTUATED CONTROL VALVE.



PROJECT:

5X800 YADADRI THERMAL POWER STATION
UNIT # 5

TITLE:

DDCMIS INTERFACE FOR
SOLENOID DRIVE (DOUBLE COIL)

DRG.NO.

PE-DM-417-145-I002

DATE

06.12.2019

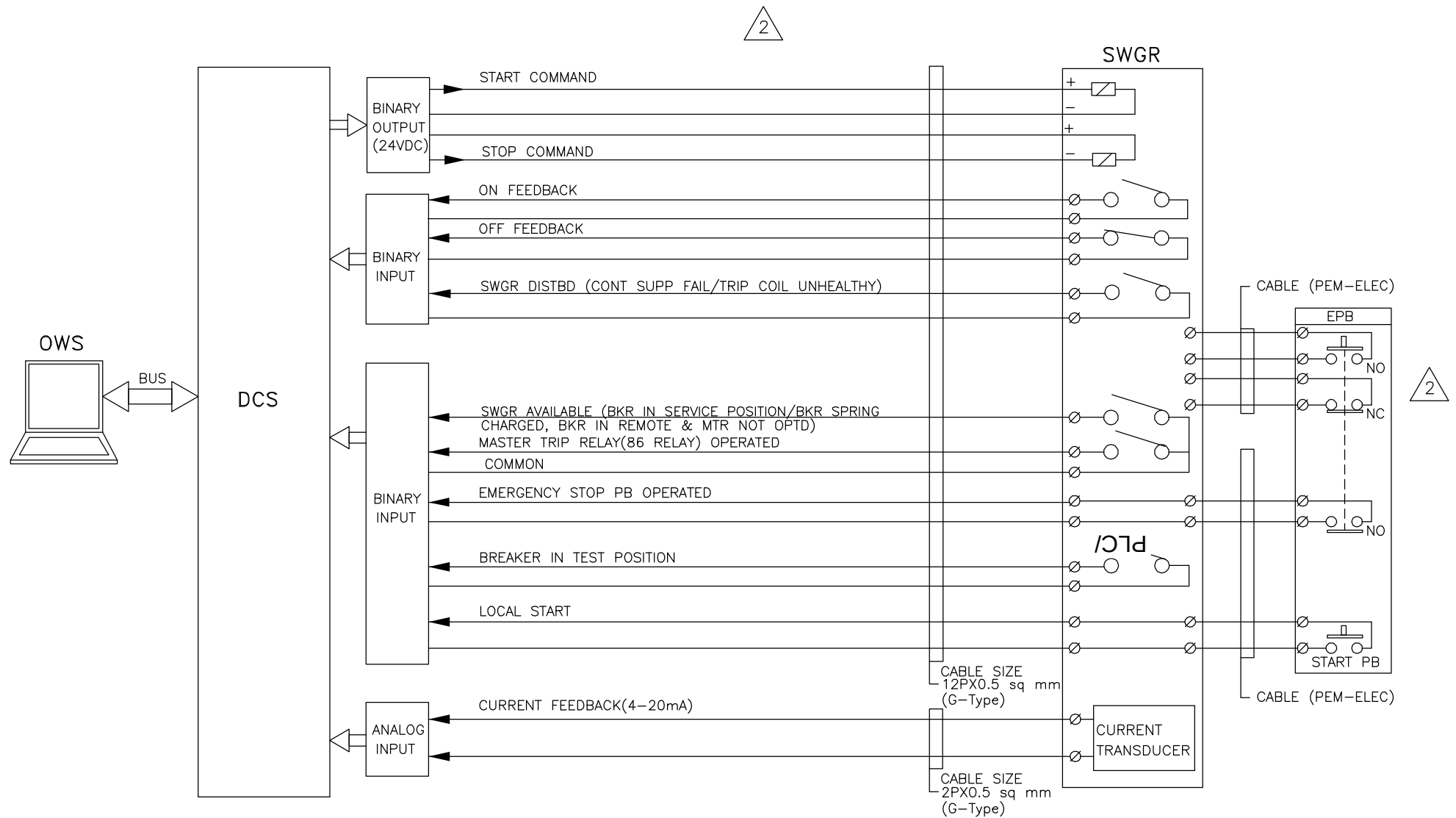
REV.NO.

03

SHT

9a OF 11

DCS INTERFACE FOR HT/LT UNIDIRECTIONAL DRIVES(BREAKER OPERATED)



NOTE:-
EPB OF RESPECTIVE DRIVE WILL BE MOUNTED NEAR TO DRIVE ONLY.

1



Page 343

PROJECT:

5X800 YADADRI THERMAL POWER STATION
UNIT # 1 TO 5

TITLE:

DDCMIS INTERFACE FOR
UNIDIRECTIONAL HT DRIVE

DRG.NO.

PE-DM-417-145-I002

DATE

06.12.2019

REV.NO.

03

SHT

10

OF

11

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ERECTION HARDWARES

1.00.00 GENERAL TECHNICAL REQUIREMENTS

This section provides the general technical guidelines for the erection materials for instruments. All erection materials shall be of good quality and conform to the operating environment of the corresponding instrument.

However, any item required for erection of Bidder supplied system but not categorically indicated in this section, shall be supplied by the Bidder and all these items shall conform to International / National standards / codes.

1.01.00 Electrical Accessories

Electrical conduit and associated materials shall conform to the requirements of the articles which follow :

- a) Rigid Steel Conduit
 - i) Conduits up to and including 25 mm shall be of 16 SWG and conduits above 25 mm shall be of 14 SWG. Minimum size of conduits shall be 19 mm.
 - ii) Each piece of conduit shall be straight, free from blister and other defects and covered with capped bushing at both ends.
 - iii) All rigid conduit couplings and elbows shall be hot dip galvanized rigid mild steel in accordance with IS:9537 Part-I (1980) and Part-II(1981).. The conduit interior and exterior surfaces shall have a continuous zinc coating with an over coat of transparent enamel lacker or zinc chromate. Conduits shall be furnished in standard length of 3 meters, threaded at both ends.
 - iv) All rigid conduit fittings shall conform to requirements of IS:2667,1976. Galvanised steel fittings shall be used with steel conduit. All flexible conduit fittings shall be liquid tight, galvanized steel. The end fitting shall be compatible with the flexible conduit supplied.
- b) Flexible Conduit
 - i) Flexible conduit shall be of three layer construction of very high quality of lead coated steel. Outside and inside layer shall be reinforced with heat resistant material.
 - ii) Lead coating outside and inside of the conduit steel surface shall provide a non-corrosive characteristic particularly in acidic atmosphere. Besides flexibility, this shall be strong enough to stay at the desired profile without support and shall be durable and strong so as to offer sufficient mechanical protection. It shall also be fully liquid dust and air tight and shall withstand a continuous hydraulic pressure up to 2 Kg/Sq. cm and temperature up to 200 °C.
- c) Special Fittings
 - i) Conduit sealing and fittings shall be provided as required and shall be consistent with the area and equipment with which they are installed.
 - ii) Double locknuts shall be provided on all conduit terminations not provided with threaded lugs and couplings. Locknuts shall be designed to securely bond the conduit to the enclosure when tightened. Locknuts shall not loosen due to vibration.

- 1.02.00 Electrical Junction Box:
Please refer to Section VII , Subsection – D of this volume of the Specification.
- 1.03.00 Cable Gland
1. Type : Double compression
 2. Entry Thread : NPT / ET
 3. Material : Brass
 4. Finish : Cadmium Plated.
 5. Protection : IP 54 or better
 6. Accessories : Neoprene gasket, locknuts, reducers etc
- 1.04.00 Cable Tray
1. Material : Mild steel, slotted
 2. Thickness : not less than 2.0 mm
 3. Finish : Hot dip galvanized
 4. Perforation : As per MFR standard
 5. Cover : Suitable for tray
- 1.05.00 Process Hook Up Accessories & specification
Material and rating of the hook up items shall suit the piping and fluid condition. Hook up materials shall be IBR certified for applicable cases. Bidder shall furnish hook up drawings and the drawings for open racks & closed racks for owner's approval.
- 1.05.01 Seamless Stainless Steel Pipe
1. Reference : ASTM A-312 TP 316
 2. Material Grade : TP 316
 3. Type : Seamless /Plain end
 4. Size : As applicable (e.g. 1/2" NB etc)
 5. Schedule : 40
 6. Standard Length : 5 meter
- 1.05.02 Stainless Steel Pipe Fittings

1. Reference : ASTM A-182 F 316 / ANSI B16.11
2. Type : Forged
3. Rating : 3000 lbs / 6000 lbs / 9000 lbs
4. Size : To suit related SS pipe.
5. End connection : Generally socket weld
6. Type of Fittings : Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc.

1.05.03 Seamless Stainless Steel Tube

1. Reference : ASTM A-213 , ASTM A-249 or ASTM A-269
2. Material Grade : TP 316
3. Size : As applicable (e.g. 1/2" OD X 0.083" wall thickness / 1/4" OD X 0.049" wall thickness etc.)
4. Type : Cold drawn annealed, pickled, passivated, de-scaled, hydraulically cleaned seamless tube.
5. Properties : The tube shall be free from scratches and suitable for bending and capable of being flared by hardened and tapered steel pin. The expanded tube shall show no crack or rupture. Hardness shall be RB 80.
6. Test Pressure : 400 Kg/Sq. cm (minimum)
7. Tolerance : ± 0.13 mm for outside diameter
: ± 15 % for wall thickness
8. Standard Length : 5 meter
9. Test : Flare, Hardness, Ball and Bubble Test

1.05.04 Stainless Steel Tube Fittings

1. Reference : ASTM-A-182
2. Type : Double ferrule double compression
3. Material : 316 Stainless steel forged
4. Ferrule : 316 Stainless Steel

- | | | | |
|---------|----|--------------------|--|
| | 5. | Type of Fittings | : Male / female connector, elbow, cross /equal tee, straight connector, bulkhead union, ferrule etc. as required to suit installation. |
| | 6. | Size | : To suit SS tubing and NPT end connection |
| 1.05.05 | | C.S. Pipe | |
| | 1. | Reference | : ASTM-A 106 Gr. C |
| | 2. | Material | : Cold drawn seamless black C.S. |
| | 3. | Type | : Seamless / Plain ends |
| | 4. | Size | : As applicable (e.g. ½" NB etc) |
| | 5. | Schedule | : 80, 160, XXS as required |
| | 6. | Standard Length | : 5 meter |
| 1.05.06 | | C.S. Pipe Fittings | |
| | 1. | Reference | : ASTM-A 105 / ANSI B16.11 |
| | 2. | Type | : Forged |
| | 3. | Rating | : 3000 lbs / 6000 lbs / 9000 lbs |
| | 4. | Size | : Suitable to related C.S.Pipe |
| | 5. | End connection | : Generally socket weld |
| | 6. | Type of Fittings | : Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc. |
| 1.05.07 | | A.S. Pipe | |
| | 1. | Reference | : ASTM-A 335 P22 AS PER ANSI B 36.10 |
| | 2. | Material | : Cold drawn seamless A.S. |
| | 3. | Type | : Seamless / Plain ends |
| | 4. | Size | : As applicable (e.g. ½" NB etc) |
| | 5. | Schedule | : XXS |
| | 6. | Standard Length | : 5 meter |
| 1.05.08 | | A.S. Pipe Fittings | |

1. Reference : ASTM-A 182 F22 AS PER ANSI B 16.11
2. Type : Forged
3. Rating : 9000 lbs
4. Size : Suitable to related A.S.Pipe
5. End connection : Generally socket weld
6. Type of Fittings : Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc.

1.05.09

G.I.Pipe

1. Reference : IS-1239, Part-I
2. Type : Medium grade, threaded at both ends protected with end caps
3. Material : Continuous ERW galvanized MS pipe
4. General : Pipe shall be galvanized both inside and outside
5. Size : As applicable (e.g 1/2"/3/4"/1" etc.)

1.05.10

G.I.Pipe Fittings

1. Reference : IS-1239, Part-II for material, dimension, thread etc.
2. Style : Threaded
3. Type of Fittings : Equal tee, three piece union, unequal tee, straight socket, 90 Deg. elbow, reducing socket cap. etc. to suit installation.
4. Size : Suitable to related G.I.Pipe

1.05.11

Carbon Steel Globe Valve

1. Reference : ASTM A-105
2. Type : Globe
3. Construction : Forged Body Cadmium Plated
4. End Connection : As applicable (eg. 1/2" Socket Weld etc.)
5. Rating : Cl. 800 / CL. 2500

- | | | |
|-----|-----------------|-----------------------------------|
| 6. | Material | : Body - Carbon steel |
| | | : Stem - Hardened Steel |
| | | : Plug - AISI 316 SS |
| | | : Seat- Stainless steel stellited |
| 7. | Packing | : Teflon / Grafoil as required |
| 8. | Yoke | : ASTM A105 |
| 9. | Hand wheel | : Carbon steel |
| 10. | Design standard | : As per ANSI B 16.34 |

1.05.12 Stainless Steel Globe Valve

- | | | |
|-----|-----------------|--|
| 1. | Reference | : ASTM A-182 F316 |
| 2. | Type | : Globe |
| 3. | Construction | : Forged Body |
| 4. | End Connection | : As applicable (eg. ½" Socket Weld etc.) |
| 5. | Proof Pressure | : 400 Kg/Cm2 |
| 6. | Material | : Body - Stainless steel |
| | | : Stem - Hardened Steel |
| | | : Plug - AISI 316 SS |
| | | : Seat- Stainless steel stellited |
| 7. | Packing | : Teflon as required |
| 8. | Yoke | : ASTM A182 F316 |
| 9. | Handwheel | : Carbon steel |
| 10. | Design standard | : As per ANSI B 16.34 |

1.05.13 Alloy Steel Globe Valve

- | | | |
|----|--------------|------------------|
| 1. | Reference | : ASTM A-182 F22 |
| 2. | Type | : Globe |
| 3. | Construction | : Forged Body |

- | | | |
|-----|-----------------|--|
| 4. | End Connection | : As applicable (eg. ½” Socket Weld etc.) |
| 5. | Rating | : CL. 2500 |
| 6. | Material | : Body - Alloy steel |
| | | : Stem - Hardened Steel |
| | | : Plug - AISI 316 SS |
| | | : Seat- Stainless steel stellited |
| 7. | Packing | : Grafoil as required |
| 8. | Yoke | : ASTM A182 F22 |
| 9. | Handwheel | : Carbon steel |
| 10. | Design standard | : As per ANSI B 16.34 |

1.05.14 Structural Steel

Steel supports for JB's, trays; tubes and related equipments shall not be limited to the following:

- | | |
|----|---------------------------------------|
| a) | MS Angle |
| b) | MS Channel |
| c) | I-Beam |
| d) | Hexagonal head Bolt & Nut with washer |
| e) | Foundation Bolt & Nut |
| f) | Expansion Bolt |
| g) | Steel Plates / Flats |
| h) | CRCA sheet |
| i) | 50 NB Pipe |
| j) | Pipe clamps, U Bolts & Nuts |
| k) | Checker plate |

1.05.15 Condensate Pot

- | | | |
|----|----------------|--|
| 1. | Reference | : ASTM A182 F22 /ASTM A105 |
| 2. | Material | : Alloy steel / carbon steel as per application |
| 3. | Construction | : Drilled from barstock |
| 4. | End connection | : As applicable (e.g 3 nos. ½” socket weld end etc.) |

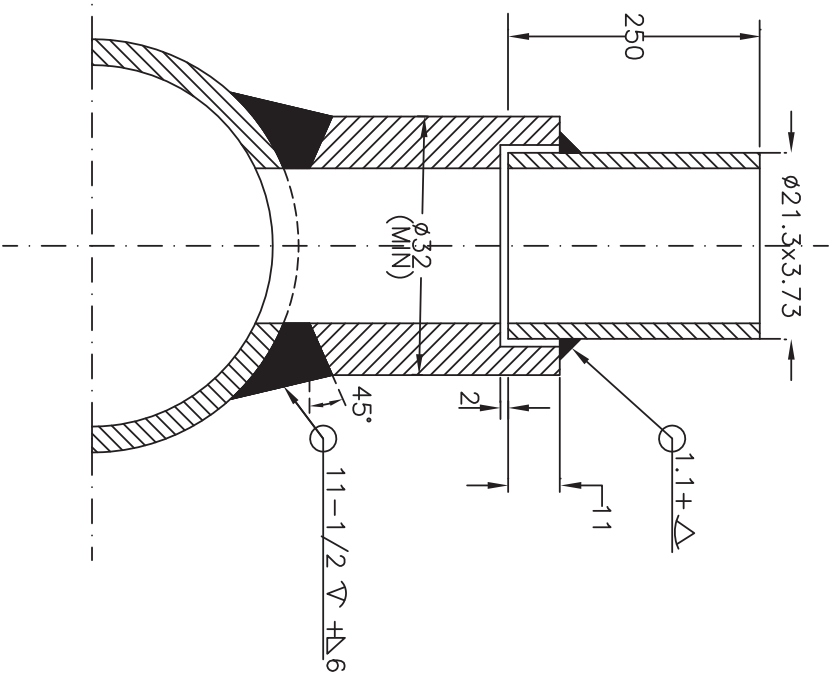
	5. Accessories	: Vent valves
1.05.16	Instrument Valve Manifold	
	1. Type	: Two valve manifold
		: Five valve manifold
	2. Mounting	: Remote 2" Pipe Mounting / Transmitter Rack mounting
	3. Construction	: Single block (bar stock)
	4. Material	: Forged body and bonnet AISI 316 stainless steel
	5. Ports	: Mfg std. (e.g 1/2 " NPT (F) etc.)
	6. Rating	: 420 Kg/Sq. cm at ambient
	7. Operating Temperature	: (-)30 to (+)170 Deg C
	8. Packing	: PTFE Wafer
	9. Seat & Stem	: AISI 316 SS
	10. Plug	: AISI 316 SS free to turn on stem / 17-4 PH
	11. Handle Bar	: AISI 316 SS
	12. Connection	: Straight
	13. Accessories	: Plugs for all ports, Mounting Bracket , bolts , nuts
1.06.00	Pneumatic Hook Up Accessories	
1.07.00	Air Header	

Technical Particulars	For Panel	For Field
Material of Construction	: Stainless steel	: Stainless steel
Inlet Connection	: 2" NPT (M)	: 1" NPT (M)
Header Take-off Material	: Stainless steel	: Stainless steel
Take off connection	: 1 / 2" NPT (M)	: 1/ 2" NPT (M)
Take-off Valves Material	: stainless steel	: stainless steel

Tube Take-off	: Tube adapter on valve	: Tube adapter on valve
Drain	: SS drain valve at lowest point	: SS drain valves at lowest point

INSTRUMENT STUB DETAILS

CUSTOMER:				TELANGANA STATE POWER GENERATION CORPORATION LTD TELANGANA, INDIA 5 x 800 MW YADADRI TPS, UNIT # 1 TO 5																			
CONSULTANT:				TATA CONSULTING ENGINEERS LIMITED BANGALORE, INDIA																			
																							
				BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA																			
JOB NO. 417																							
STATUS CONTRACT																							
DISTRIBUTION																							
REV.	DATE	AUTH	CHD	APPD	REV.	DATE	AUTH	CHD	APPD	The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.													
TITLE														INSTRUMENT STUB DETAILS									
DEPT.														SCALE									
SIGN																							
DRAWING NO.														PE-DG-417-145-1101									
SHEET 1 OF 6														REV. 00									



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1/2" GLOBE VALVE OF MATERIAL AS PER ANSI B 31.1.
4. TWO ISOLATION VALVES ARE TO BE USED FOR PRESSURE EXCEEDING 40 Kg/Cm2.
5. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
6. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY(1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.

TITLE : 5 x 800 MW YADADRI TPS

STD INSTRUMENT STUB

DETAILS

PRESSURE STUB

DRG. NO.

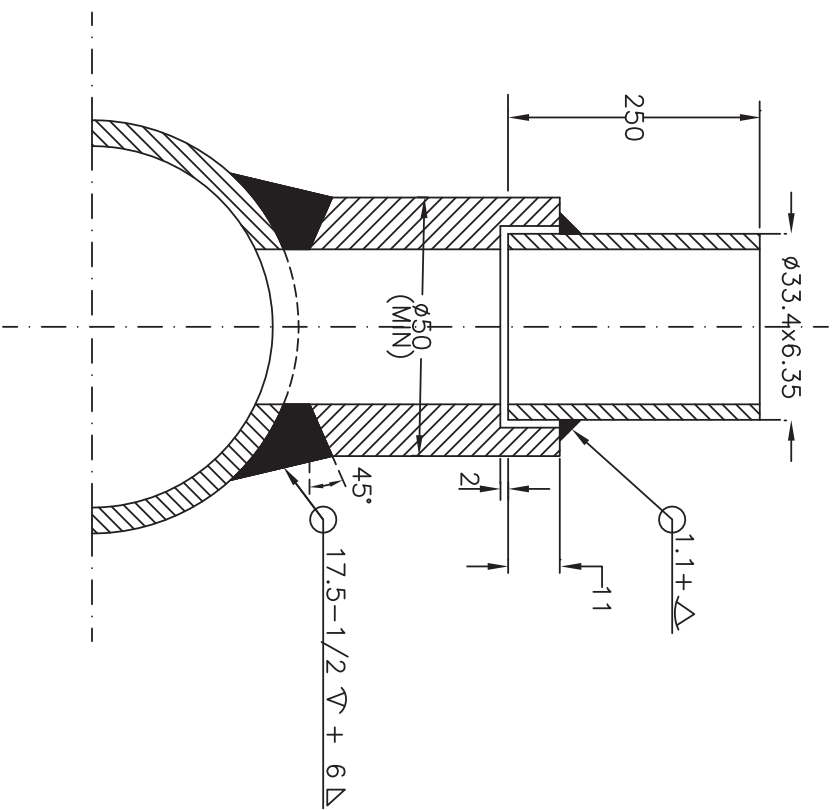
PE-DG-417-145-1101

REV. 00

SH. 02 OF 06



SYSTEM PRESS < 60kg/Cm2 & SYSTEM TEMP<425 Deg C, Nb15 , CL3000



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1" GLOBE VALVE OF MATERIAL AS PER ANSI B 31.1.
4. TWO ISOLATED VALVES ARE TO BE USED.
5. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
6. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY(1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.

TITLE : 5 x 800 MW YADADRI TPS

STD INSTRUMENT STUB

DETAILS

PRESSURE STUB

DRG. NO.

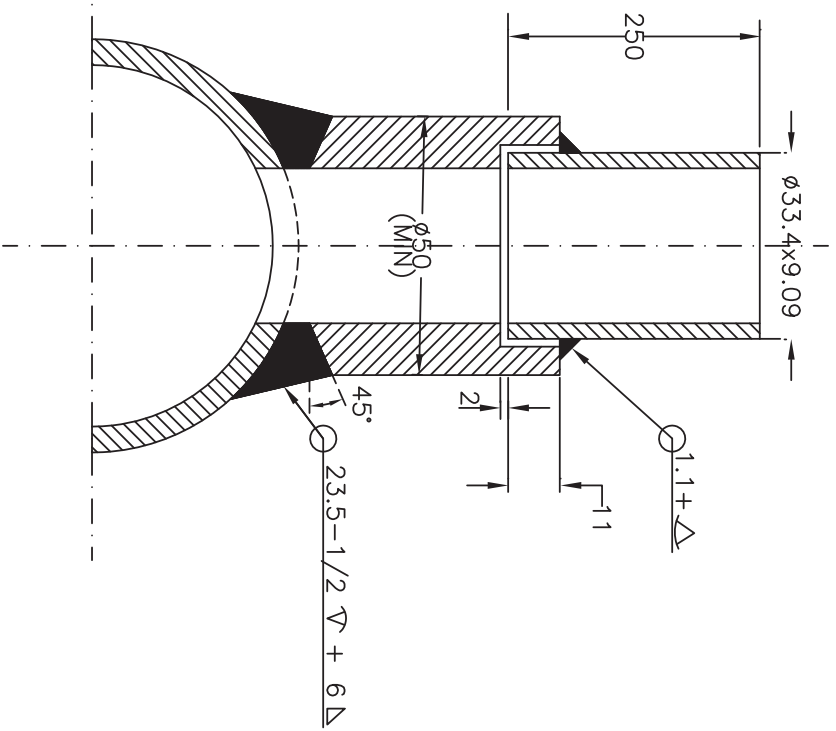
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REV. 00

SH. 03 OF 06



SYSTEM PRESS > 60Kg/Cm2 & 425 Deg C < SYSTEM TEMP <= 500 Deg C , Nb25 , CL3000/6000



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHALL BE 250 MM.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1" GLOBE VALVE OF MATERIAL AS PER ANSI B 31.1.
4. TWO ISOLATED VALVES ARE TO BE USED.
5. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.
6. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY(1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.

TITLE : 5 x 800 MW YADADRI TPS

STD INSTRUMENT STUB

DETAILS

PRESSURE STUB

SYSTEM TEMP > 500 Deg C , Nb25 , CL9000

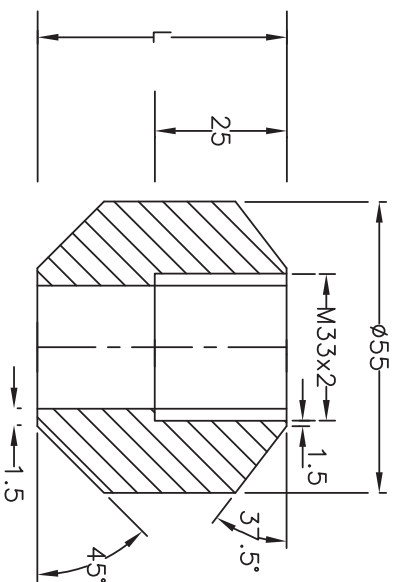
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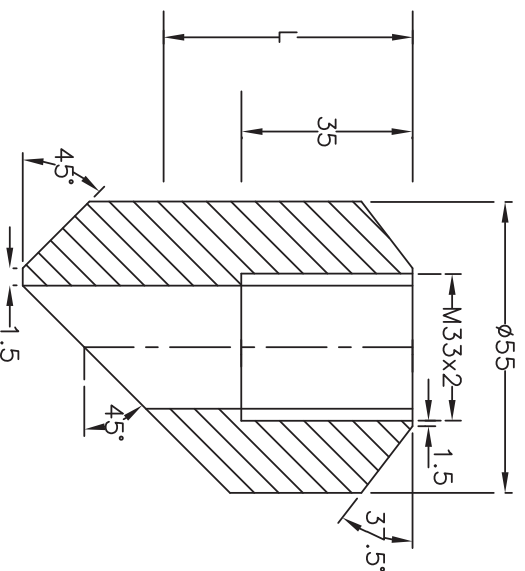
REV. 00

SH. 04 OF 06





TEMPERATURE STUB FOR STRAIGHT IMMERSION



TEMPERATURE STUB FOR SLANT IMMERSION

NOTE :

1. MATERIAL OF THE BOSS SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED.
2. LENGTH OF THE STUB (L) SHALL BE 64/45 mm DEPENDING UPON PIPE SIZE, AS PER CORPORATE STD. AA 7326102.(FOR PIPE OD 88.9 mm TO 159 mm STUB HEIGHT SHALL BE=64mm & FOR PIPE OD ≥ 219.1 mm STUB HEIGHT SHALL BE=45mm)
3. STRAIGHT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 168.3 mm & ABOVE. THE STUB HEIGHT FOR PIPE OD 168.3 mm TO <219.1 mm SHALL BE 64 mm.
4. SLANT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 88.9 mm TO 159 mm.
5. FOR MAIN PIPE OD'S 88.9 mm & BELOW SUITABLE EXPANDER SHALL BE USED.
6. PLEASE REFER SHEET-6 FOR THERMOWELL INSTALLATION.

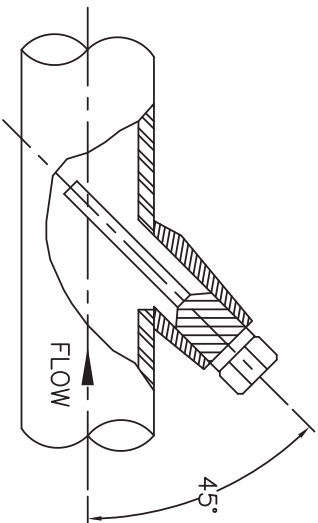
TITLE : 5 x 800 MW YADADRI TPS

STD INSTRUMENT STUB
DETAILS

TEMPERATURE STUB

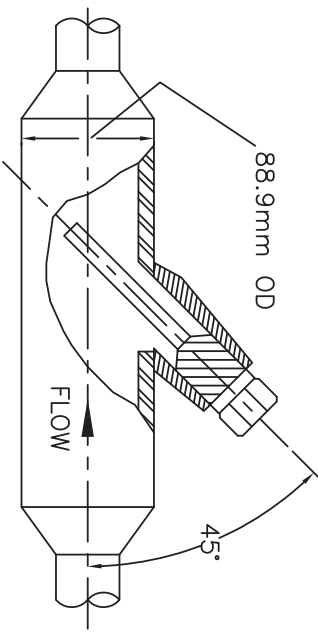


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REV. 00
SH. 05 OF 06



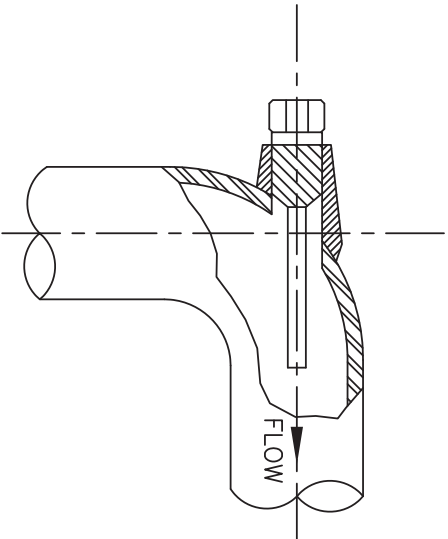
INSTALLATION TYPE-1

FOR MAIN PIPE OD 88.9mm to 159mm



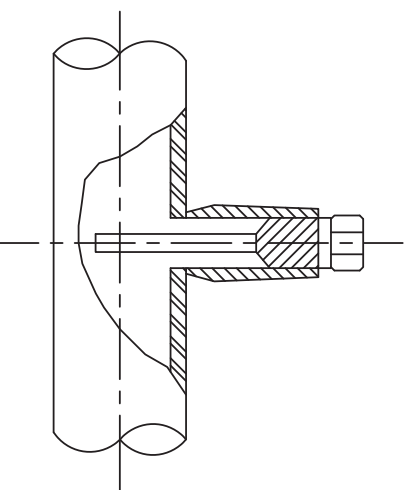
INSTALLATION TYPE-2

FOR MAIN PIPE OD BELOW 88.9mm



INSTALLATION TYPE-3

FOR MAIN PIPE OD 88.9mm & BELOW



INSTALLATION TYPE-4

FOR MAIN PIPE OD 168.3mm & ABOVE



TITLE : 5 x 800 MW YADADRI TPS

STD INSTRUMENT STUB
DETAILS

THERMOWELL INSTALLATION

DRG. NO.
PE-DG-417-145-1101
REV. 00
SH. 06 OF 06

ANNEXURE

Sl.No	Package Name	Vendor Sl. No	Vendor proposed for approval	TSGENCO Remarks for YTPS (5x800MW)
1.	FLOW ELEMENT-ORIFICE	1	ASIAN INDUSTRIAL VALVES & INSTRUMENTS, TAMILNADU	Approved.
		2	GENERAL INSTRUMENTS CONSORTIUM, TAMILNADU	Approved.
		3	INSTRUMENTATION LTD., KERALA	Approved.
		4	INSTRUMENTATION ENGINEERS PVT LTD., HYDERABAD	Approved.
		5	MICRO PRECISION PRODUCTS PVT. LTD., HARYANA	Approved.
		6	STAR-MECH CONTROLS (I) PVT.LTD., PUNE	Approved.
		7	NOT USED	
		8	NOT USED	
		9	TANSA EQUIPMENTS PVT. LTD., MUMBAI	Approved.

		10	HYDROPNEUMATICS PVT. LTD., GOA	Approved.
		11	NOT USED	
		12	NOT USED	
		13	NOT USED	
		14	FLOW STAR ENGINEERING PVT. LTD., FARIDABAD	Approved.
2.	FLOW ELEMENT- NOZZLE	1	ASIAN INDUSTRIAL VALVES & INSTRUMENTS,TAMILN ADU	Approved.
		2	BOPP & RUETHER HEINRICHS MESSTECHNI,GERMAN Y	Approved.
		3	GENERAL INSTRUMENTS CONSORTIUM,NEWDE LHI	Approved.
		4	HYDROPNEUMATICS PVT. LTD., GOA	Approved.
		5	INSTRUMENTATION LTD., KERALA	Approved.
		6	MICRO PRECISION PRODUCTS PVT. LTD., HARYANA	Approved.
		7	STAR-MECH CONTROLS (I) PVT.LTD., PUNE	Approved.
		8	TECHNOMATIC ITALY	Approved.

		9	NOT USED	
		10	MINCO (INDIA) FLOW ELEMENTS PVT. LTD., GOA	Approved.
		11	NOT USED	
3.	CONTROL VALVE	1	BTG KALLE INVENTING, SWEDEN	Approved.
		2	CONTROL COMPONENT INC.,NEW DELHI	Approved.
		3	DAUME REGELARMATUREN GMBH,	Approved.
		4	DRESSER VALVE INDIA PVT. LTD, TAMIL NADU	Approved.
		5	DRESSER PRODUITS INDUSTRIELS, FRANCE	Approved.
		6	EMERSON PROCESS MANAGEMENT CHENNAI LIMITED	Approved.
		7	FORBES MARSHALL ARCA PVT.LTD., PUNE	Approved.
		8	FISHER SANMAR LTD., NEWDELHI	Approved.

9	FLOWSERVE INDIA CONTROLS PVT. LTD.,KOLKATA	Approved.
10	INSTRUMENTATION LTD., KERALA	Approved.
11	KSB MIL CONTROLS LTD., KERALA	Approved.
12	KOSOFLUID CONTROLS PALAKKAD, KERALA	Approved.
13	KOSO INDIA PRIVATE LIMITED, MAHARASHTRA	Approved.
14	LESLIE CONTROLS, INC, USA	Approved.
15	SEVERN GLOCON INDIA PVT. LTD., TAMIL NADU	Approved.
16	BOMAFA SPECIAL VALVE SOLUTIONS PVT LTD., GUJARAT	Approved.
17	MASCOT VALVES PVT. LTD., GUJARAT	Approved.
18	R.K.CONTROL INSTRUMENTS PVT. LTD., MAHARASHTRA	Approved.
19	NOT USED	

		20	NOT USED	
		21	NOT USED	
4.	ULTRASONIC FLOWMETER	1	CHEMTROLS INDUSTRIES LTD, MUMBAI	Approved.
		2	FLASH FORGE MUMBAI	Approved.
		3	ADEPT FLUIDYNE PVT. LTD., MAHARASHTRA	Approved.
		4	ELECTRONET EQUIPMENTS PVT LTD., PUNE	Approved.
		5	NOT USED	
		6	NOT USED	
		7	NOT USED	



**TECHNICAL SPECIFICATION
FOR VENTILATION SYSTEM
5X800 MW YADADRI TPS**

DOCUMENT NO.: PE-TS-417-554-A001

REVISION 00

DATE: FEB 2020

SECTION: I
SUB-SECTION: D
STANDARD TECHNICAL SPECIFICATIONS

Note-In the event of any conflict between the requirements of two clauses of this specification documents or requirements of different codes and standards specified, Section - C shall prevail over section –D, however more stringent requirement as per the interpretation of the owner shall apply.



**STANDARD TECHNICAL SPECIFICATION
FOR
AIR WASHER**

SPECIFICATION NO.PES-554-01

VOLUME II B

SECTION D

REV. 00

DATE: NOV 2012

SHEET 1 OF 3

**STANDARD TECHNICAL SPECIFICATION
FOR
AIR WASHER**

	STANDARD TECHNICAL SPECIFICATION FOR AIR WASHER	SPECIFICATION NO.PES-554-01	
		VOLUME II B	
		SECTION D	
		REV. 00	DATE: NOV 2012
		SHEET 2 OF 3	
1.	GENERAL		
1.1.1	This specification covers the design, manufacture, construction features, installation, commissioning and conducting performance test at site.		
2.	CODES AND STANDARDS		
	The design/manufacture and performance of air washer shall comply with all currently applicable statutes, regulations and safety codes in the locality where the air washer is installed. The equipments shall also conform to the requirements of the latest editions of applicable Indian/British/US standards. Nothing in this specification shall be construed to relieve the vendor of this responsibility. In particular the equipments shall conform to the latest editions of the following standards:-		
2.1.1	IS:277: Galvanised steel sheets		
2.1.2	IS:1239: Mild steel tubes		
2.1.3	IS: 2062:		
3.	DESIGN/CONSTRUCTION FEATURES		
3.1	GENERAL		
3.1.1	The air washer shall be designed for max. air velocity of 2.8M/sec. Circulating water quantity shall be 1.0 CMH for every 1000 CMH of air flow, unless otherwise stated in data sheet A. The minimum saturating efficiency of air washer shall not be less than 90% Minimum length of air washer shall be 2500 mm.		
3.2	TANK (SUMP)		
3.2.1	The air washer tank shall either be masonry or metallic construction as specified in data sheet A. Masonry tank shall be provided by purchaser whereas metallic tank shall be of welded construction, fabricated from not less than 6mm thick MS plates, and inside, outside surfaces shall be provided with anti corrosive paint (Zinc sprayed to coating thickness of 75 micron min.).		
3.2.2	The air washer tank shall have a minimum depth of 600mm and tank construction shall be such that the suction screen can be replaced while the air washer is under operation. The inlet and outlet ends of tank shall be suitably constructed to accommodate distribution plates and eliminator plates.		
3.3	DISTRIBUTION PLATE		
3.3.1	The distribution plate shall be fabricated from minimum 18 gauge thick GSS and shall have minimum 50% free area. The angles used for supports shall be galvanised.		
3.3.2	The distribution plate shall be built up of number of sections for easy handling.		
3.4	HEADERS AND STAND PIPE		
3.4.1	The air washer shall be of two bank construction (one cross flow and other unit flow). The piping up to and including 100mm dia meter shall be of galvanised steel and above 100mm dia shall be black steel (subsequently spray galvanized to coating thickness as per approved TDS). All piping shall be adequately supported.		

	STANDARD TECHNICAL SPECIFICATION FOR AIR WASHER	SPECIFICATION NO.PES-554-01	
		VOLUME II B	
		SECTION D	
		REV. 00	DATE: NOV 2012
		SHEET 3 OF 3	

3.5	SPRAY NOZZLES
3.5.1	Spray nozzles shall be made of HDP (High density polyethylene) and shall be self cleaning type. The nozzles shall be designed to produce fine atomised spray and shall be spaced to give, uniform coverage of the air washer section. The pressure drop through the nozzle shall be in the range of 1.4 kg/cm2 g to 2.4 Kg/cm2g
3.6	ELIMINATOR PLATE
3.6.1	Eliminator plate shall be fabricated from 22 gauge thick GSS (Zinc coating thickness as per approved TDS).The eliminator section shall have minimum 6 bends. Spacer bars, tie rods and supports shall be of galvanised steel construction. Eliminator box shall be complete with suitable drop tray and drain pipe.
3.7	SUCTION SCREENS
3.7.1	Suitable no. of suction screens shall be provided by vendor and one set of spare screens shall be furnished along with each air washer.
3.8	INSPECTION DOOR AND MARINE LIGHT
3.8.1	Air tight inspection door of 600x700mm, metallic construction shall be provided. The air washer shall be equipped with marine light as required.
3.9	MAKE UP, DRAIN AND QUICK FILL CONNECTION
3.9.1	The air washer shall be provided with quick fill and make up connection. The quick fill valve shall be a globe valve. Float valve for making connection shall be backed up by a gate valve. Drain connections complete with isolating valves shall be provided for both suction and main tank. Over-flow pipe shall be provided for main tank and shall be connected to drain pipe, before the isolating valve or drain. In case of masonry tanks suitable pipe pieces with stiffener plates shall be provided by Vendor for use during casting of masonry tank.
4.	DATA TO BE FURNISHED BY VENDOR AFTER AWARD OF CONTRACT
4.1.1	Performance curve for air washer
4.1.2	GA drg.
4.1.3	Foundation drag. weight, dynamic loading etc.
4.1.4	O&M manual



**AIR WASHER
DATA SHEET - A**

VOLUME II-B

SECTION D

REV 00

DATE NOV 2012

SHEET 1 OF 2

S.No. DESCRIPTION

DETAILS

GENERAL

- | | | |
|----|---------------|---|
| 1. | Designation | Air washers for power house building. |
| 2. | Nos. required | Refer Section-C of Specific Technical Requirement |
| 3. | Service | Evaporative Cooling of TG Hall & electrical bay |
| 4. | Location | As per section-C/ Tender Layout Drg. |

DESIGN DATA

- | | | |
|----|--|--|
| 5. | Type | Sheet metal type, as per schedule of Ventilation system. |
| 6. | Capacity M3/hr | Refer Section-C of Specific Technical Requirement |
| 7. | Inlet air temperature | (Refer design data.) |
| 8. | Saturation Efficiency (min). | To achieve saturation efficiency of 90% |
| 9. | Allowable Pressure drop through Spray nozzle | 2.4 Kg/cm ² (g) max. |
| 9. | Pressure drop across Spray chamber | 15 to 20 mm WG. |

MATERIALS

- | | | |
|-----|-----------------------------|--|
| 11. | Moisture Eliminators plates | 24 SWG Galvanized Sheet (Vertical and brake type). / 100% Virgin PVC of minimum finished thickness of 2 mm. |
| 12. | Moisture Eliminators Frame | 22 SWG G.I. Sheets. |
| 13. | Distribution plates | 18 G GSS to have 50% free area. |
| 14. | Tank | MS |
| 15. | Casing | Black M.S. (10 SWG min.) |
| 16. | Louvers | 20 G GSS sheet & frame of 18 G galvanized steel angle. Louvers with Bird screen of galvanized wire mesh of 10 mm square. |
| 17. | Piping | MS Heavy Class Galvanized to IS: 1239 Part I, OR IS –3589 depending upon size. |



**AIR WASHER
DATA SHEET - A**

VOLUME II-B

SECTION D

REV 00

DATE NOV 2012

SHEET 2 OF 2

- | | | |
|-----|----------------------|--|
| 18. | Suction Screen Water | Brass (40 mesh size 2 nos for each air washer) |
| 19. | Spray nozzles | Brass/Bronze with chrome plating or suitable plastic material (Nylon/Polymer) and shall be self cleaning type. |
| 20. | Flooding Nozzles | Nylon/Polymer. |
| 21. | Banks | Two spray banks each connected to individual header |

EQUIPMENT SELECTION CRITERIA

- | | | |
|-----|--|------------------------------------|
| 22. | Face Velocity through louver. | Not to exceed 2.5 m/s |
| 23. | Max. Pressure drop | Not to exceed 6.5 mm Wg when clean |
| 24. | Saturation efficiency | Not less than 90%. |
| 25. | Face velocity of air through spray chamber. | Not to exceed 2.5 m/s. |
| 26. | Allowable pressure drop for washing chamber. | 15 to 20 mm Wg. |

NOTE:

- 1) All parts coming in contact with moisture for air washer shall be spray galvanized/epoxy painted
(2 coat of rust preventing epoxy primer & 2 coat of finished paint from both sides.)
- 2) Moisture eliminator shall have bends at 30 Degree with the direction of air flow & shall have effectively hooked edges for trapping the water.



**STANDARD TECHNICAL SPECIFICATION
FOR
VENTILATION FANS**

SPECIFICATION NO.PES-554-03

VOLUME II B

SECTION D

REV. 02

DATE: NOV 2012

SHEET 1 OF 4

**STANDARD TECHNICAL SPECIFICATION
FOR
VENTILATION FANS**

	STANDARD TECHNICAL SPECIFICATION FOR VENTILATION FANS	SPECIFICATION NO.PES-554-03	
		VOLUME II B	
		SECTION D	
		REV. 02	DATE: NOV 2012
		SHEET 2 OF 4	
1.	GENERAL	This specification covers the design, manufacture, testing of performance at manufacturer's/sub-contractors works, delivery at site, handling at site, erection and commissioning of ventilation fans.	
2.	CODE AND STANDARDS	The design, manufacture and performance of equipment shall comply with all currently applicable statutes, regulations and safety codes in the locality where it is to be installed. The equipment shall conform to latest edition of applicable Indian Standards or their equivalent standards. Nothing in this specification shall be construed to relieve the vendor of this responsibility. In particular the equipment shall conform to the latest editions of the Following standards.	
2.1.1	IS:4894	-Centrifugal fans	
2.1.2	IS:3588	-Electric Axial Flow fans	
2.1.3	IS:2312	-Propeller type A.C. ventilation fans	
2.1.4	IS-3963	-Roof extractor units	
2.1.5	BS:848	-Method of performance test for fans.	
2.1.6	AMCA publication 99 standards handbook		
2.1.7	AMCA standard 210, Test code for air moving devices.		
3.	DESIGN AND CONSTRUCTION		
3.1	THE ENCLOSED DATA SHEET A GIVES THE NECESSARY DETAILS FOR CENTRIFUGAL/AXIAL/ROOF EXTRACTOR UNITS ETC.		
3.2	WELDING PROCESS AND WELDERS EMPLOYED FOR FABRICATION SHALL BE QUALIFIED AS PER ASME SEC. IX		
3.3	CASING		
3.3.1	The centrifugal fans casing shall be of welded construction fabricated with heavy gauge material (min 3 mm) with flanges (min. 5 mm) on inlet and out let side for direct connection and shall be rigidly reinforced and supported by structural angles. The seams shall be permanently sealed airtight. Horizontal Split casings shall be provided on large size fans. Casing drain (at bottom) with threaded plug/ with valve shall be provided, as required. All mounting/ connecting holes shall be drilled off centre.		
3.3.2	The axial flow casing for supply fans/roof extractors shall be of heavy gauge construction (min 3 mm) properly reinforced for rigidity and shall be complete with suitable supports. Access doors with suitable locking arrangement shall be provided in the casing for easy access to the motor and impeller. External junction box/ Terminal box on casing with IP-55 protection shall be provided, if required. Wiring for motor from external junction box/ Terminal box shall be through flexible conduit.		
3.3.3	Suitable motor brackets designed for rigid mounting of motors, shall be provided for roof extractors and wall mounted exhaust/ supply fans.		

	STANDARD TECHNICAL SPECIFICATION FOR VENTILATION FANS	SPECIFICATION NO.PES-554-03	
		VOLUME II B	
		SECTION D	
		REV. 02	DATE: NOV 2012
		SHEET 3 OF 4	

3.4	IMPELLER
3.4.1	Centrifugal fan impeller shall have die formed, aerofoil or laminar blades welded to the rim and back plate and shall have non-overloading, self cleaning characteristics. Rim shall be spun to have smooth contour. If required, intermediate stiffening rings shall be provided. Shaft sleeves shall be furnished, if specified. The impeller, pulley and shaft sleeve shall be secured to the shaft by key and/or nuts (threaded opposite to direction of rotation of impeller). The impeller shall be statically and dynamically balanced.
3.4.2	The axial fan impeller shall be of high efficiency aerofoil design. The blades shall be mounted on a streamlined hub and the impeller shall be mounted directly on the motor shaft. Impeller shall be in one piece however; fabricated blades will be acceptable up to 450 mm impeller diameter.
3.4.3	Roof ventilator impeller may either be centrifugal or axial type. Backward inclined blades shall be provided for centrifugal impellers. Blades may be die-formed or cast. Axial flow impeller shall be directly mounted to motor shaft whereas centrifugal impeller may either be direct-driven or belt-driven. The shaft of belt-driven centrifugal fan shall be solid cold rolled carbon steel, ground and polished. However, direct mounted impellers are preferred.
3.5	BEARINGS:
3.5.1	The centrifugal fan bearing may be ball, roller or sleeve bearings of self-aligning heavy duty type with adequate capacity and life. Make of Bearings to be specified. Bearings shall be oil/grease lubricated and provided with fittings for lubrication from outside and shall be located in easily accessible position to facilitate maintenance.
3.6	INLET CONES AND GUARDS
3.6.1	Centrifugal fans inlet shall be spun to have a smooth contour. Inlet screen, if provided, shall be galvanised wire mesh of 25 mm square with wire thickness of min. 1.5 mm.
3.6.2	Inlet cone, outlet bell and suitably designed guards shall be provided.
3.7	GUIDE VANES:
3.7.1	In case of vane axial fans guide vanes shall be provided on discharge side.
3.8	BASE PLATE AND VIBRATION ISOLATORS
3.8.1	Base plate and vibration isolators, which may be double deflection rubber in shear or rubber in compression type or spring type shall be provided. With each fan rubber bushes, washers wherever needed for vibration isolator in sufficient nos. shall be included, as required, to ensure isolation of foundation from vibration of equipment. For roof ventilators suitable mounting arrangement shall be provided such that there is no ingress of rain water into the building.
3.9	HOOD AND COWL
3.9.1	Roof exhaustors shall be provided with hinge type hood providing easy access to motor and impeller. Weather proof lockable type disconnect switch shall be provided such that hood can open only when the disconnect switch is in 'off'

	STANDARD TECHNICAL SPECIFICATION FOR VENTILATION FANS	SPECIFICATION NO.PES-554-03	
		VOLUME II B	
		SECTION D	
		REV. 02	DATE: NOV 2012
		SHEET 4 OF 4	

position. On larger size of roof ventilators hoods may be of split construction. 15 mm mesh galvanised bird screen shall be provided.

3.9.2 Rain protection cowls shall be designed to suit wall exhausters/supply fans for protecting fans from rain. The cowls shall be provided with bird screen of heavy gauge expanded metal netting.

3.10 SPEED

3.10.1 The speed of axial flow fans/roof ventilators shall not exceed 960 RPM for impeller dia exceeding 450 mm and shall not be greater than 1440 with impeller dia less than 450 mm.

4. MOTORS

Drive motors shall be of totally enclosed type, suitable for horizontal/vertical mounting as applicable and shall comply with the requirments of the specifications furnished elsewhere for motors.

5. ACCESSORIES

Accessories as specified in Data sheet-A and as required for satisfactory trouble free & safe operation of fans shall be provided.

TESTING AND INSPECTION

List of TCs arranged as per Approved Quality Plan shall be furnished along with copy of TCs at the time of inspection by BHEL

- Visual inspection of sheets/plates, angles, channels etc. – Pitting, lamination in sheets/ plates, angles and channels shall be avoided.- visual inspection by main contractor of BHEL.
- Sheets/ Plates - Test certificate shall be furnished for physical and chemical properties for sheets / plates- for review by BHEL
- Shaft: Mechanical and chemical— review by BHEL
- Motors (of approved make): Routine TC ,FLP TC if applicable
- Workmanship and dimensional check as per manufacturing drg. and approved Drgs.- by main contractor of BHEL.- Shall be checked by BHEL/ Customer during final inspection.
- Balancing of impellers- Dynamic balancing certificates shall be furnished –grade 6.3 or better to ISO-1940. Balancing weights shall be positively locked/ welded to avoid loosening. - witness by manufacturer - TC to be furnished for review by BHEL(consisting of weight of impeller, radius of correction and balancing rpm). For spare impellers Dynamic Balancing shall be witnessed by BHEL.
- Performance test of one Centrifugal fan or Axial Fan /per type/per size as per applicable standard – by BHEL.

Centrifugal/ Axial fans 100% run tested by main contractor of BHEL. Run test by BHEL/Customer may be at random or 100%- Vibration shall be within satisfactory zone of VDI 2056 (group- G) machines when measured on bearing housing and noise level <85 dbA at 1 metre distance. Max. Temp. on bearing housing- 40 degrees Centigrade + ambient



**CENTRIFUGAL FAN
DATA SHEET - A**

VOLUME II-B

SECTION D

REV 00

DATE NOV 2012

SHEET 1 OF 3

No. Particulars

Data

1 General Information

1.1 Fan Designation/application.
system/

Refer schedule of Ventilation
Air washers & UAF Units.

1.2 Nos. required/capacity
Technical

Refer Section-C of Specific
Requirement

1.3 Location

Refer layout drg. Attached.

2.0 Design Data

2.1 Type

DIDW for Air Washer and SISW for
UAF

2.2 Type of blades

backward curved

2.3 Arrangement

To suit application as per layout.

2.4 Discharge direction

To suit application as per layout.

2.5 Duty

Continuous

2.6 Capacity at site (Cubic Meter/hr) & static pressure.
Technical

Refer Section-C of Specific
Requirement

2.7 Suction pressure (mm Wg)

As per system requirement.

2.8 Fluid

Atmospheric Air.

2.9 Suction Temperature

Refer weather data attached.

2.10 Suction humidity

Refer weather data attached.

3.0 Materials

3.1 Fan Scroll

Heavy Gauge Mild Steel to IS: 2062
with galvanised

3.2 Fan Casing (side plates & stiffeners)

Heavy Gauge Mild Steel to IS: 2062 /
IS: 1079 / Eq. Minimum 3 mm thick
casing.

3.3 Impeller

Mild Steel/plate to IS: 2062

3.4 Impeller hub

Mild Steel/plate to IS: 2062

3.5 Impeller back plate blade & shroud

Mild Steel to IS: 2062 / IS: 1079 / Eq.



**CENTRIFUGAL FAN
DATA SHEET - A**

VOLUME II-B

SECTION D

REV 00

DATE NOV 2012

SHEET 2 OF 3

- | | | |
|------|---|--|
| 3.6 | a) Shaft
b) Shaft sleeve | EN-8 or eqv.
-do- |
| 3.7 | Support frame and structure. | Mild Steel to IS: 2062 |
| 3.8 | Flexible connection at outlet
impregnated canvas with MS Flanges and cleats (3mm thick). | Fire resistant type plastic |
| 3.9 | V Belt | ISI marked (Reinforced rubber section to
IS: 4776) |
| 3.10 | V Pulley
per | Cast Iron multi groove to grade FG 20 as

IS: 210. Having taper lock type
M.S./C.I. |
| 3.11 | Slide rails | G.I. according to supplier's design |
| 3.12 | Connection pieces | M.S. Galvanized / Epoxy painted. |
| 3.13 | Bolts & nuts | Hard synthetic rubber |
| 3.14 | Vibration isolating pads, washers and spring
if any. | |
| 4.0 | <u>ACCESSORIES</u> | |
| 4.1 | Common base plate | Required. |
| 4.2 | Anchor bolts | -do- |
| 4.3 | Vibration Isolators | Hard synthetic rubber |
| 4.4 | V-belt pulleys | -do- |
| 4.5 | V-belts | Reinforced rubber of appropriate
section |
| 4.6 | Belt guard | Required. |
| 4.7 | Outlet damper | Required(M.S. Heavy Gauge) |
| 4.8 | Inlet guard | Required. |
| 4.9 | Inlet Vane (variable) | Not required. |
| 4.10 | Drain valve | Required. |
| 4.11 | Acoustic silencers | Not required. |
| 5.0 | <u>Motor</u> | |
| 5.1 | Motor by | Bidder |



CENTRIFUGAL FAN
DATA SHEET - A

VOLUME II-B

SECTION D

REV 00

DATE NOV 2012

SHEET 3 OF 3

5.2 Starter by

BHEL

6.0 Painting of fans including base frame

Galvanized / epoxy painting (as per
Section-C & painting specifications)

NOTE:

- 1) Motors shall have 15 % margin on duty power point.
- 2) Fan shall be designed to operate with in 9% and 25% of system throttling line.
- 3) Opposed Multiple louvers damper shall be provided at fan outlet. Louvres shall be of 2 mm thick MS (galvanized). Casing shall be of 3.15 mm thick MS (galvanized).



VENTILATION FAN (R.E.UNIT)
DATA SHEET - A

VOLUME II-B

SECTION D

REV 00

DATE : NOV 2012

SHEET 1 OF 2

General Information

- | | | |
|----|---------------|---|
| 1) | Designation | Roof extractor Units for areas as per schedule of ventilation system. |
| 2) | Nos. required | As per schedule. |
| 3) | Service | Continuous |
| 4) | Location | Roof of respective areas. |
| 5) | Area | As per schedule |

Design Data

- | | | |
|-----|-------------------------------|--|
| 6) | Type | axial flow type. |
| 7) | Air delivery capacity system. | as per schedule of ventilation |
| 8) | Fluid | Atmospheric Air. |
| 9) | Temperature | 50 Deg. C |
| 10) | Static Pressure required | As per Section 'C' schedule of ventilation system. |
| 11) | Outlet air velocity | Not more than 12 m/sec. |

Materials

- | | | |
|-----|--|---|
| 12) | Casing/cowl/hood | M.S. Sheet to IS: 2062 /IS: 1079/Eq. |
| 13) | Impeller
617 | Cast Aluminium alloy to A-6M IS-
Grade LM6 |
| 14) | Support frame and structure.
2062). | M.S. of adequate thickness (IS- |

ACCESSORIES

- | | | |
|-----|--------------------------|------|
| 15) | Vibration isolating pads | Yes. |
| 16) | Base frame for mounting | Yes. |
| 17) | Wire Guard at inlet. | Yes. |
| 18) | Disconnect switch | Yes. |

**VENTILATION FAN (R.E.UNIT)****DATA SHEET - A**

VOLUME II-B

SECTION D

REV 00

DATE : NOV 2012

SHEET 2 OF 2

19) Gravity damper at outlet

Yes

Motor

20) Motor by

Bidder

21) Starter by

Bidder

22) Type of motor

Conforming to IS: 325 latest/as per specification.

23) Free delivery test

Yes.

24) Performance test at specified duty point.

Yes

25) Speed

Not more than 1500 RPM

NOTE:

1. Motors shall have 15% on duty power Point.



VENTILATION FAN (R.E.UNIT)
DATA SHEET - A

VOLUME II-B

SECTION D

REV 00

DATE : NOV 2012

SHEET 3 OF 2



Ventilation Fan (Axial Flow Type)

DATA SHEET - A

VOLUME II-B

SECTION D

REV 00

DATE NOVEMBER 2014

SHEET 1 OF 2

No. Particulars

Data

General Information

1) Designation

Supply/Exhaust Fans.

2) Nos. required
in

Refer schedule of Ventilation system
section-C under specific technical
requirement.

3) Service
air.

To exhaust warm air/to supply fresh

4) Location

Wall mounted.

5) Area

Same as above in 2.

Design Data

6) Type
supply

Axial fans suitable for 415V/3 phase
for Motor.

7) Air delivery capacity
system.

As per schedule of ventilation

8) Fluid

Atmospheric Air.

9) Temperature

Refer Section of specific technical
requirement

10) Static Pressure required

As per Section 'C' schedule of
ventilation system.

11) Outlet Air Velocity

Not more than 12 m/sec.

Materials

12) Casing

M.S. (IS-2062)

13) Impeller
617)

Cast Aluminium. (Alloy A-6M, IS-

14) Hub

Al Alloy.

15) Support frame and structure.
(Galvanized/

M.S. of adequate thickness
Painted) IS-2062.

16) Neoprene rubber pads

As required.



Ventilation Fan (Axial Flow Type)

DATA SHEET - A

VOLUME II-B

SECTION D

REV 00

DATE NOVEMBER 2014

SHEET 2 OF 2

- | | | |
|-----|---|--|
| 17) | Coned inlet for wall exhausters/supply fans | MS (IS-2062) |
| 18) | Supporting frame for mounting. | Required. |
| 19) | Protective screen at inlet. | Yes (Min 14 SWG Galvanized wire knitted in 1" square mesh. |
| 20) | Rain Protection Cowl | Aluminum or hot dip Galvanized after fabrication from M.S. |

Motor

- | | | |
|-----|------------|--------|
| 21) | Motor by | Bidder |
| 22) | Starter by | BHEL |

NOTE:

- 1) For Battery Room, motor for fan shall be of flame proof type & fan of spark proof construction with Epoxy painting.
- 2) Gravity type damper shall be provided at the outlet of axial fan for exhaust application.
- 3) Motor shall have 15% margin over Duty Point.



Ventilation Fan (Axial Flow Type)

DATA SHEET - A

VOLUME II-B

SECTION D

REV 00

DATE NOVEMBER 2014

SHEET 3 OF 2



**STANDARD TECHNICAL SPECIFICATION
FOR
LOW PRESSURE AIR DISTRIBUTION
SYSTEM**

SPECIFICATION NO.PES-554-02

VOLUME II B

SECTION D

REV. 02

DATE: NOV 2012

SHEET 1 OF 7

**STANDARD TECHNICAL SPECIFICATION
FOR
LOW PRESSURE AIR DISTRIBUTION SYSTEM**



TECHNICAL SPECIFICATION
LOW PRESSURE AIR DISTRIBUTION
SYSTEM

SPECIFICATION NO.PES-554-02

VOLUME II B

SECTION D

REV. 02

DATE: NOV 2012

SHEET 2 OF 7

1. GENERAL

This specification covers the design, manufacture, construction features, installation, inspection testing and air balancing of air distribution system upto a total pressure of 95mm w.g. The specification is intended to cover the air distribution for air conditioning system and ventilation system not involving localised exhaust.

2. CODES AND STANDARDS

2.1.1 The design, construction and performance of complete system shall conform to all currently applicable statutes, regulations, safety codes in the locality where the equipment are to be installed.

2.1.2 Unless specified otherwise the equipments shall generally conform to latest applicable Indian Standards. Nothing in this specification shall be construed to relieve the vendor of this responsibility. In particular the equipment shall generally conform to latest editions by the following standards:-

- a) IS: 655 - Specifications for metal air ducts
- b) IS:277 - Specifications for galvanised steel sheets
- c) IS:737 - Specification for wrought aluminium and aluminium alloy sheet and strip.

3. MATERIAL

3.1.1 Metal air ducts shall be either of galvanised steel sheets or aluminium sheets, as indicated in data sheet-A.

3.1.2 The rolled steel sheets before galvanising shall be properly annealed or normalised so as to allow fabrication of ducts without developing cracks. Zinc coating on the steel shall be as per IS 277 Gr. 275 / as specified in Data Sheet A.

3.1.3 The aluminium sheets shall be of grade S1C or NS3 and shall be suitable for duct fabrication work as per IS-737 latest.

4. CONSTRUCTION/FABRICATION

The thickness of sheets, the type of bracing and other fabrication details shall generally conform to requirements given hereunder unless specified otherwise in data sheet A and/or indicated on drawings.

4.1 RECTANGULAR DUCTS

4.1.1

S.No.	Max Side	Sheet Thickness		Type of transverse Joint connections	Bracings
		(mm) GI	(mm) Al		
a)	Up to 600	0.63 (24G)	0.80	S-drive, pocket or bar slips or flanged joints on 2.5m centres	None
b)	601 to 750	0.63	0.80	S-drive, 25mm pocket or	25x25x3 mm MS



TECHNICAL SPECIFICATION
LOW PRESSURE AIR DISTRIBUTION
SYSTEM

SPECIFICATION NO.PES-554-02

VOLUME II B

SECTION D

REV. 02

DATE: NOV 2012

SHEET 3 OF 7

		(24G)		25mm bar slips or flanged joints on 2.5m centres	angles, 1.2m from joints
c)	751 to 1000	0.80 (22G)	1.00	S-drive, 25mm pocket or 25mm bar slips or flanged joints on 2.5m centres	25x25x3 mm MS angles, 1.2m from joints
d)	1001 to1500	0.80 (22G)	1.00	40x40x3mm MS angle, flanged connections or 40mm pocket or40mm bar slips with 35x3mm bar reinforcing on 2.5m centres	40x40x3 mm MS angles, 1.2m from joints
e)	1501 to2250	1.00 (20G)	1.50	40x40x3mm MS angle, flanged connections or 40mm pocket or40mm bar slips, 1M maximum centres, with 35x3mm bar reinforcing	40x40x3 mm diagonal angles or 40x40x3mm angles, 600mm from joints
f)	2251 & above	1.25 (18G)	1.80	50x50x3mm MS angles,connections or 40mm pocket or 40 mm bar slips, 1M maximum centres with 35x3mm bar reinforcing.	50x50x3mm diagonal angles or 50x50x3mm angles 600 mm from joints.
g)	No bracing is required if transverse joints are less than 600mm apart				
h)	For ducts larger than 2250mm, special handling and supporting methods shall be provided as per the approval of Purchaser				

- 4.1.2 All rectangular ducts having either dimension larger than 450mm shall be cross broken except these ducts which are insulated with sand cement plaster. Air outlet connections on ducts need not be cross broken.
- 4.1.3 The seams on duct cones shall be of Pittsburgh type. Longitudinal seams shall be smooth inside the ducts.
- 4.1.4 The flanges used for transverse joints shall be joined together with GI bolts (grade 4.6) and nuts spaced at 125mm centres as per following:
- Upto 1000mm - 6 mm dia GI bolts
 - 1001 to 1500 - 8 mm dia GI bolts
 - 1501 and above - 10mm dia GI bolts
- 4.1.5 The MS angle flanges shall be connected to ducts with rivets at approx. 100mm centres. The flanged joints shall have 6mm thick felt packing stuck to flanges with shellac varnish. The holes in the felt packing shall be burnt through. The ducts are to be tapped 6mm across the MS flanges.
- 4.1.6 MS angles used for bracings shall be tack welded to the ducts or rivetted at 125mm centres, as applicable.



TECHNICAL SPECIFICATION
LOW PRESSURE AIR DISTRIBUTION
SYSTEM

SPECIFICATION NO.PES-554-02

VOLUME II B

SECTION D

REV. 02

DATE: NOV 2012

SHEET 4 OF 7

4.2 ROUND DUCTS

4.2.1

S.No.	Duct dia-mm	Sheet Thickness		Reinforcing
		(mm) GI	(mm) Al	
a)	Up to 150	0.63 (24G)	0.80	None
b)	151 to 600	0.80 (22G)	1.00	None
c)	601 to 1000	1.00 (20G)	1.50	40x40x3mm girth MS
d)	1001 to 1250	1.00 (20G)	1.50	40x40x3mm girth MS angles at 2.0 meter centres
e)	1251 & above	1.25 (18G)	1.80	40x40x3mm girth MS angles at 1.2m centres

4.2.2 The seams on round ducts may be continuously welded or grooved longitudinal seam. In case of welding of GI sheet, zinc rich paint shall be applied on the welded zone.

4.2.3 Round ducts shall either be joined by welding or the ducts shall be swedged 40mm from the ends such that larger end will butt against the swedge and is held in place with sheet metal screws.

4.3 DUCT SUPPORTS

Unless specified otherwise on drawings, rectangular ducts with larger side of 2250mm or above shall be supported by 15mm MS rods and 50x50x3mm and MS angles while those below 2250 mm shall be supported by 10mm MS rods and all angles shall be given a coat of primer paint. The duct supports shall be at a distance not exceeding 1800mm. The MS rods shall be fixed to MS angle cleats, which in turn are fixed to ceiling slab by suitable anchor fasteners. All anchor fasteners, MS angle cleats, coach screws, hooks and other supporting material required shall be provided by vendor.

However, If ducts are thermally insulated, the MS angles and supports shall not be in direct contact with ducts, for which purpose wooden pieces/ Resin bonded fibre glass sheets (50 mm thick) shall be used in between.

4.4 FLEXIBLE CONNECTIONS

Wherever the sheet metal ducts connects to intake or discharge of fan units a flexible connection of at least 150mm width made by closely woven double layer Fire resistant or canvas shall be provided. The same shall be attached to angle iron frames on equipment and to similar frame on duct or casing by means of a steel band or collar fitting over the end of the flexible connection and bolted through angle iron frame so as to clamp securely between the band and the angle frame.

4.5 TRANSFORMATIONS AND BREACHES

All curves, bends, offsets and other transformations shall be made for easy and

	TECHNICAL SPECIFICATION LOW PRESSURE AIR DISTRIBUTION SYSTEM	SPECIFICATION NO.PES-554-02	
		VOLUME II B	
		SECTION D	
		REV. 02	DATE: NOV 2012
		SHEET 5 OF 7	

noiseless flow of air. The throat of every branch duct shall be sized to have a velocity not exceeding that in the main duct to which the branch is connected.

4.6 CAULKING

Wherever duct passes through wall, the opening between masonry and duct work shall be neatly caulked or sealed to prevent movement of air from one space to adjoin by space with a rated fire resistant material.

4.7 EASEMENT

Normally pipe hangers, light fitting rods etc. shall not be allowed to pass through the ducts. Wherever, It becomes absolutely essential to pass these hangers/rods etc. Through the ducts, prior approval of purchaser shall be taken and light streamlines easement around the same shall be provided to maintain smooth air flow.

4.8 ACCESS DOORS

Access doors shall be provided in ducts, plenums etc. on both sides to allow access and servicing of equipment viz. pipes, dampers, coils, valves, heaters etc.

All access doors shall be adequately sized and lined suitably with felt to prevent air leakage. The doors shall be of built-up construction, structurally strong and shall have at least two hinges each, and shall be with two rust proof window sash locks of approved type. All doors shall be so set as to flush with outer finish of duct insulation etc.

4.9 DAMPERS AND SPLITTERS

4.9.1 Dampers and splitters shall be provided at suitable points for proportional volume control of the system. Splitters and dampers shall be made of minimum 18 gauge GSS of quadrant type with locking device mounted outside the duct at accessible location.

4.9.2 Fire Dampers

Fire dampers/fire doors shall be provided as specified in Data Sheet -A and shall be installed at locations indicated on drawings and/or as required/approved by purchaser, including all openings in passage of duct work through fire walls and floors etc. The fire damper shall be of electrical type with damper motor actuated by thermal sensor or fusible link type.

4.9.3 Gravity operated back draft dampers shall be provided to ensure pressurisation of rooms as specified. These dampers shall be designed such as not to allow infiltration of outside air while forced exit of air shall be achieved through this damper. The louvres shall be freely mounted on spindles to allow the dampers to open with the pressure developed by the fan. The dampers shall be provided with flange at inlet.

4.9.4 Vanes

Unless otherwise shown in the drawings all elbows shall be such that the throat radius is 75% of the duct width. In case throat radius is smaller, suitable single thickness vanes of approved details shall be provided.

4.9.5 Flashing

	TECHNICAL SPECIFICATION LOW PRESSURE AIR DISTRIBUTION SYSTEM	SPECIFICATION NO.PES-554-02	
		VOLUME II B	
		SECTION D	
		REV. 02	DATE: NOV 2012
		SHEET 6 OF 7	

For the ducts penetrating roofs or outside walls, provision of flashing shall be made by the ducting vendor.

4.10

DIFFUSERS AND GRILLS

The type and quantity of diffusers and grills is indicated on enclosed drawings/data sheet A. The size/quantity of diffusers/ grills indicated in the drawing/data sheet is indicative and is for vendor’s reference purpose only. Vendor shall ensure that the diffusers/grills offered are of requisite capacity, throw and terminal velocity. The pressure drop and noise levels shall be as per data sheet. A enclosed. The diffusers/grills shall be approved by purchaser.

Unless specified otherwise the diffusers/grills shall be of mild steel land painted with two coats of primer paint. Supply air grills shall be complete with volume control dampers. Supply air grills shall be double deflection type while Return Air grills can be single deflection type. Ceiling outlets/diffusers shall have volume control dampers, fixed grids and blanking baffles. All volume control dampers shall be operated by a key from the front of grills/diffusers.

Suitable vanes shall be provided in duct collars to have uniform air distribution. Blank-off baffles wherever required, shall also be provided.

4.11

PLENUMS AND RA BOXING

All plenum chambers and/or connections to fans, dampers etc. shall be constructed in 18 gauge GI sheet. supported on 40x40x6mm MS angle frames. All vertical angles shall be riveted at appox. 125mm. centres to the casing. Suitable caulking compound (Pecora or equivalent) shall be inserted between the base of the angle and all masonry construction to which angles are fastened.

Return air boxing requirements if any are indicated in data sheet-A and the same shall be provided by vendor. The return air box shall be fabricated out of GI sheets shall be insulated with 25mm thick fibre-glass.

4.12

ACCOUSTIC LINING

The ducts shall be lined acoustically from inside as given in data- sheet A and/or section C of the specification.

4.13

PAINTING

Wherever specified the ducts shall be painted or lined with suitable anti-corrosive paint/ lining as per approval of purchaser. In particular the ducts coming in contact with acid fumes shall be epoxy coated, inside and outside.

4.14

THERMAL INSULATION

Thermal insulation shall be as per data sheet - A and the insulation shall conform to enclosed spec. no. PES-553-08.

	TECHNICAL SPECIFICATION LOW PRESSURE AIR DISTRIBUTION SYSTEM	SPECIFICATION NO.PES-554-02	
		VOLUME II B	
		SECTION D	
		REV. 02	DATE: NOV 2012
		SHEET 7 OF 7	

5.	INSPECTION AND TESTING
5.1	INSPECTION & TESTING DURING FABRICATION–BY MAIN VENDOR
5.1.1	Visual inspection of GI sheets and angles, channels etc. – dents, black spots, chipping of zinc coating, white dust on galvanised sheets shall be avoided. Pitting , lamination in angles and channels shall be avoided.- visual inspection by Main Vendor.
5.1.2	Galvanised sheets - Test certificate shall be furnished for visual check, coating thickness, adhesion test, sheet thickness, uniformity of coating –review of TC by BHEL/Customer
5.1.3	Check for dimensions & mass as per latest IS-277.
5.1.4	Check for defect, twists, ungalvanised spots as per IS-2629.
5.1.5	Bend test & wrapping test as per IS-277.
5.1.6	Zinc coating test on samples as per IS-6745.
5.2	INSPECTION & TESTING AT SITE.
5.2.1	The duct branches, elbows etc. shall be inspected and the joints and connections etc, are to be checked before they are assembled in position.
5.2.2	After completion, all duct systems shall be checked and tested for air leakage, tightness, velocity, pressure drop, vibration and noise etc.
6.	BALANCING
6.1.1	The entire air distribution system shall be balanced by vendor to supply the air quantities as required in various rooms so as to maintain the requisite temperature and air flow in the conditioned spaces. The final balance of air quantities through each grill/diffuser etc. shall be recorded and submitted to purchaser for approval. Proper steps shall be taken to have a uniform temperature in all enclosures, with utmost care for noise level to be within tolerance limit
6.1.2	All instruments required for testing/balancing etc. of the air distribution system shall be provided by vendor.
7.	DATA TO BE FURNISHED BY VENDOR AFTER THE AWARD OF CONTRACT
7.1	Fabrication drawings of ducts and grilles, louvers, dampers, etc, including typical details of grilles dampers etc.
7.2	Test certificates in line with scope of inspection.
7.3	Other dimensional drawings & documents as may be required by purchaser for better understanding of the system & for preparation of operation, maintenance & instruction manual.



**LOW PRESSURE
AIR DISTRIBUTION SYSTEM
DATA SHEET - A**

VOLUME II-B

SECTION D

REV 00

DATE NOV 2012

SHEET 1 OF 2

- | | | |
|----|--|--|
| 1) | General (List of areas) | As per schedule/tender drgs of Ventilation system. |
| 2) | i) GSS Duct Work | |
| | a) Type | Zinc coating (Refer Section-C of Specific Technical Requirement) |
| | b) 1.25 mm thk ducting | Bidder to estimate as per Drawings/sketch |
| | c) 1.0 mm thk ducting | Separately for Ventilation system. |
| | d) Any other size | (area wise) |
| | e) Battery Room ducting. sides. | MS with epoxy painting on both sides. |
| 3) | Special painting epoxy | MS Ducts in Battery Room to be painted. Both interior & exterior) |
| 4) | Thermal Insulation | Required in duct for vent. System exposed to Sun only (furnished by Cement sand plaster) |
| 5) | SA grilles (for each size) (SQ.M) schedule/tender | To suit airflow as per drgs. |
| 6) | Exhaust Gravity/Manual relief dampers (for each size & to maintain a slight positive pressure inside.) | -do- |
| | a) Frame | 1.6mm M.S. |
| | b) Louver | 0.8mm Al. |

NOTE:

- 1) Ducting shall be as per IS-655 standard.
- 2) Opposed blade type volume control damper (gang operated) shall be provided at each supply air grilles.
- 3) Bidder to provide suitable gasketing at each duct flange.(Asbestos shall not be used).
- 4) Supply Air Grills shall have 2 (two) set of adjustable louvres.
- 5) Bidder to indicate unit rates for variable items like ducting, grilles with & without volume control damper, gravity damper, thermal insulation, etc.
- 6) Grilles, frames & louvres shall be of at least 18 SWG sheet and 20 SWG MS respectively.



**LOW PRESSURE
AIR DISTRIBUTION SYSTEM
DATA SHEET - A**

VOLUME II-B

SECTION D

REV 00

DATE NOV 2012

SHEET 2 OF 2

- 6) Fire damper shall be solenoid operated in accordance with NFPA. The solenoid shall be charged during open condition and shall be de-energising to close.
- 7) Access door in ducting system shall be provided as required.
- 8) MS Angle (painted) shall be used only as duct supports.
- 9) Velocity thru duct shall not exceed 12 M/sec for Ventilation system.
- 10) All exhaust/return air grilles shall have one set of louvres in the front or thick rat-proof wire net guards.



**STANDARD TECHNICAL SPECIFICATION FOR
CENTRIFUGAL PUMPS**

SPECIFICATION NO. PES-554-05

VOLUME II-B

SECTION D

REV 01

DATE NOV 2012

SHEET 1 OF 8

**STANDARD TECHNICAL SPECIFICATION
FOR
CENTRIFUGAL PUMPS**



STANDARD TECHNICAL SPECIFICATION FOR CENTRIFUGAL PUMPS

SPECIFICATION NO. PES-554-05

VOLUME II-B

SECTION D

REV 01

DATE NOV 2012

SHEET 2 OF 8

1.0 GENERAL

This specification covers the design, material, constructional features, manufacture, assembly, inspection and testing at manufacturer's or his subcontractor's works, suitable painting requirements of centrifugal pumps and drives complete with all accessories as specified hereinafter.

2.0 CODES AND STANDARDS

2.1 The design, manufacture, inspection, testing & performance of the pumps as specified hereinafter, shall comply with the requirements of the latest revision of the following standards as indicated below (as applicable):

- a) IS-1520 :Horizontal centrifugal pumps for clear, cold and fresh water
- b) IS-5120 :Technical requirements - Rotodynamic special purpose pump
- c) IS-1710 :Vertical turbine pumps for clear, cold and fresh water
- d) Hydraulic Institute Standards of USA
- e) BS - 599 :Method of testing Pumps
- f) PTC - '6' :Centrifugal Pumps Power test code
- g) API - 610

Wherever standards for certain aspects materials etc., not mentioned, the same shall be as per the applicable Indian or International standards.

2.2 In case of any conflict between the above codes/standards and this specification, the later shall prevail and in case of any further conflict in this matter, the decision of Purchaser's engineer shall be final and binding.

3.0 DESIGN REQUIREMENTS

3.1 The pumps shall be of heavy duty suitable for long periods of uninterrupted service and shall be standard product of the manufacturer thoroughly proven for satisfactory performance and reliability

3.2 The materials of construction of various components shall be as indicated under Data Sheet-A and where not specified to the applicable Indian/British/American standards.

3.3 All pressure containing components including the pump casing, nozzles and stuffing box housing shall be designed, fabricated and tested in accordance with applicable Indian standards if not specified otherwise.

3.4 The pump shall be suitable for handling the fluid as specified in Data Sheet-A

4.0 CONSTRUCTIONAL FEATURES

4.1 Pump Casing

4.1.1 Pump casing may be axially or radially split or barrel type construction as specified in the pump data specification sheet. The casing shall be designed to withstand the maximum pressure developed by the pump at the pumping temperature.



STANDARD TECHNICAL SPECIFICATION FOR CENTRIFUGAL PUMPS

SPECIFICATION NO. PES-554-05

VOLUME II-B

SECTION D

REV 01

DATE NOV 2012

SHEET 3 OF 8

4.1.2 Pump casing shall be provided with adequate number of vent and priming connections with valves, unless the pump is made self venting & priming. Casing drain, as required, shall be provided complete with drain valves.

4.1.3 Pump shall preferably be of such construction that it is possible to service the internals of the pump without disturbing suction and discharge piping connections.

4.1.4 Under certain conditions, the pump casing nozzles will be subjected to reactions from external piping. Pump design must ensure that the nozzles are capable of withstanding external reactions not less than those specified in API-610.

4.2 Impeller

Unless specifically indicated under Data Sheet-A enclosed, the pump impellers shall be of closed vane type. The impellers shall be secured to the shaft and shall be retained against circumferential movement by keying, pinning or lock rings. Impellers shall be statically and dynamically balanced individually. The assembled rotor shall be dynamically balanced and checked for eccentricity.

4.3 Wearing Ring

Renewable wearing rings for the casing and/or the impellers and renewable shaft sleeves, shall be provided for all pumps. Length of the shaft sleeves must extend beyond the outer faces of gland packing or seal and plate so as to distinguish between the leakage between shaft & shaft sleeve and that past the seals/gland.

4.4 Shaft

Shaft size selected shall take into consideration the critical speed which shall be away from the operating speed as recommended in applicable Code/Standard. The critical speed shall also be at least 10% away from runaway speed.

4.5 Bearings

Bearings and hydraulic devices (if provided for balancing axial thrust) of adequate design shall be furnished for taking the entire pump load arising from all probable conditions of continuous operation throughout its Range of Operation and also at the shut off condition. The bearing shall be designed on the basis of 20,000 working hrs minimum for the load corresponding to the duty point. Proper lubricating arrangement for the bearings shall be provided. The design shall be such that the bearing-lubricating element does not contaminate the liquid being pumped. Where there is a possibility of liquid entering the bearing, suitable arrangement in the form of deflectors or otherwise shall be provided ahead of bearing assembly. Bearings shall be easily accessible without disturbing the pump assembly.

4.6 Stuffing Boxes

Packed type stuffing boxes of adequate depth with lantern rings shall be provided to minimize the leakage. In all cases where the pump suction is below atmospheric pressure, the shaft packing shall be sealed by the liquid pumped by tapping off from the pump discharge itself and all pipes, valves, fittings etc., required for this shall be furnished by the manufacturer.

4.7 Shaft Couplings



STANDARD TECHNICAL SPECIFICATION FOR CENTRIFUGAL PUMPS

SPECIFICATION NO. PES-554-05

VOLUME II-B

SECTION D

REV 01

DATE NOV 2012

SHEET 4 OF 8

The pumps shall be directly coupled to their drives through heavy duty flexible coupling. Suitable coupling guards shall be provided along with the coupling. The pump and its drive motor shall be mounted on a common base plate.

4.8 Base Plate and sole Plate

Unless otherwise stated the data specification sheet, a common base plate mounting both for the pump and drive shall be furnished. The base plate shall be of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and the pumping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, hydraulic piping thrust, etc. Suitable drain taps and drip lip shall be provided.

If required in the data specification sheet, steel sole plates shall be provided, below the base plate.

4.9 Prime Mover

The drive motor selected shall conform to the requirements of the enclosed motor specifications.

4.10 Lifting arrangement

Each pump and motor shall incorporate suitable lifting attachments e.g. lifting lugs or eye bolts etc., to facilitate erection and maintenance.

5.0 Performance Requirements

5.1 The pump shall be designed to have best efficiency at the specified duty point. The pump set shall be suitable for continuous operation at any point within the Range of Operation as stipulated in the data specification sheets.

5.2 Pump shall have a continuously rising head capacity characteristics from the specified duty point towards shut off point, the maximum being at shut off. Power capacity characteristic will be non-overloading type i.e. 110% of the design flow the power required to drive the pump will be practically the same as that at the design flow.

5.3 Wherever specified in data sheet, pumps of each category shall be suitable for parallel operation. The head vs capacity, input power vs. capacity characteristics, etc., shall match to ensure equal load sharing and trouble free operation throughout the range.

5.4 The pump motor set shall be designed in such a way that there is no damage due to the reverse flow through the pump which may occur due to any malfunction of the system.

6.0 Drive Rating

6.1 The power rating of the drive shall be selected such that a minimum margin of 15% is available over the pump input power required at the rated duty point. However, the drive rating shall not be less than the maximum power requirement at any point within the 'Range of Operation' specified.



**STANDARD TECHNICAL SPECIFICATION FOR
CENTRIFUGAL PUMPS**

SPECIFICATION NO. PES-554-05

VOLUME II-B

SECTION D

REV 01

DATE NOV 2012

SHEET 5 OF 8

6.2 In cases where parallel operation of the pumps are specified the actual drive rating is to be selected by the bidder considering overloading of the pumps in the event of tripping of one of the operating pumps.

6.3 The bidder under this specification shall assume full responsibility in the operation of the pump and the drive as one unit.

7.0 SCOPE OF INSPECTION AND TESTING

7.1 Castings

7.1.1 Witnessing pouring and thereafter physical testing of castings of 'Critical' nature such as casings, impellers, diffusers.

7.1.2 Identification and correlation with test reports for all tests as per the relevant material specifications for castings of 'Major' nature such as suction bell, discharge elbow, stuffing box, gland, wearing rings, shaft sleeves etc.

7.1.3 Foundry's conformity certificate for castings of 'Minor' nature such as base plates, covers etc.

7.1.4 Verification of heat treatment charts (as applicable)

Note: Casting defects shall not be filled by any method until and unless approved by BHEL/their customer

7.2 Forgings and

7.2.1 Identification and correlation with mill test certificates for all tests as per the relevant specifications for important forgings like casings, stage bodies, diffusers, shaft material.

7.2.2 Verification of heat treatment charts (time temperature) (as applicable).

7.3 Fabricated items

7.3.1 Identification and correlation with mill test certificates for material of items such as discharge bellows, column pipes etc.

7.3.2 Approval of welding procedure specifications and qualifications of weld procedures and personnel.

7.3.3 Dye penetrant tests of weldment as per ASTM E-165 and acceptance norm as per ASME Sec.VIII, Div.1, Appendix 8

7.3.4 Verification of heat treatment charts (time temperature), (as applicable)

7.3.5 Hydro test as per para 7.5.1 below.

Note: For para 7.1.2, 7.2.1 and 7.3.1 above; in case correlating test certificates are not available, material shall be identified by BHEL and physical tests conducted by the supplier in the presence of BHEL



STANDARD TECHNICAL SPECIFICATION FOR CENTRIFUGAL PUMPS

SPECIFICATION NO. PES-554-05

VOLUME II-B

SECTION D

REV 01

DATE NOV 2012

SHEET 6 OF 8

7.4 In process Inspection and Testing

7.4.1 Dye penetrant testing after machining for impellers including vanes, pump shaft, diffusers as per applicable code; in absence of which, as per ASTM E - 165. No defect shall be permitted on moving parts. On static parts acceptance norms are as per ASME Sec.III NB 2546.

7.4.2 Ultrasonic testing of dynamic duty component, i.e. pump shafts (50mm dia and above) and static duty forgings i.e. Barrel, casting (15mm and above wall thickness) as per applicable code, in absence of which as per ASTM E388 and acceptance norms as stipulated hereunder.

7.4.3 Acceptance norms for UT for dynamic duty components. the following defects are unacceptable :

- Cracks, flakes, seams and laps
- Defects giving indications longer than that from a 4mm equivalent flaw.
- Group of defects with maximum indications less than that from a 4mm equivalent flaw, which cannot be separated at testing sensitivity, if the back echo is reduced to less than 50%.
- Defects giving indications of 2 to 4mm dia. equivalent flaw separated by distance less than four times the size of the larger of the adjacent flaw.

7.4.4 For static duty components - as per NB 2542.2 of ASME Sec. III.

7.4.5 Hydro tests of all pressure parts such as casings, column pipes, discharge elbows etc., at two times duty point pressure or 1.5 time shut off pressure, whichever is higher for 30 min., without any leakage.

Note : In case the pump is required to boost certain pressure, the inlet pressure head shall also be taken into consideration to compute test pressures.

7.4.6 Static and dynamic balancing of individual impellers and also assembled rotors as per V.D.I. 2060 Q 6.3 or ISO 1940 G 6.3.

7.5 Performance Test

7.5.1 Pump testing with unit supply motor as per specifications and acceptance norms cited elsewhere, in absence of which as per IS 5120 latest edition. Performance shall be checked for minimum of 7 points (including shut off head and over load) following characteristics shall be checked:

Capacity V/s Head

Capacity V/s Power absorbed by pump

Capacity V/s pump efficiency

Note : For pump of fire protection system, performance test shall be conducted up to 150% of rated capacity

7.5.2 NPSH test in case specifically mentioned elsewhere



**STANDARD TECHNICAL SPECIFICATION FOR
CENTRIFUGAL PUMPS**

SPECIFICATION NO. PES-554-05

VOLUME II-B

SECTION D

REV 01

DATE NOV 2012

SHEET 7 OF 8

7.5.3 Vibration and noise level measurement. Acceptance norms shall be as per manufacturers standards.

7.5.4 Overall dimensions as per GA drawings

7.5.5 Examination after selective opening up after running for pumps operating at speed over 1800 rpm and capacity exceeding 68M3/hr.

7.5.6 Painting and packing as per technical specification.

7.6 Test at site

The pumps will be tested at site by the purchaser to verify their performance. If the pumps fail to operate smoothly or within the required performance all such deficiencies shall be rectified by the manufacturer by making suitable alternatives in the pump set and additional tests required to show the effect of such alterations shall be performed by him.

7.7 Performance Guarantee

The vendor shall guarantee the material and workmanship of all components as well as the operation of the pump as per requirement of this specification.

The vendor shall also guarantee for each pump the total dynamic head at the specified rated capacity and also corresponding efficiency, brake horse power and shut off head.

8.0 CLEANING, PROTECTION & PAINTING

Before shipment of the equipment to be supplied under this specification the necessary cleaning, flushing etc., as per manufacturers standard shall be done to remove all dirts, scales etc. Shop coats of rust inhibiting paints, lacquers etc., shall be applied to various parts as necessary. Flanges, inlet and outlet pipe, etc shall be protected.

9.0 DRAWINGS, TECHNICAL DOCUMENTS AND OTHER INFORMATION REQUIRED WITH THE PROPOSAL

9.1 Fully dimensioned outline GA drawings of the pump motor assembly unit for each type and size offered. This drawing should include:-

- i) Foundation base plate and sole plate details as applicable
- ii) Civil foundation and anchor bolts details and loading data
- iii) Minimum submergence required for the pump (if applicable)

9.2 Cross sectional drawing of the equipment showing the details of assembly of components and their material of construction with standard applicable codes.

9.3 Performance characteristics (Discharge capacity vs head, BHP and efficiency of the pumps.



**STANDARD TECHNICAL SPECIFICATION FOR
CENTRIFUGAL PUMPS**

SPECIFICATION NO. PES-554-05

VOLUME II-B

SECTION D

REV 01

DATE NOV 2012

SHEET 8 OF 8

- 9.4 Motor speed torque curve superimposed on pump speed torque curve. Required NPSH of pump.
- 9.5 Experience list about the supply and successful operation of similar pumps for similar application.
- 9.6 A comprehensive write up or brochure on the details of manufacturing and testing facilities in the shop of the manufacturer.
- 9.7 Quality plan for the equipment being offered, in BHEL format as practiced in the manufacturer's works and Field Quality Plan for receipt, storage erection, commissioning & testing at site.
- 9.8 Data sheet-B with all the particulars filled in.

10.0 DRAWINGS AND DATA AFTER AWARD OF CONTRACT

The vendor shall furnish the drawings and other technical documents as required in Data Sheet-C enclosed with this specification

10.1 MANUFACTURERS NAME AND TAG. PLATES

Each pump shall have a permanently attached brass/metal tag on the body indicating the following information both in Hindi and English.

- a) Manufacturer's name and trade mark
- b) Design Capacity and Head
- c) Design
- d) Purchaser's tag no. as furnished during the contract. The purchaser's tag no. will be indicated by the Purchaser on the drawing submitted for approval by the vendor.

11.0 DRAWINGS/DOCUMENTS TO BE FURNISHED BY VENDOR AFTER THE AWARD OF CONTRACT.

- 11.1 Certified GA drawings of pump motor assembly weights, crane
- 11.2 Detailed cross sectional drawings of the pump and motor assembly and all equipment & accessories supplied under the this specification along with details of material of construction with applicable standard codes
- 11.3 Foundation drawings with details of foundation pocket indicating static as well as dynamic load and other data with dimensions.
- 11.4 Certified characteristics curves (discharge capacity vs. head, BHP and efficiency) of each type of pump and motor.
- 11.5 Material and other test certificates as required by the application clauses of this specification.
- 11.6 Motor speed torque curves super imposed on pump speed torque curves.
- 11.7 Quality plan along with complete details of testing and inspection requirements of centrifugal pumps in BHEL format. Vendor shall also furnish Field Quality Plan.



**STANDARD TECHNICAL SPECIFICATION FOR
CENTRIFUGAL PUMPS**

SPECIFICATION NO. PES-554-05

VOLUME II-B

SECTION D

REV 01

DATE NOV 2012

SHEET 9 OF 8

11.8 Installation , operation and maintenance manual.

11.9 Other drawings and data, if necessary.



**CENTRIFUGAL PUMPS
DATA SHEET - A**

VOLUME II-B

SECTION D

REV 00

DATE NOV 2012

SHEET 1 OF 2

<u>S.No.</u>	<u>DESCRIPTION</u>	<u>DETAILS</u>
1)	Designation	Air washer Pumps.
2)	Type	Horizontal Centrifugal Type.
3)	Quantity	As per section-C
4)	Installation	On floating type foundation inside Air
Washer		Room
5)	Fluid to be handled	Filtered Water.
6)	Temperature of Fluid	To suit.
7)	Capacity Cum/Hr TDH at	To suit system requirements however head shall Not be less than 35 MWC.
8)	Duty	-----Continuous (24Hr./day)-----
9)	Suction condition	-----Flooded-----
10)	Type of drive	Direct (flexible coupling)
11)	Type of prime mover	LV Ac Motor.
12)	Maximum speed	Not more than 1500 RPM
13)	Type of lubrication	Grease Lubrication

MATERIALS OF CONSTRUCTION

<u>S.No.</u>	<u>DESCRIPTION</u>	<u>DETAILS</u>
a)	Impeller	Bronze
b)	Pump Shaft	Carbon Steel C-45, IS-1570 or class-IV, IS- 1875
c)	Casing	Cast Iron, grade-20, IS- 210
d)	Wearing ring	Bronze
e)	Shaft Sleeve	Bronze
f)	Base Plate/frame	Cast Iron to Grade FG-200 IS-210/fabricated Mild steel



**CENTRIFUGAL PUMPS
DATA SHEET - A**

VOLUME II-B

SECTION D

REV 00

DATE NOV 2012

SHEET 2 OF 2

- | | | |
|-----------|---------------------|--|
| g) | Counter Flanges | Mild Steel |
| h) | Stuffing box bush | Deep Bronze packing to be renewable with Case. |
| i)
not | Stuffing box gland | Flexible graphite or PTFE (Asbestos shall be used) |
| j) | Pump Motor Coupling | Pin & Bush type (Flexible) |
| k) | Bolt and Nuts | MS |

15) **ACCESSORIES REQUIRED**

The following accessories shall be provided by the bidder for each pump.

- | | | |
|----|--|-----|
| a) | Priming funnel | Yes |
| b) | Drain piping upto
Common drain point. | Yes |
| c) | Vent | Yes |
| d) | Suction & Discharge
Pressure gauges | Yes |
| e) | Companion flanges | Yes |
| f) | Common base plate | Yes |
| g) | Suction strainer. | Yes |
| h) | Isolating valve. | Yes |
| i) | NRV at pump outlet at inlet/outlet | Yes |
| j) | Any special requirements | Yes |
| k) | Inspection & Testing | Yes |



**STANDARD TECHNICAL
SPECIFICATION
FOR
AIR FILTER**

SPECIFICATION NO.PES-554-04

VOLUME II B

SECTION D

REV. 02

DATE: NOV 2012

SHEET 1 OF 3

**STANDARD TECHNICAL SPECIFICATION
FOR
AIR FILTER**

	STANDARD TECHNICAL SPECIFICATION FOR AIR FILTER	SPECIFICATION NO.PES-554-04	
		VOLUME II B	
		SECTION D	
		REV. 02	DATE: NOV 2012
		SHEET 2 OF 3	

1.

GENERAL

This specification covers the design, manufacture, inspection and testing at manufacturer’s work or his sub-contractor’s works of Air filters to be used for air-conditioning and ventilation system:

2.

CODES AND STANDARDS

This design, manufacture and performance of AIR FILTERS shall comply with all currently applicable statutes, regulation and safety codes in the locality where the equipment will be installed. The equipment shall also conform to latest applicable Indian/British/USA standards. Nothing in this specification shall be construed to relieve the vendor of this responsibility. The following standards, in particular, shall be applicable for certified ratings of filters and for conducting performance test, if required.

a) BS EN - 779 -Methods of test for air filters used in air conditioning and general ventilation.

3.

GENERAL

The enclosed Data sheet A gives the type and other particulars of filters required.

3.1

POLY FIBRE AIR FILTERS

Filtering media shall consist of a suitable fibrous material (e.g. polyethylene extruded sections coir etc.) packed into a 20 gauges GSS framework, complete with handles etc. The filter element shall be supported by galvanised steel wire mesh of 10mm. sq. on either side, Velocity across the filters shall not exceed 2.5 M/sec. Average efficiency Em (%) shall be ≥ 80 as per BS EN - 779..

3.2

DRY FABRIC AIR FILTERS

Filter element shall be pressed felt filter fabric or suitable material recommended by the manufacturer, stitched on to galvanised wire gauge support and crimped to form deep folds. Suitable aluminium spacers shall be provided to ensure uniform distribution of air flow through filters. Filter casing shall be provided with neoprene sponge rubber sealing, The filter shall have Average efficiency Em (%) of ≥ 95 as per BS EN - 779.

3.3

PANEL TYPE METALLIC FILTERS (DRY/VISCOUS)

Filter shall consist of V-fold galvanised wire mesh interspaced with flat layers of galvanised wire mesh. The density of media shall increase in the direction of air flow. Edges of wire mesh shall be suitably hemmed to prevent abrasion during handling. The media shall be supported on either side by galvanised expanded metal casing. The framework shall be at least 18 gauge GSS. Filter shall be either dry or wetted type as per data sheet=A. The oil shall be mineral oil of approved quality and make. As a the filter frame made of Aluminium alloy conforming to IS:737 can be considered unless use of aluminium is prohibited otherwise due to site conditions being saline/corrosive.

	STANDARD TECHNICAL SPECIFICATION FOR AIR FILTER	SPECIFICATION NO.PES-554-04	
		VOLUME II B	
		SECTION D	
		REV. 02	DATE: NOV 2012
		SHEET 3 OF 3	

All filters shall be capable of being cleaned of their accumulated dust by tap water flushing. The dry metallic filter shall have Average arrestance Am (%) shall be ≥ 90 . However oil wetted air filters shall have Average Efficiency Em (%) ≥ 90 as per BS EN - 779..

3.4

ABSOLUTE FILTERS (HEPA)

Filters shall be constructed by pleating a continuous sheet of filter medium into closely spaced pleats separated by heavy corrugated aluminium spacers. They shall be individually tested and certified to have an efficiency of not less than 99.97% when tested with 0.3 micron dioctylphalate smoke as per IS:2831. The clean filter initial static pressure drop shall not be greater than 25mm WC at rated capacity. A neoprene sponge rubber sealing shall be provided on either face of filter frame.

3.5

WATER REPELLANT NYLON FILTERS

This shall be constructed of water repellent nylon fabric with continuous water spraying on it from a header for keeping it clean. Efficiency of this filter shall be 85% down to 10 microns. This filter shall be used for unitary air filtration system only.

4.

INSPECTION & TESTING

The scope of inspection for air filters shall be as below:

List of TCs arranged as per Approved Quality Plan shall be furnished along with copy of TCs at the time of inspection by BHEL.

4.1.1

Dimensional inspection of frame & filter media – TC from Manufacturer- review by BHEL/Customer.

4.1.2

Witnessing by BHEL/Customer of type tests on one per type per size air filters for the following properties.

a)

Gravimetric efficiency.

b)

Pressure drop in clean & dirty (choked - %age to be specified) condition.

c)

Efficiency as per BS EN - 779.

4.1.3

Verification of type test certificates for similar type & size of filters for sodium flame test as per BS-3928 (if applicable- refer data sheet) - by BHEL/Customer

5.

DATA TO BE FURNISHED BY VENDOR AFTER AWARD OF CONTRACT

5.1.1

GA Drawing

5.1.2

Drawing showing material/construction detail

5.1.3

Installation and\service manual

5.1.4

Rating curves/charts

5.1.5

Test certificates

Elect. diagrams (when automatic cleaning type)



**AIR FILTER
DATA SHEET - A**

VOLUME II-B

SECTION D

REV 00

DATE NOV 2012

SHEET 1 OF 1

Description

Data

1) General

1.1 Service	Ventilation system .
1.2 Location	Main power house bldg. & Blower room of both the unit.
1.3 Nos.	Refer Section 'C' of Specification.
1.4 Total air flow/type	Refer Section 'C' of Specification.
1.5 Temperature	As per project information.
1.6 Relative Humidity	100%
1.7 Gas Composition	Atmospheric Air (Dusty) as prevalent in power station.
1.8 Filter Media	Synthetic non woven
1.9 Efficiency	Average arrestance efficiency of 65-80 % for Dry panel filter (pre-filters) and average arrestance efficiency of 80-90 % for fine filters.
1.10 Allowable pressure drop	2.5 mm & 6.5 mm in clean and dirty condition respectively for dry panel filters (pre filters). 12 mm in clean condition for fine filters.
1.11 Frame Work	18 G, GSS.
1.12 Mounting	Ladder Type M.S Angles (galvanised)
1.13 Size	600 x 600 mm

Note:-

- 1) Face velocity of air across the filters shall not exceed 2.5 m/sec.



**STANDARD TECHNICAL
SPECIFICATION
FOR
THERMAL INSULATION FOR COLD
SURFACES**

SPECIFICATION NO.PES-554-06

VOLUME II B

SECTION D

REV. 01

DATE: NOV 2012

SHEET 1 OF 5

**STANDARD TECHNICAL SPECIFICATION
FOR
THERMAL INSULATION FOR COLD SURFACES**

	TECHNICAL SPECIFICATION THERMAL INSULATION FOR COLD SURFACES	SPECIFICATION NO.PES-554-06	
		VOLUME II B	
		SECTION D	
		REV. 01	DATE: NOV 2012
		SHEET 2 OF 5	

1.

SCOPE

This specification covers design, manufacture, testing at manufacturers works, supply, application & finishing of insulation for cold piping, air conditioning ducting & equipment for low temperature service.

2.

CODES & STANDARDS

The design, manufacture and performance of materials covered under this specification shall comply with all currently applicable statues, regulations & safety codes in the locality where the equipment/material are to be installed. The material shall also conform to the latest applicable Indian/British/American codes & standards. Nothing in this specification shall be construed to relieve the vendor of his responsibility. In particular, the material shall conform to the latest editions of the following standards :-

2.1.1

IS:3069 :

Glossary of terms & symbols & units relating to thermal insulation materials.

2.1.2

IS:4671 :

Expanded polystyrene for thermal insulation purposes.

2.1.3

IS:3677 :

Mineral wool for thermal insulation

2.1.4

IS:8183 :

Resin bonded mineral wool

2.1.5

IS:702

3.

DESIGN REQUIREMENTS

3.1.1

The insulating material as well as protective covering shall be new & unused, non-corrosive, vermin/rodent proof and shall be guaranteed to withstand continuously & without deterioration the maximum/minimum temperatures to which they may be subjected to, under specified site conditions.

3.1.2

The insulation material must be light weight, strong, free from shots & coarse fibre & shall provide high insulation efficiency at low weight & coat. It should be non-hygroscopic & should not rot. It shall not settle or shake down even when subjected to prolonged vibrations.

3.1.3

The insulation material, density and thickness etc. Shall be as specified in DATA SHEET A.

4.

APPLICATION DETAILS

4.1.1

The surface to be insulated shall be thoroughly cleaned and allowed to dry. Pressure/hydrostatic tests, if any, shall be carried out before application of insulation.

4.1.2

A layer of solvent free, anticorrosive paint shall be applied & allowed to dry.

4.1.3

Hot industrial bitumen of grade 85/40 or 85/25 conforming to latest IS:702 shall be uniformly applied @ 1.5 kg/sq.m on the surface to be insulated. A similar layer shall also be applied on the inside surface & edges of the insulation. A suitable cold adhesive compound may also be used in place of bitumen.

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		VOLUME II B	
		SECTION D	
		REV. 01	DATE: NOV 2012
		SHEET 3 OF 5	

4.1.4

Insulation in the form of pipe sections/rolls slabs of specified density & thickness shall be stuck to the coated surface with joints staggered & well butted & secured. The adjoining sections shall be tightly pressed together. All the joints shall be sealed with bitumen/equivalent adhesive. Voids if any shall be packed with suitably cut pieces of insulation material.

4.1.5

In case of double layer application both circumferential & longitudinal joints shall be suitably staggered.

5.

VAPOR SEALING & INSULATION FINISH

The insulation shall be treated for vapor sealing & weather proofing & finished as specified in DATA SHEET A The acceptable types of finishes are outlined below:-

5.1

FINISHING SYSTEM I: EXTERNAL INSULATION WITH PLASTER FINISH

5.1.1

A thick vapor seal of hot bitumen @ 2.5 kg/Sqm shall be applied on the outer surface of insulation & allowed to dry.

5.1.2

The surface shall then be wrapped with 20mm (3/4"_ hexagonal mesh of 24 SWG GI wire, butting all the joints & laced down with 22 SWG GI lacing wire.

5.1.3

12.5mm (1/2 inch) thick sand cement plaster in the ratio of (1:1) shall be applied in two layers, the second layer being brought to a smooth finish. A water proofing compound shall be added to the cement before its application.

5.2

FINISH SYSTEM II: EXTERNAL INSULATION WITH PLASTER FINISH OVER POLYTHENE.

5.2.1

The insulation shall be covered with 500 g polythene/polythene bonded Hessians (PBH) with 50mm overlap on longitudinal & circumferential joints. Overlaps shall be sealed with synthetic adhesive in case o-f polythene & liberal coat of bitumen in case of PBH:

5.2.2

The surface shall then be wrapped with 20mm (3/4") mesh of 24 SWG GI wire butting all the joints & laced down with 22 SWG GI lacing wire.

5.2.3

12.5mm thick (1/2 inch) sand cement plaster in ratio of(4:1) shall be applied in two layers, the second layer being brought to a smooth & even finish similarly as described above.

5.3

FINISH III:EXTERNAL INSULATION WITH SHEET METAL FINISH

5.3.1

The insulation shall be covered with 500g polythene with 50mm overlaps at joints which shall be sealed with synthetic adhesive or equivalent compound.

5.3.2

The polythene shall be covered with 24 gauge GI/aluminum sheet

5.3.3

25mm wide x 22 SWG GI/aluminum peripheral straps shall be fixed over the GI/aluminum sheet at 300mm centres to secure.

5.4

FINISH IV: EXTERNAL INSULATION WITH PLASTER & WATER PROOFING COMPOUND

For ducts & piping exposed to atmosphere, the finish shall be as follows:

	TECHNICAL SPECIFICATION THERMAL INSULATION FOR COLD SURFACES	SPECIFICATION NO.PES-554-06	
		VOLUME II B	
		SECTION D	
		REV. 01	DATE: NOV 2012
		SHEET 4 OF 5	

5.4.1

A thick vapor seal of hot bitumen at 2.05 kg/sq.m shall be applied on the outer surface of insulation & allowed to dry.

5.4.2

The surface shall then be wrapped with 20mm (32/4") hexagonal mesh of 24 SWG GI Wire butting all the joints & laced down with 223 SWG GI lacing wire.

5.4.3

12.5mm thick (1/*2 inch) sand cement plaster in ratio of (4:1) shall be applied in two layers, the second layer being brought to a smooth finish with water proofing compound added to the cement.

5.4.4

3mm (1/8") thick coat of water proofing compound shall be applied & wrapped with fibre glass RP tissue. A final coat of 3mm thick water proofing compound shall then be applied over the fiberglass RP tissue & allowed to dry. Alternatively, in place of water proofing as desired above, tar felt type 3 grade 1 of IS 1322 with joints overlapped by 75mm shall be fixed & sealed with bitumen & over this 24 SWG. 25mm hexagonal GI mesh shall be fixed with 22 swig. GI lacing wire & finally bitumen paint shall be applied over wire netting.

6.

INSULATION OF PUMPS & VALVES

For all inspection covers & hatches on equipment, pump casing & valve bodies, flanges etc. the insulation shall be applied such as to facilitate removal with minimum damage to the insulation. This shall be achieved by encasing the insulation in 22 gauge aluminum sheet metal boxes, which shall be bolted together around the equipment to permit easy removal & replacement. Proper care shall be taken to maintain continuity of vapor seal between the static & removable partitions of the insulation.

The tenderer may offer thickness of insulation & finishes other than that specified in DATA SHEET A. However, calculations/reasons in support of alternative proposal shall be furnished for purchaser’s approval.

7.

INSPECTION & TESTING (REFER SPEC. NO - PES-553.00)

All necessary tests, as required to ensure that the material supplied conform to the requirements of applicable codes & standards, shall be carried out at manufacturer’s works & test certificates including these for material/accessories shall be furnished for purchasers approval.

8.

PAINTING

8.1.1 Pipe work having insulation & cladding shall be provided with color identification for the fluids handled and for indicating direction of flow.

8.1.2 Equipment surfaces having insulation and cladding shall also have identification numbers and any other relevant data provided on the insulated surface.

8.1.3 All painting for insulated surfaces shall conform to the requirement specified elsewhere.

9.

DATA TO BE FURNISHED AFTER AWARD OF CONTRACT

9.1.1 Final version of data sheet ‘B’ incorporating changes if any along with design data.

	TECHNICAL SPECIFICATION THERMAL INSULATION FOR COLD SURFACES	SPECIFICATION NO.PES-554-06	
		VOLUME II B	
		SECTION D	
		REV. 01	DATE: NOV 2012
		SHEET 5 OF 5	
9.1.2	Test certificates/reports giving result of insulation to ensure conformance to applicable codes & standards & in particular the following :- i) Thermal conductivity test ii) Sound absorption coefficient test iii) Corrosion test iv) Sulphur content, moisture content, shot content, moisture absorption etc. v) Compressive strength & cross breaking strength test.		
9.1.3	Sketches/technical literature/sectional drgs. indicating insulation materials finish and method of application etc.		
9.1.4	Manual dealing with safety aspects & instructions for combating fire arising out of insulation work		
9.1.5	Instructions on maintenance of insulation work.		



INSULATION
DATA SHEET - A

VOLUME II-B

SECTION D

REV 00

DATE : NOV 2012

SHEET 1 OF 2

INSULATION MATERIAL :

Insulation	Code	Thermal Conductivity MW/cm °C	Density Kg/m ³
Resin bonded mineral wool / glass wool	IS:8183	0.49 at 50 °C	At least 24 (For Thermal Insulation) 48 for Acoustic insulation
Mineral Wool Pipe Section (min. Gr.2)	IS:9842	0.43 at 50 °C	At least 81
Expanded Polystyrene	IS:4671	0.37 at 50°C	At least 15

TYPE OF INSULATION :

S.No.	Surface	Insulation Material	Insulation Form	Thickness (mm)
i)	Supply & Return air duct for air-conditioning system	Resin bonded Glass Wool (IS:8183)	Roll / Slab	50
ii)	Refrigerant Piping	a) Expanded Polystyrene or b) Mineral Wool	Pipe Section Pipe Section	75 75
iii)	AHU drain pipe (Suction & Liquid line)	a) Expanded Polystyrene or b) Mineral Wool	Pipe Section Pipe Section	25 25
iv)	AHU casing and condensate pan	a) Expanded Polystyrene or b) Mineral Wool	Slabs Slabs	25 25
v)	Chilled water piping, valves & specialties	a) Expanded Polystyrene or b) Mineral Wool	Pipe Section Pipe Section	75 75
vi)	Chiller	a) Expanded Polystyrene or b) Mineral Wool	Slabs Slabs	100 100
vii)	Chilled Water Pumps	a) Expanded Polystyrene or b) Mineral Wool	Slabs Slabs	50 50
viii)	Expansion tank with pipe	a) Expanded Polystyrene or b) Mineral Wool	Slabs/Pipe Section Slabs/Pipe Section	50 50



INSULATION
DATA SHEET - A

VOLUME II-B

SECTION D

REV 00

DATE : NOV 2012

SHEET 2 OF 2

ix) Acoustic insulation of Duct

Glass Wool

Slab

25



**TECHNICAL SPECIFICATION
FOR VENTILATION SYSTEM
5X800 MW YADADRI TPS**

DOCUMENT NO.: PE-TS-417-554-A001

REVISION 00

DATE: FEB 2020

**SECTION: I
SUB-SECTION: E
ANNEXURE-I
LIST OF MAKES OF SUB-VENDOR ITEMS**

VENTILATION SYSTEM LIST OF MAKES OF SUB-VENDOR ITEMS

SL No	ITEM	VENDOR
1	AIR WASHER & UAF*	HYDERABAD POLUTION CONTROL
		SK SYSTEM
		ADVANCE VENTILATION
		DRAFT AIR
		BLUE STAR
		VOLTAS
		STERLING WILSON
		ROOTS COOLING SYSTEM
		C DOCTOR
		TAP
		Pack Plast
		Industrial projects and products
2	CENTRIFUGAL FAN	FLAKT
		KRUGER
		DRAFT AIR
		HYDERABAD POLUTION CONTROL
		ADVANCE VENTILATION
		PATEL AIR
		NICOTRA
		SK SYSTEM
		MARATHON
		CB DOCTOR
		SARLA
		Comefri
3	FRESH AIR/ SUPPLY/ EXHAUST/ RE UNIT FANS / PROPELLAR	HYDERABAD POLUTION CONTROL
		SK SYSTEM
		ADVANCE VENTILATION
		KRUGER
		NICOTRA
		MARATHON
		FLAKT
		CB DOCTOR
		SARLA (SITAL)
		PATEL AIR
		KHAITAN
4	PUMPS	BEST & CROMPTON
		JYOTI
		SAM TURBO
		KBL
		KSB



VENTILATION SYSTEM LIST OF MAKES OF SUB-VENDOR ITEMS

		M&P
		VOLTAS
		BEACON-WEIR
		WORTHINGTON
		Flowmore
		SULZER PUMPS INDIA LTD.
		BHARAT PUMPS & COMPRESSORS LTD
		FLOWSERVE INDIA CONTROL PVT LTD
		V-FLOW PUMPS & SYSTEMS CO
		Kishore pumps
5	LV MOTORS (FLAME PROOF)	SIEMENS
		ABB
		CGL
		MARATHON
		KEC
		BHARAT BIJLEE
		BHARAT ELECTRIC
		NGEF
		JYOTI
		LHP
6	LV MOTORS (NON FLAME PROOF)	SIEMENS
		ABB
		CGL
		MARATHON
		KEC
		BHARAT BIJLEE
		BHARAT ELECTRIC
		NGEF
		JYOTI
		LHP
7	AIR FILTER	PUROLATOR
		FMI
		ANFILCO
		TENACITY
		JOHN FOWLER
		SPECTRUM
		AIR TECH
		PUROMATIC
8	INSULTATION MATERIAL	BEARDSHEL
		K-FLEX
		PARAMONT
		ARMAFLEX
		SUPREME

VENTILATION SYSTEM LIST OF MAKES OF SUB-VENDOR ITEMS

		LLOYDS
		UP TWIGA
		AEROCELL
9	FIRE DAMPER	TSC
		CARRYAIRE
		RAVISTAR (SYSTEM AIR)
11	BUTTERFLY VALVES	Audco
		Fouress Engg
		INTER VALVE
		BDK
		WEIR BDK
		TYCO
		CRANE PROCESS
		KEYSTONE
		Fluidline
		INSTRUMENTATION LTD
		R and D MULTIPLES (METAL CAST) PVT LTD
		SURYA VALVES AND INSTRUMENTS MFG CO
		PENTAIR VALVES AND CONTROLS INDIA PRIVATE LIMITED
		UPADHAYA VALVES MANUFACTURERS PRIVATE LIMITED
		VENUS PUMPS AND ENGG. WORKS
12	NON RETURN VALVE	Leader Valves
		H SARKAR
		Fluidline
		HI-TECH
		CRESCENT VALVES
		A V VALVES
		Bankim
		SHIVADURGA
		SURYA VALVES AND INSTRUMENT MANUFACTURING
		ATAM VALVES
		GM DAULI & SONS
		KBL
		VENUS PUMPS AND ENGINEERING WORKS
13	STEEL GATE/GLOBE/NR VALVES(WATER SYSTEM)	CRESCENT VALVES
		BDK
		Audco
		Fouress Engg
		KIRLOSKAR BROTHERS LTD.
		SANT VALVES

VENTILATION SYSTEM LIST OF MAKES OF SUB-VENDOR ITEMS

		BOMBAY METAL & ALLOYS
		Bankim
		Leader Valves
		H SARKAR
		AV Valves
		VENUS PUMPS
14	STEEL GATE/GLOBE/NR VALVES(WATER SYSTEM)	Fluidline
		HI –TECH
		SHIVADURGA
		SURYA VALVES AND INSTRUMENT MANUFACTURING
		ATAM VALVES
		GM DAULI & SONS
		KBL
15	Pipes (MS/GI) - ERW	SURYA ROSHNI
		TISCO
		DADU PIPES
		INDUS TUBES
		WELSPUN
		TATA
		BST
		JINDAL
		SAIL
		PSL
		LALIT PROFILE
		SAMSHI PIPE INDUSTRIES
		S MUKUT PIPES
		MANN INDUSTRIES
		SURENDRA ENGINEERING
		PRATIBHA PIPES AND STRUCTURES PVT LTD
		JCO GAS PIPES
		NUKAT TANK AND VESSELS
		GOODLUCK TUBES
		ADVANCE STEEL TUBES
		BIHAR TUBES
		HITECH PIPES
		RATNAMANI
		MAHARASHTRA SEAMLESS
16	GI SHEETS FOR DUCTING	TISCO
		INDIAN IRON & STEEL CO
		RASHTRIYA ISPAT NIGAM LIMITED
		ESSAR
		ISPAT INDUSTRIES

VENTILATION SYSTEM LIST OF MAKES OF SUB-VENDOR ITEMS

		JSW
		LLOYDS
		Bhushan steels
		TATA
		SAIL
		JINDAL
17	GRILL/DIFFUSER/VOLUME CONTROL DAMPER	AIR FLOW
		TSC
		AIR MASTER
		CARRYAIRE
		RAVISTAR (SYSTEM AIR)
18	HUMID STAT	JHONSON CONTROL
		HONEYWELL AUTOMATION
		PENN
19	Y / POT STRAINER	MULTITEX
		GREAVES COTTON
		JAYPEE
		SANT VALVES
		OTOKLIN
		GRAND PRIX
		GUJARAT OTOLIFT
		DS ENGG
		SAROJINI ENTERPRISE
		BHATIA ENGINEERING
		FILTRATION ENGINEERS INDIA PVT LTD
		SUNGOV ENGINEERING
20	LOCAL CONTROL PANEL	INDUSTRIAL CONTROL & APPLIANCE
		Pyrotech Electronics Pvt. Ltd.
		Positronics Pvt. Ltd.
		CONTROL & SWITCHGEAR
		SIEMENS
		L&T
		GE POWER
		RITTAL
		HOFFMAN

Annexure

YADADRI TPS(5X800MW) Approved Vendors List-M/s BHEL/PS-PEM

Lr.No.CE/TPC/SE-3/EME-11/YTPS/F. PEM Vendors Approval/D.No.51/18,Dt:23.10.2018

Sl. No	Package Name	Sl. No	Vendor proposed for approval	TSGENCO Remarks for YTPS (5X800MW)
2	DC LEAD ACID BATTERIES	1	EXIDE INDUSTRIES LTD, NEW DELHI	Approved
		2	HOPPECKE BATTERIEN GMBH & CO.KG, GERMANY	Approved
3	DC BATTERY CHARGER	1	AMARA RAJA POWER SYSTEMS LIMITED,	Approved
		2	CHHABI ELECTRICALS PVT.LTD., MAHARASHTRA	Not Approved
		3	EMERSON NETWORK POWER PVT LTD PUNE	Approved
		4	HBL POWER SYSTEMS LTD., TELANGANA	Approved
		5	STATCON POWER CONTROLS LTD.	Approved
		6	CHLORIDE POWER SYSTEMS & SOLUTIONS LIMITED, KOLKATA	Approved
		7	DUBAS ENGG PVT LTD., KARNATAKA	Not Approved
		8	MASS-TECH CONTROLS PVT.LTD., MUMBAI	Not Approved
		9	STATCON ENERGIAA PRIVATE LIMITED, NOIDA (UP)	Not Approved
		10	VERTIV ENERGY PRIVATE LIMITED, MAHARASHTRA	Not Approved
4	HT XLPE CABLES	1	APAR INDUSTRIES LIMITED, GUJARAT	Approved
		2	CABLE CORPORATION OF INDIA LTD., MUMBAI	Approved
		3	GEMSCAB INDUSTRIES LTD., NEW DELHI	Approved
		4	HAVELLS INDIA LIMITED, NOIDA (UP)	Approved


Chief Engineer/TPC

Annexure

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Lr.No.CE/TPC/SE-3/EME-11/YTPS/F. PEM Vendors Approval/D.No.51/18,Dt:23.10.2018

Sl. No	Package Name	Sl. No	Vendor proposed for approval	TSGENCO Remarks for YTPS (5x800MW)
		5	KEI INDUSTRIES LTD., NEW DELHI	Approved
		6	KEC INTERNATIONAL LIMITED, MUMBAI	Approved
		7	PARAMOUNT COMMUNICATIONS LTD., NEW DELHI	Approved
		8	POLYCAB WIRES PVT. LTD., MUMBAI	Approved
		9	TORRENT CABLES LTD.GUJARAT	Approved
		10	TIRUPATI PLASTOMATICS PVT LTD., RAJASTHAN	Approved
		11	UNIVERSAL CABLES LTD., MADHYA PRADESH	Approved
		12	TORRENT POWER LTD., GUJARAT	Approved
		13	CMI LTD., NEW DELHI	Not Approved
		14	CRYSTAL CABLE INDUSTRIES LTD., KOLKATA	Not Approved
		15	DYNAMIC CABLES LIMITED, RAJASTHAN	Not Approved
		16	FINOLEX CABLES LIMITED, PUNE	Not Approved
		17	GUPTA POWER INFRASTRUCTURE LIMITED, GHAZIABAD (UP)	Not Approved
		18	RAVIN CABLES LIMITED, MUMBAI	Not Approved
		19	SRIRAM CABLES PVT. LTD., NEW DELHI	Not Approved
		20	STERLITE POWER TRANSMISSION LTD., NEW DELHI	Not Approved
5	LT XLPE POWER CABLES	1	CORDS CABLE INDUSTRIES LTD., NEW DELHI	Approved
		2	DIAMOND POWER INFRASTRUCTURE LTD. NEW DELHI	Approved
		3	DELTON CABLES LTD. HARYANA	Approved
		4	GEMSCAB INDUSTRIES LTD., NEW DELHI	Approved
		5	HAVELLS INDIA LTD., NOIDA (UP)	Approved
		6	KEI INDUSTRIES LTD., NEW DELHI	Approved


Chief Engineer/TPC

Annexure

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Lr.No.CE/TPC/SE-3/EME-11/YTPS/F. PEM Vendors Approval/D.No.51/18,Dt:23.10.2018

Sl. No	Package Name	Sl. No	Vendor proposed for approval	TSGENCO Remarks for YTPS (5x800MW)
		7	PARAMOUNT COMMUNICATIONS LTD., NEW DELHI	Approved
		8	POLYCAB WIRES PVT. LTD., MUMBAI	Approved
		9	TORRENT CABLES LTD., GUJARAT	Approved
		10	THERMO CABLES LTD., HYDERABAD	Approved
		11	CRYSTAL CABLE INDUSTRIES LTD., KOLKATA	Approved
		12	SUYOG ELECTRICALS LTD., GUJARAT	Approved
		13	CMI LTD., NEW DELHI	Not Approved
		14	APAR INDUSTRIES LTD., MUMBAI	Not Approved
		15	KEC INTERNATIONAL LIMITED, MUMBAI	Not Approved
		16	TIRUPATI PLASTOMATICS PVT. LTD., RAJASTHAN	Not Approved
		17	DYNAMIC CABLES LIMITED, RAJASTHAN	Not Approved
		18	GUPTA POWER INFRASTRUCTURE LIMITED, GHAZIABAD (UP)	Not Approved
		19	GOVIND CABLE INDUSTRIES, GHAZIABAD (UP)	Not Approved
		20	RAVIN CABLES LIMITED, MUMBAI	Not Approved
		21	SRIRAM CABLES PVT. LTD., NEW DELHI	Not Approved
		22	SPECIAL CABLES PVT. LTD., NEW DELHI	Not Approved
6	CABLE TRAYS & ACC.	1	INDIANA GRATINGS PVT. LTD., MUMBAI	Approved
		2	INDUSTRIAL PERFORATION (I) PVT.LTD., KOLKATA	Approved
		3	PREMIER POWER PRODUCTS (CAL) PVT. LTD., KOLKATA	Approved
		4	RUKMANI ELECTRICAL & COMPONENTS PVT LTD., KOLKATA	Approved
		5	RABI ENGINEERING WORKS PVT. LTD., KOLKATA	Approved
		6	UNITECH FABRICATORS AND ENGINEERS PVT	Approved


Chief Engineer/TPC

Annexure

YADADRI TPS(5X800MW) Approved Vendors List-M/s BHEL/PS-PEM

Lr.No.CE/TPC/SE-3/EME-11/YTPS/F. PEM Vendors Approval/D.No.51/18,Dt:23.10.2018

Sl. No	Package Name	Sl. No	Vendor proposed for approval	TSGENCO Remarks for YTPS (5x800MW)
			LTD., KOLKATA	
		7	INDIA ELECTRICALS SYNDICATE, KOLKATA	Approved
		8	PATNY SYSTEMS PVT. LTD., TELANGANA	Approved
		9	RATAN PROJECTS & ENGINEERING CO. PVT. LTD., KOLKATA	Approved
		10	VINFAB ENGINEERS INDIA PVT. LTD., MUMBAI	Approved
		11	ADVANCE POWER PRODUCTS, KOLKATA	Not Approved
		12	EROS METAL WORKS (P) LTD., MAHARASHTRA	Not Approved
		13	INDMARK FORMTECH PVT. LTD., MAHARASHTRA	Not Approved
		14	MAHESHWARI ELECTRICAL MFRS. PVT. LTD., UP	Not Approved
		15	NAMDHARI INDUSTRIAL TRADERS PVT. LTD, PUNJAB	Not Approved
		16	PARMAR METALS PVT.LTD., RAJKOT	Not Approved
		17	PENTAX FERRO INCORPORATE, MUMBAI	Not Approved
		18	SARAL INDUSTRIES, UP	Not Approved
		19	VATCO ELEC-POWER PVT. LTD., MUMBAI	Not Approved
7	CABLE TRAY SUPPORT SYSTEM (WELDED TYPE)	1	ASSOCIATED POWER STRUCTURES PVT. LTD.,	Approved
		2	PATNY SYSTEMS (P) LTD., TELANGANA	Approved
		3	INDUSTRIAL PERFORATION (I) PVT.LTD., KOLKATA	Approved
		4	RATAN PROJECTS & ENGINEERING CO. PVT.LTD., KOLKATA	Approved
		5	TJSV STEEL FABRICATION & GALVANIZING (INDIA) LIMITED, TAMIL NADU	Approved
		6	VINFAB ENGINEERS INDIA PVT. LTD., MUMBAI	Approved
		7	EROS INFRASTRUCTURES PVT. LTD., MAHARASHTRA	Not Approved


Chief Engineer/TPC

Annexure

YADADRI TPS(5X800MW) Approved Vendors List-M/s BHEL/PS-PEM

Lr.No.CE/TPC/SE-3/EME-11/YTPS/F. PEM Vendors Approval/D.No.51/18,Dt:23.10.2018

Sl. No	Package Name	Sl. No	Vendor proposed for approval	TSGENCO Remarks for YTPS (5x800MW)
		8	INDMARK FORMTECH PVT. LTD., MAHARASHTRA	Not Approved
		9	JAGANNATHAN ENGINEERING WORKS, TAMIL NADU	Not Approved
		10	NAMDHARI INDUSTRIAL TRADERS PVT. LTD., PUNJAB	Not Approved
		11	PENTAX FERRO INCORPORATE, MUMBAI	Not Approved
		12	PREMIER POWER PRODUCTS (CAL) PVT. LTD., KOLKATA	Not Approved
		13	PARMAR METALS PVT.LTD., RAJKOT	Not Approved
		14	RABI ENGINEERING WORKS PVT. LTD., KOLKATA	Not Approved
		15	RUKMANI ELECTRICAL & COMPONENTS PVT LTD., KOLKATA	Not Approved
		16	SARAL INDUSTRIES, UP	Not Approved
		17	UNITECH FABRICATORS AND ENGINEERS PVT LTD., KOLKATA	Not Approved


Chief Engineer/TPC

Annexure

YADADRI TPS(5X800MW) Approved Vendors List-M/s BHEL/PS-PEM

Lr.No.CE/TPC/SE-3/EME-11/YTPS/F. PEM Vendors Approval/D.No.51/18,Dt:23.10.2018

Sl. No	Package Name	Sl. No	Vendor proposed for approval	TSGENCO Remarks for YTPS (5x800MW)
13	PVC WIRES	REPUTED BIS MAKES SHALL BE ENSURED		
14	DISTRIBUTION BOARDS	1	AMARA RAJA POWER SYSTEMS LIMITED, NEW DELHI	Approved
		2	CHHABI ELECTRICALS PVT.LTD., MAHARASHTRA	Approved
		3	C&S ELECTRIC LIMITED, NEW DELHI	Approved
		4	EMERSON NETWORK POWER, THANE	Approved
		5	HITACHI-HIREL POWER ELECTRONICS, GANDHINAGAR	Approved
		6	HBL POWER SYSTEMS LTD., TELANGANA	Approved
		7	JASPER ENGINEERS PVT. LTD., NOIDA, UP	Approved
		8	JACKSON ENGINEERS LIMITED, NOIDA, UP	Approved
		9	LARSON & TOUBRO LTD., MUMBAI	Approved
		10	NITYA ELECTROCONTROLS PVT. LTD., UP	Approved
		11	RSI SWITCHGEAR PVT. LTD.,RAJASTHAN	Approved
		12	SIEMENS LIMITED,HARYANA	Approved
		13	AVAIDS TECHNOVATORS PVT. LTD., NEW DELHI	Not Approved
		14	BCH ELECTRIC LTD., FARIDABAD	Not Approved
		15	RYB SWITCHGEARS PVT. LTD., NEW DELHI	Not Approved



SUB-VENDOR LIST FOR ELECTRICAL ITEMS

ITEM DESCRIPTION	SL NO.	VENDOR NAME
CABLE GLANDS	1	ALLIED TRADERS & EXPORTERS
	2	ARUP ENGG & FOUNDRY WORKS
	3	BALIGA LIGHTING EQPT.PVT.LTD.
	4	COMMET BRASS PRODUCTS
	5	DOWELLS
	6	ELECTROMAC INDUSTRIES
	7	INCAB
CABLE LUGS	1	DOWELLS
	2	UNIVERSAL MACHINES LTD.
LV MOTORS (NON FLAME PROOF)	1	ABB
	2	BHARAT BIJLEE LTD.
	3	CROMPTON GREAVES
	4	GE-POWER
	5	KIRLOSKAR ELECTRIC CO LTD.
	6	LAXMI HYDRAULICS PVT. LTD
	7	MARATHON
	8	NGEF
	9	RAJINDRA ELECT INDUSTRIES
	10	SIEMENS



VENTILATION SYSTEM LIST OF MAKES OF SUB-VENDOR ITEMS

NOTES:

1. VOID

2. THE SUB VENDOR LIST ABOVE IS INDICATIVE ONLY AND IS SUBJECT TO BHEL AND CUSTOMER APPROVAL DURING DETAILED ENGINEERING STAGE WITHOUT ANY COMMERCIAL & DELIVERY IMPLICATION TO BHEL. BIDDER TO PROPOSE SUB VENDOR WITHIN 4 WEEKS OF PLACEMENT OF LOI. THEREAFTER NO REQUEST FOR ADDITIONAL SUB-VENDOR SHALL BE ENTERTAINED.

3. THE INSPECTION CATEGORY WILL BE INTIMATED AFTER AWARD OF CONTRACT BY BHEL/CUSTOMER. HOWEVER THE SAME WILL BE ADHERED BY THE BIDDER WITHOUT ANY COMMERCIAL AND DELIVERY IMPLICATION TO BHEL/ CUSTOMER.

4. PLEASE ALSO REFER RESPECTIVE SUB-SECTION C-3, C-4 FOR ELECTRICAL AND C&I RELATED EQUIPMENT LIST OF MAKE.



5X800 MW YADADRI TPS

**VENTILATION SYSTEM
MANDATORY SPARE LIST**

SPECIFICATION NO. PE-TS-417-554-A001

SECTION : I

SUB-SECTION : E

REV 00

DATE: FEB 2020

**SECTION-I
SUB SECTION -E**

**ANNEXURE-II
MANDATORY SPARE LIST**

NAME OF PROJECT:		5X800 MW TSGENCO YADADRI TPS		
NAME OF PACKAGE:		VENTILATION SYSTEM		
TECHNICAL SPECIFICATION:		PE-TS-417-554-A001		
S. No.	DESCRIPTION	UNIT	Qty	AMOUNT (Ex-Works)
1	Ventilation System (Mechanical)			
1.1	Centrifugal fans			
1.1.1	Sets of bearings for Air washer fans	Set	2 Set for each Type of Fan	
1.1.2	Sets of bearings for U.A.F. fans	Set	2 Set for each Type of Fan	
1.1.3	Impeller for the Fan	Set	2 Set for each Type of Fan	
1.2	Centrifugal pumps			
1.2.1	Set of bearings for Air washer pumps	Set	2 Set for each Type and rating of Pump	
1.2.2	Set of bearings for U.A.F. pumps	Set	2 Set for each Type and rating of Pump	
1.2.3	Gland packing, shaft sleeve & casing wearing ring	Set	2 Set for each Type and rating of Pump	
1.2.4	Impeller for the Pump	Set	2 Set for each Type and rating of Pump	
1.3	Spray Nozzles			
1.3.1	Spray nozzles for air washer unit	Nos.	10% of total installed quantity	
1.3.2	Spray nozzles for U.A.F. unit	Nos.	10% of total installed quantity	
1.4	SS Filters			
1.4.1	SS Filter for Air washer	Nos.	20% of total installed quantity	
1.4.2	SS Filter for Unitary air filtration unit	Nos.	20% of total installed quantity	
1.5	Flow Regulating Valve			
1.5.1	For Air Washer	Nos.	20% or minimum 2 Nos. Whichever is higher	
1.5.2	For Unitary Air Filtration Unit	Nos.	20% or minimum 2 Nos. Whichever is higher	
1.6	Basket for POT Strainer			
1.6.1	Strainer Basket for Air Washer	Nos.	2 Nos. For each type and size	
1.6.2	Strainer Basket for Unitary Air Filtration unit	Nos.	2 Nos. For each type and size	
1.7	Valves			
1.7.1	Gate valve for Air washer	Nos.	20% or minimum 2 Nos. Whichever is higher	
1.7.2	NR Valve for Air washer	Nos.	20% or minimum 2 Nos. Whichever is higher	
1.7.3	Gate valve for Unitary Air Filtration Unit	Nos.	20% or minimum 2 Nos. Whichever is higher	
1.7.4	NR valve for Unitary Air Filtration Unit	Nos.	20% or minimum 2 Nos. Whichever is higher	
1.7.5	Gate Valve for Make-up Drain of Air washer	Nos.	20% or minimum 2 Nos. Whichever is higher	
1.7.6	Gate valve for UAF	Nos.	40% or minimum 2 Nos. Whichever is higher	
1.8	Fan-Filter Units (i.e., Axial supply air fans with filters)			
1.8.1	Filter	Set	2 set for each FFU	
1.8.2	Fan-motor Bearing	Set	2 set for each rating of FFU	
1.8.3	Vibration Isolators	Set	2 set for each FFU	
1.8.4	Back Draft Dampers	Nos.	2 no of each size	
1.8.5	Fan motor	Set	2 sets for each rating of fan	
1.8.5	Any other spare parts recommended by the Manufacturer	-	As recommended by the Manufacturer	
1.9	Wall mounted supply/ Exhaust fan			
1.9.1	Fan-motor Bearing	Set	2 sets for each rating of fan	
1.9.2	Vibration Isolators	Set	2 sets for each fan	
1.9.3	Fan motor	Set	2 sets for each rating of fan	
2	Ventilation System (Electrical)			
2.1	Electrical Spares for panels			
2.1.1	Control Supply Transformer	Nos.	4 Nos. of each type and rating	
2.1.2	Contractor	Nos.	4 Nos. of each type and rating	
2.1.3	Coils for contractor & aux. contractor	Nos.	10 Nos. for each contractor	
2.1.4	Main & Aux. Contacts sets for contractor and Aux. Contractor	Set	10 Sets. For each contractor	
2.1.5	Air Break Switch	Nos.	2 Nos. for each rating	
2.1.6	Control, Isolating and selector switches	Nos.	10% of each type and rating	
2.1.7	MCB/ MCCB	Nos.	20% of installed quantity	
2.1.8	Circuit Breaker	Nos.	2 Nos. for each rating	
2.1.9	Indicating Lamps	Nos.	20% of installed quantity	
2.1.10	Indicating Lamps cover of different colour and holders	Nos.	10% of installed quantity	
2.1.11	Push Buttons of various colours	Nos.	20 nos. of each type and colour	
2.1.12	Terminal Blocks	Nos.	10% of installed quantity	
2.2	Electrical Spares for Motors			
2.2.1	Terminal plates	Nos.	20 Nos. each for small motors up to 30KW and 8 Nos. each for motors above 30KW	
2.2.2	Heaters	Set	2 Set for each motor of rating above 30KW	
2.2.3	Greasing arrangements	Set	8 sets for each type of motors	
2.2.4	Motors below 0.75 KW	Nos.	20% of the installed quantity or minimum 2 nos. whichever is higher	
2.2.5	Bearings (DE & NDE)	Nos.	8 sets of each type and rating	
2.3	Motor			
2.3.1	415 Volt Motor (above 30KW Rating upto 200KW)			
2.3.1.1	End Shield Cover Driving & Non-Driving End	Sets	2 sets. for each type and rating of Motor	
2.3.1.2	Driving End & Non-Driving End Bearing	Sets	2 sets. for each type and rating of Motor	
2.3.1.3	Cooling Fan	Nos.	2 nos. for each type and rating of Motor	
2.3.1.4	Motors Space Heater	Nos.	2 nos. for each type and rating of Motor	
2.3.1.5	Motor Terminal Block	Nos.	2 nos. for each type and rating of Motor	
2.3.1.6	Complete Set of Coupling	Set	2 Set for each Application	

NAME OF PROJECT:		5X800 MW TSGENCO YADADRI TPS		
NAME OF PACKAGE:		VENTILATION SYSTEM		
TECHNICAL SPECIFICATION:		PE-TS-417-554-A001		
S. No.	DESCRIPTION	UNIT	Qty	AMOUNT (Ex-Works)
2.3.2	EQUIPMENT / PACKAGE 415 Volt Motor (Upto 30KW Rating)			
2.3.2.1	Driving End & Non-Driving End Bearing	Set	6 Set for each type and rating of Motor	
2.3.2.2	Cooling Fan	Nos.	4 nos. for each type and rating of Motor	
2.3.2.3	Motor Terminal Block	Nos.	10 nos. for each type and rating of Motor	
2.3.2.4	Complete Set of Coupling	Set	2 Set for each Application	
3	Ventilation System (C&I)			
3.1	Transmitters/ Gauges/Switches etc. along with relevant accessories	Nos.	20% of total or at least four (whichever is higher) for each type along with accessories.	
3.2	Temperature Element (RTD/Thermo-couple) with thermowell	Nos.	20% of each type , range and immersion length . Minimum 10 nos.	
3.3	Junction Box			
3.3.1	Junction box	Nos.	20% of total quantity for each size but minimum 4 nos.	
3.3.2	Terminals in Terminal blocks	Nos.	20 nos. of each type	
3.6	Process Connection Piping (impulse piping/tubing, sampling piping / tubing & air supply piping as applicable)			
3.6.1	Valves of all types	Nos.	20% of each type, class, size & model	
3.6.2	Valve Manifolds (2 way/3 way/5 way)	Nos.	20% of each type, class, size & model	
3.6.3	Fittings	Nos.	20% of each type, class, size & model	
3.6.4	Filter Regulators	Nos.	40% of each model	
3.7	Dampers			
3.7.1	Actuator Diaphragm	Set	2 set for each damper	
3.7.2	O-Ring set	Nos.	4 nos. of each size for positioner	
3.7.3	Feedback Linkage	Nos.	2 nos. for each type	
3.7.4	Packing & gasket	Nos.	2 nos. for each type	
3.8	Solenoid Valves			
3.8.1	Solenoid Valve Coil	Nos.	4 nos. of each rating & insulation	
3.8.2	Plunger	Nos.	2 nos. of each type	
3.8.3	Seat	Nos.	4 no. of each type & size	
3.8.4	Gaskets	Set	4 sets of each type & size	
3.8.5	O-Ring set	Set	10 sets of each type & size	
3.9	Actuator			
3.9.1	Complete set of Actuator	Nos.	2Nos. for each type and rating	
3.9.2	Limit Switch	Nos.	6 Nos each type and rating	
3.9.3	Torque Switch	Nos.	6 Nos each type and rating	
3.9.4	Auxiliary Contact	Nos.	2 nos. each type and rating	
3.9.5	Motor	Nos.	2 nos. each type and rating	
3.9.6	Complete Seal kit	Set	2 Set for each type and rating	
3.9.7	Complete O-Ring Set	Set	2 Sets	
3.9.8	Electronic Card	Nos.	Two(2) for each type/make	
3.9.9	Feedback Assembly (4-20mA) for Inching type	Nos.	Two(2) for each type/make	
4.0	Control Valves			
4.1	Pneumatic Control Valves & Block Valves			
4.1.1	Plot Relay	Set	2 sets for each valve	
4.1.2	Actuator Diaphragm	Nos.	2 nos. for each valve	
4.1.3	Feedback Linkage	Nos.	2 nos. for each valve	
4.1.4	Smart Positioners	Nos.	20% of total quantity of each model/type	
4.1.5	I/P Converters (If any)	Nos.	20% of total quantity or minimum 30 nos.	
4.1.6	Complete Consumables for Valve Viz. O-ring, Gland Packing, Packing Ring, Bonnet Seal etc.	Sets	4 Sets each size, rating, type	
4.1.7	Valve Disc	Sets	4 Sets each size, rating, type	
4.1.8	Valve Spindle	Sets	4 Sets each size, rating, type	
4.1.9	Valve Seat	Sets	4 Sets each size, rating, type	
4.1.10	Bush	Sets	4 Sets each size, rating, type	
4.1.11	Guide	Sets	4 Sets each size, rating, type	
4.1.12	Guide Bush	Sets	4 Sets each size, rating, type	
4.1.13	Coupling Nut	Sets	4 Sets each size, rating, type	
4.1.14	Actuator Piston with Rod & Seal	Sets	4 Sets each size, rating, type	
4.1.15	Control valve stem packing and spare operator moulded rubber diaphragms	Sets	2 sets for each size, rating, type	
4.1.16	Valve trim (including cage, plug, stem, seat rings, guide bushings etc.) for each of the control valves as offered.	Sets	2 sets for each size, rating, type	
4.1.17	Solenoid valves, position transmitters, limit switches, I/P convertors, positioners etc. of each type	Nos.	20% of total quantity spare with minimum 2 no. for each size, rating, type	

NAME OF PROJECT:		5X800 MW TSGENCO YADADRI TPS			
NAME OF PACKAGE:		VENTILATION SYSTEM			
TECHNICAL SPECIFICATION:		PE-TS-417-554-A001			
S. No.	DESCRIPTION	UNIT	Qty	AMOUNT (Ex-Works)	
	EQUIPMENT / PACKAGE				
Notes:					
a)	Mandatory spares listed above are bare minimum requirement. In case any additional mandatory spares requirement is covered elsewhere in the tender specification apart from specified above, same shall be deemed to have been covered in bidder's scope of supply.				
b)	"One (1) Set" and "One (1) set of each type & rating" is defined as total numbers as required for one complete replacement for one equipment of similar size & capacity.				
c)	In case any spare indicated in the specification is "not applicable" for particular equipment, then suitable applicable alternate spare shall be supplied by the bidder without any financial implication."				
d)	For quantities indicated in percentage, fractions are to be rounded-off to next higher integer.				
e)	The quantity indicated shall be arrived based in the BOQ for the entire plant. Further, Stage # 1 and Stage # 2 detailed break up of Mandatory Spares shall be submitted by bidder based on finalised BOQ arrived during detail engineering.				
g)	Bidder to note that even though there may be some spares which are repetitive at various sl.no mentioned above, bidder to ensure that prices are quoted against each sl.no. In case any cell is left blank in the unpriced schedule shall be treated as "quoted" and included in total price.				
Particulars of bidder / authorised representative					
	Name	Designation	Signature	Date	Company Seal



**TECHNICAL SPECIFICATION
FOR VENTILATION SYSTEM
5X800 MW YADADRI TPS**

DOCUMENT NO.: PE-TS-417-554-A001

REVISION 00

DATE: FEB 2020

**SECTION: I
SUB-SECTION: E
ANNEXURE-III
PAINTING AND COLOUR SCHEME
(AS PER SECTION C2C)**



5X800 MW YADADRI TPS

**VENTILATION SYSTEM
LIST OF TOOLS & TACKLES**

SPECIFICATION No: PE-TS-417-554-A001

SECTION : I

SUB-SECTION : E

REV 00

DATE: FEB 2020

SHEET 1 OF 2

SECTION-I

SUB-SECTION-E

ANNEXURE-IV

LIST OF TOOLS & TACKLES

NAME OF PROJECT:		5X800 MW TSGENCO YADADRI TPS		
NAME OF PACKAGE:		VENTILATION SYSTEM		
TECHNICAL SPECIFICATION No:		PE-TS-417-554-A001		
SL NO	DESCRIPTION	UNIT	Stage # 1 Qty	Stage # 2 Qty
1	Measuring tape	NO	1	1
2	Tachometer	NO	1	1
3	Double ended spanner	SET	1	1
4	Ring spanners	SET	1	1
5	Gasket punch	NO.	1	1
6	Center punch	NO.	1	1
7	Hammer with wooden handles	NO.	1	1
8	Scissors for sheet metal cutting	NO.	1	1
9	Torch light (suitable for 2 cells)	NO.	1	1
10	Multimeter	NO.	1	1
11	Anemometer	NO.	1	1
12	Compound pressure gauge	NO.	1	1
13	Slide wrench 8"	NO.	1	1
14	Slide wrench 10"	NO.	1	1
15	Slide wrench 6"	NO.	1	1
16	Box spanner set	SET	1	1
17	Screw driver set	SET	1	1
18	Align key set	SET	1	1
19	MS tool box	NO	1	1
1				
NOTES				
1	ABOVE IS THE MINIMUM LIST. ANY OTHER TOOL / TACKEL REQUIRED FOR THE SYSTEM SHALL ALSO BE PROVIDED BY THE VENDOR WITHOUT ANY COST IMPLICATION.			



5X800 MW YADADRI TPS

VENTILATION SYSTEM

SPECIFICATION No: PE-TS-417-554-A001

SECTION : 1

SUB-SECTION : E

REV 00

DATE: APRIL 2020

SHEET

SECTION-II

SUB-SECTION-E

ANNEXURE-V

WATER ANALYSIS



TITLE : 5X800 MW YADADRI THERMAL POWER STATION	SPECIFICATION NO. PE-TS-417-554-A001	
	SECTION : I	
TECHNICAL SPECIFICATION FOR VENTILATION SYSTEM	SUB-SECTION:E	
	REV. NO. 00	DATE :

CLARIFIED WATER ANALYSIS

S.No.	CONSTITUENTS	As	CONTENT
1.	Calcium	CaCO ₃	121.9 ppm
2.	Magnesium	CaCO ₃	74.1 ppm
3.	Sodium	CaCO ₃	184.4 ppm
4.	Potassium	CaCO ₃	1.1 ppm
5.	Iron in Soln.	Fe	Nil
	TOTAL CATIONS	CaCO₃	381.5 ppm
6.	Bicarbonate	CaCO ₃	134.8 ppm
7.	Sulphate	CaCO ₃	80.9 ppm
8.	Chloride	CaCO ₃	161.0 ppm
9.	Nitrate	CaCO ₃	3.5 ppm
10.	Phosphate	CaCO ₃	Nil
11.	Fluoride	CaCO ₃	1.3 ppm
	TOTAL ANIONS	CaCO₃	381.5 ppm
12.	Reactive Silica	SiO ₂	14.1 ppm
13.	Colloidal Silica	SiO ₂	Nil
14.	Total Silica	SiO ₂	14.1 ppm
15.	Nitrites	NO ₂	Nil
16.	Total Hardness	CaCO ₃	196 ppm
17.	Total Suspended Solid		15 ppm
18.	pH value at 25°C	-	8.0
19.	Turbidity		15 NTU

Note:

The analysis of the clarified water is exhibited here shall be multiplied with 6.5 COC to derive the circulating water analysis.



5X800 MW YADADRI TPS

VENTILATION SYSTEM

SPECIFICATION No: PE-TS-417-554-A001

SECTION : 1

SUB-SECTION : E

REV 00

DATE: APRIL 2020

SHEET

VOID



2X800 MW TANGEDCO UPPUR TPP BTG

**VENTILATION SYSTEM
DRAWINGS / DOCUMENTS SUBMISSION
PROCEDURE**

SPECIFICATION No: PE-TS-425-554-A001

SECTION : I

SUB-SECTION : E

REV 00

DATE: APR 2020

SHEET 1 OF 2

SECTION-I

SUB-SECTION-E

ANNEXURE-VI

DRAWINGS / DOCUMENTS SUBMISSION PROCEDURE

(AS PER SECTION C2B)



5X800 MW YADADRI TPS

SPECIFICATION No: PE-TS-417-554-A001

VENTILATION SYSTEM

SECTION : I

**MASTER DRAWING LIST WITH SCHEDULE
OF SUBMISSION**

SUB-SECTION : E

REV 00

DATE: FEB 2020

SHEET

SECTION-I

SUB-SECTION-E

ANNEXURE-VII

**MASTER DRAWING LIST WITH SCHEDULE OF
SUBMISSION**

MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION						
PROJECT: 5 X 800 MW YADADRI TPS						
PACKAGE: VENTILATION SYSTEM						
SL.NO.	Package	SI No	Drawing NO	Drg Title	Schedule date(From Date of LOI)	Category
1	VENTILATION SYSTEM	554	PE-V0-417-554-A002	QUALITY PLAN OF AIR WASHER & UAF FOR VENTILATION SYSTEM	9 Weeks	A-CUST
2	VENTILATION SYSTEM	554	PE-V0-417-554-A003	QUALITY PLAN OF CENTRIFUGAL PUMPS FOR VENTILATION SYSTEM	9 Weeks	A-CUST
3	VENTILATION SYSTEM	554	PE-V0-417-554-A004	QUALITY PLAN OF CENTRIFUGAL FANS FOR VENTILATION SYSTEM	10 Weeks	A-CUST
4	VENTILATION SYSTEM	554	PE-V0-417-554-A005	QUALITY PLAN OF AXIAL FLOW FANS & RE UNITS FOR VENTILATION SYSTEM	10 Weeks	A-CUST
5	VENTILATION SYSTEM	554	PE-V0-417-554-A006	QUALITY PLAN OF MOTOR FOR VENTILATION SYSTEM	12 Weeks	A-CUST
6	VENTILATION SYSTEM	554	PE-V0-417-554-A008	VENTILATION FAN SCHEDULE.	18 Weeks	A-CUST
7	VENTILATION SYSTEM	554	PE-V0-417-554-A009	DATA SHEET & GA FOR AIR WASHER & UAF ALONGWITH FAN AND PUMP FOUNDATION DETAILS FOR VENTILATION SYSTEM	9 Weeks	A-CUST
8	VENTILATION SYSTEM	554	PE-V0-417-554-A010	DATA SHEET & GA FOR ROOF EXTRACTOR, AXIAL EXHAUST AND SUPPLY AIR FANS WITH FIXING ARRANGEMENT FOR VENTILATION SYSTEM	9 Weeks	A-CUST
9	VENTILATION SYSTEM	554	PE-V0-417-554-A011	DATA SHEET & GA FOR VALVES AND STRAINER FOR VENTILATION SYSTEM	5 Weeks	I-CUST
10	VENTILATION SYSTEM	554	PE-V0-417-554-A012	DATA SHEET FOR INSULATION FOR VENTILATION SYSTEM	5 Weeks	I-CUST
11	VENTILATION SYSTEM	554	PE-V0-417-554-A013	DATA SHEET & GA FIRE DAMPER FOR VENTILATION SYSTEM	5 Weeks	A-CUST
12	VENTILATION SYSTEM	554	PE-V0-417-554-A014	DATA SHEET FOR INSTRUMENTS (PRESSURE GAUGE, TEMP GAUGE, LEVEL GAUGE, PRESSURE SWITCH, LEVEL SWITCH) FOR VENTILATION SYSTEM	10 Weeks	I-CUST
13	VENTILATION SYSTEM	554	PE-V0-417-554-A015	DATA SHEET OF PIPE FOR VENTILATION SYSTEM	3 Weeks	I-CUST
14	VENTILATION SYSTEM	554	PE-V0-417-554-A016	DATA SHEET OF GI AND MS SHEET FOR VENTILATION SYSTEM	3 Weeks	I-CUST
15	VENTILATION SYSTEM	554	PE-V0-417-554-A017	DATA SHEET & GA FOR PRE AND FINE FILTERS FOR VENTILATION SYSTEM	5 Weeks	I-CUST
16	VENTILATION SYSTEM	554	PE-V0-417-554-A018	DATA SHEET FOR MOTORS (A/W Fan, A/W pumps, UAF Fan, UAF Pump, RE unit, Supply and Exhaust axial fan) FOR VENTILATION SYSTEM	12 Weeks	A-CUST
17	VENTILATION SYSTEM	554	PE-V0-417-554-A019	TYPICAL Details DUCT FABRC DRG / SUPPORT / EREC.FOR VENTILATION SYSTEM INSUL OF DUCT / PIPING & EQUIPMENTS PIPE ERECTION	4 Weeks	I-CUST
18	VENTILATION SYSTEM	554	PE-V0-417-554-A020	GA OF PROPELLER FAN FOR VENTILATION SYSTEM	6 Weeks	I-CUST
19	VENTILATION SYSTEM	554	PE-V0-417-554-A021	PID & SCHEME FOR AIRWASHER AND UAF UNIT FOR VENTILATION SYSTEM	4 Weeks	A-CUST
20	VENTILATION SYSTEM	554	PE-V0-417-554-A022	AIR WASHER LAYOUT OUTSIDE "A ROW" SIDEALONGWITH FOUNDATION DETAILS - TG BUILDING (Unit 1 & 2)	10 Weeks	A-CUST
21	VENTILATION SYSTEM	554	PE-V0-417-554-A023	AIR WASHER LAYOUT FOR"B-C BAY" SIDEALONGWITH FOUNDATION DETAILS - TG BUILDING (Unit 1 & 2)	10 Weeks	A-CUST
22	VENTILATION SYSTEM	554	PE-V0-417-554-A024	UAF LAYOUT ALONGWITH FOUNDATION DETAILS - ESP BUILDING. (Unit 1 & 2)	8 Weeks	A-CUST
23	VENTILATION SYSTEM	554	PE-V0-417-554-A025	UAF LAYOUT ALONGWITH FOUNDATION DETAILS - FGD CONTROL ROOM (STAGE-I)	8 Weeks	A-CUST
24	VENTILATION SYSTEM	554	PE-V0-417-554-A026	VENTILATION DUCT LAYOUT FORTG BUILDING - 'A' ROW SIDE (Unit 1 & 2)	9 Weeks	A-CUST
25	VENTILATION SYSTEM	554	PE-V0-417-554-A027	VENTILATION DUCT LAYOUT FORTG BUILDING - 'BC BAY' SIDE(Unit 1 & 2)	9 Weeks	A-CUST
26	VENTILATION SYSTEM	554	PE-V0-417-554-A028	VENTILATION DUCT LAYOUT FOR ESP BUILDINGS (Unit 1 & 2)	9 Weeks	A-CUST
27	VENTILATION SYSTEM	554	PE-V0-417-554-A029	VENTILATION DUCT LAYOUT FOR FGD CONTROL BUILDING (STAGE-1)	9 Weeks	A-CUST
28	VENTILATION SYSTEM	554	PE-V0-417-554-A030	LOCATION OF ROOF EXTRACTOR UNIT IN TG BUILDING ALONGWITH FIXING DETAILSFOR VENTILATION SYSTEM	9 Weeks	A-CUST
29	VENTILATION SYSTEM	554	PE-V0-417-554-A031	VENT. ARRANGEMENT FOR BATTERY ROOM. (Unit 1 & 2)	10 Weeks	I-CUST
30	VENTILATION SYSTEM	554	PE-V0-417-554-A032	VENT. ARRANGEMENT FOR VARIOUS AUXILIARY BUILDING.	14 weeks	I-CUST
31	VENTILATION SYSTEM	554	PE-V0-417-554-A033	ELECTRICAL FEEDER LIST FOR VENTILATION SYSTEM	14 weeks	I-G-P
32	VENTILATION SYSTEM	554	PE-V0-417-554-A034	VENTILATION CABLE SCHEDULE	14 weeks	I-G-P
33	VENTILATION SYSTEM	554	PE-V0-417-554-A035	P.G/ DEMONSTRATION TEST PROCEDUREFOR VENTILATION SYSTEM	9 Weeks	A-CUST
34	VENTILATION SYSTEM	554	PE-V0-417-554-A036	O & M MANUAL FOR VENTILATION SYSTEM	21 Weeks	I-CUST
35	VENTILATION SYSTEM	554	PE-V0-417-554-A037	D ata sheet Control Cable & screened control cables	14 weeks	I-CUST
36	VENTILATION SYSTEM	554	PE-V0-417-554-A038	QAP for Control Cable & screened control cables	14 weeks	I-CUST
37	VENTILATION SYSTEM	554	PE-V0-417-554-A040	AIR WASHER LAYOUT OUTSIDE "A ROW" SIDEALONGWITH FOUNDATION DETAILS - TG BUILDING (Unit 3, 4 & 5)	10 Weeks	A-CUST
38	VENTILATION SYSTEM	554	PE-V0-417-554-A041	AIR WASHER LAYOUT FOR"B-C BAY" SIDEALONGWITH FOUNDATION DETAILS - TG BUILDING (Unit 3, 4 & 5)	10 Weeks	A-CUST
39	VENTILATION SYSTEM	554	PE-V0-417-554-A042	UAF LAYOUT ALONGWITH FOUNDATION DETAILS - ESP BUILDING. (Unit 3, 4 & 5)	8 Weeks	A-CUST
40	VENTILATION SYSTEM	554	PE-V0-417-554-A043	VENTILATION DUCT LAYOUT FORTG BUILDING - 'A' ROW SIDE (Unit 3, 4 & 5)	8 Weeks	A-CUST
41	VENTILATION SYSTEM	554	PE-V0-417-554-A044	VENTILATION DUCT LAYOUT FORTG BUILDING - 'BC BAY' SIDE (Unit 3, 4 & 5)	9 Weeks	A-CUST
42	VENTILATION SYSTEM	554	PE-V0-417-554-A045	VENTILATION DUCT LAYOUT FOR ESP BUILDINGS (Unit 3, 4 & 5)	9 Weeks	A-CUST
43	VENTILATION SYSTEM	554	PE-V0-417-554-A046	VENTILATION DUCT LAYOUT FOR FGD CONTROL BUILDING (STAGE-2)	9 Weeks	A-CUST
44	VENTILATION SYSTEM	554	PE-V0-417-554-A047	VENT. ARRANGEMENT FOR BATTERY ROOM. (Unit 3, 4 & 5)	9 Weeks	A-CUST

	5X800 MW YADADRI TPS VENTILATION SYSTEM MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION	SPECIFICATION No: PE-TS-417-554-A001	
		SECTION : I	
		SUB-SECTION : E	
		REV 00	DATE: FEB 2020
		SHEET	

NOTE:

- 1) THE DRAWING DOCUMENT MENTIONED IN THE ABOVE LIST IS MINIMUM REQUIREMENT. THE FINAL LIST SHALL BE DECIDED WITH SUCCESSFUL VENDOR DURING DETAIL ENGINEERING.
- 2) ANY ADDITIONAL DRAWING/DOCUMENT IF ASKED FOR DURING DETAIL ENGINEERING SHALL BE PROVIDED WITHOUT ANY COST AND TIME IMPLICATION TO BHEL.
- 3) THE CATEGORY OF THE DRAWINGS/DOCUMENTS ARE INDICATIVE ONLY AND SHALL BE DECIDED DURING DETAIL ENGINEERING.



5X800 MW YADADRI TPS

SPECIFICATION No: PE-TS-425-554-A001

SECTION : I

SUB-SECTION : E

REV 00

DATE: APR 2020

SHEET 1

**VENTILATION SYSTEM
FORMAT FOR OPERATION AND
MAINTENANCE MANUAL**

SECTION-I

SUB-SECTION-E

ANNEXURE-IX

FORMAT FOR OPERATION AND MAINTENANCE MANUAL



5X800 MW YADADRI TPS

SPECIFICATION No: PE-TS-425-554-A001

SECTION : I

SUB-SECTION : E

REV 00

DATE: APR 2020

SHEET 2

**VENTILATION SYSTEM
FORMAT FOR OPERATION AND
MAINTENANCE MANUAL**

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

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



5X800 MW YADADRI TPS

SPECIFICATION No: PE-TS-425-554-A001

SECTION : I

SUB-SECTION : E

REV 00

DATE: APR 2020

SHEET 3

**VENTILATION SYSTEM
FORMAT FOR OPERATION AND
MAINTENANCE MANUAL**

Sl.no. & Sections	Description	Tick (V)if included in Manual			Remarks
		Yes	No	Not Applicable	
4.0	COMMISSIONING ACTIVITIES (IF NOT COVERED IN SEPARATE DOCUMENT I.E. ERECTION MANUAL, COMMISSIONING MANUAL)				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	OPERATION GUIDELINES FOR PLANT PERSONAL/USER/OPERATOR				
5.1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5.2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5.3	Do's & Don't of the equipments.				
5.4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5.5	Parameters to be monitored with normal values and limiting values				
5.6	Trouble shooting with causes and remedial measures				
5.7	Routine operational checks, recommended logs & records				
5.8	Changeover schedule if more than one auxiliary for the same purpose is given				
5.9	Painting requirement and schedule				
5.10	Inspection, repair , Testing and calibration procedures				
6.0	MAINTENANCE GUIDELINES FOR PLANT PERSONAL				



5X800 MW YADADRI TPS

SPECIFICATION No: PE-TS-425-554-A001

SECTION : I

SUB-SECTION : E

REV 00

DATE: APR 2020

SHEET 4

VENTILATION SYSTEM FORMAT FOR OPERATION AND MAINTENANCE MANUAL

Sl.no. & Sections	Description	Tick (V)if included in Manual			Remarks
		Yes	No	Not Applicable	
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	Statutory and other specific requirements considerations.				
8.0	List of reference documents				
9.0	Binding as per requirement				



5X800 MW YADADRI TPS

**VENTILATION SYSTEM
SITE STORAGE AND PRESERVATION**

SPECIFICATION No: PE-TS-417-554-A001

SECTION : I

SUB-SECTION : E

REV 00

DATE: APRIL 2020

SHEET

SECTION-I

SUB-SECTION-E

ANNEXURE-IX

SITE STORAGE AND PRESERVATION

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHANICAL BOPs

(Doc No: PE-DC-SSG-A001 REV.00)



PROJECT ENGINEERING MANAGEMENT, POWER SECTOR
BHARAT HEAVY ELECTRICALS LIMITED-NOIDA

CONTENT

- 1 SCOPE OF THE DOCUMENT
- 2 PURPOSE OF STORAGE & PRESERVATION
- 3 MEASURES TO BE TAKEN FOR STORAGE AND PRESERVATION
 - a) GENERAL STORAGE REQUIREMENTS
 - b) GENERAL PRESERVATION REQUIREMENTS
 - c) GENERAL INSPECTION REQUIREMENTS
- 4 TYPE OF STORAGE FOR VARIOUS EQUIPMENT
5. CONCLUSION
6. STACKING ARRANGEMENT FOR PLATES AND STRUCTURAL STEEL

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. 'No smoking' signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. 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.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.
11. Following preservatives/preservation methods can be used depending upon type of equipment
 - a. Rust preventive fluid (RPF)
 - b. Rust protective paints
 - c. Tarpaulin covers, in case of outdoor storage
 - d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –
 - Ingress of moisture and corrosion damages.
 - Damage to protective coating.
 - Open ends in pipes, vessels and equipment -
 - In case any open ends are noticed, same shall be capped.
2. Any damages to equipment / materials.
 - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
 - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere. (C)**

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.



ii **Semi-closed storage. (S)**

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.





iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.



The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H ₂ SO ₄)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self-life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self-life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

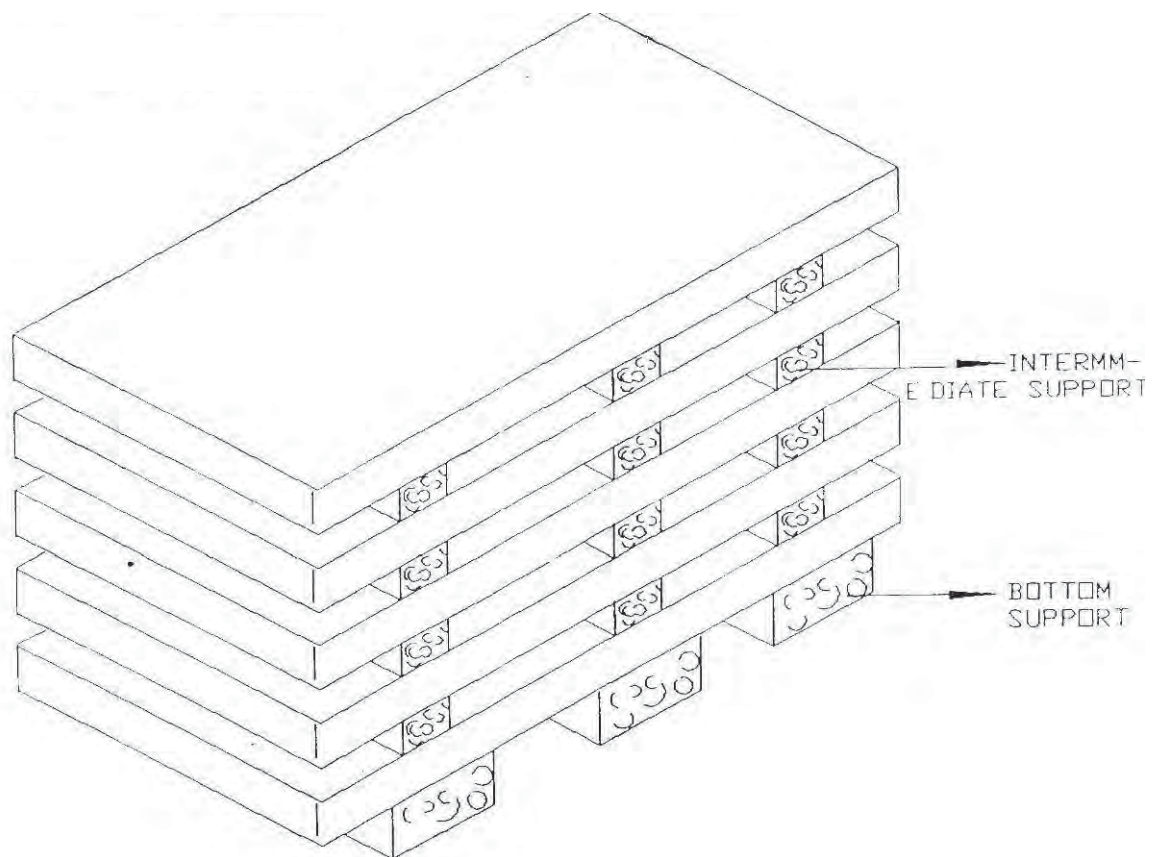


Figure – 1 – PLATE STACKING ARRANGEMENT

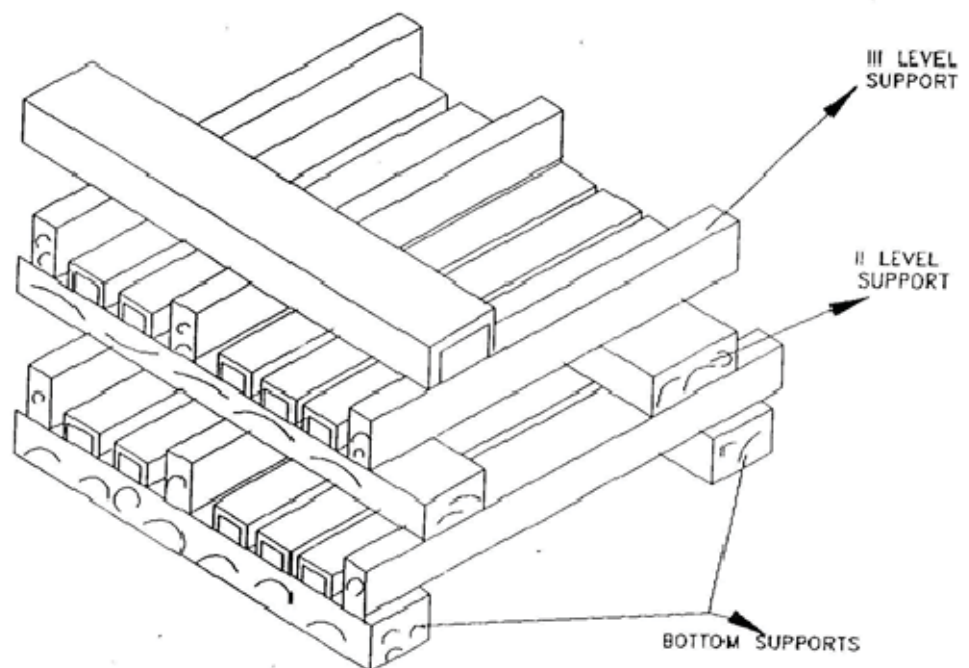


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT



5X800 MW YADADRI TPS

VENTILATION SYSTEM

SPECIFICATION No: PE-TS-417-554-A001

SECTION: II

REV. 00

DATE: APRIL 2020

SECTION II



5X800 MW YADADRI TPS

VENTILATION SYSTEM
INSPECTION AND TESTING

SPECIFICATION No: PE-TS-417-554-A001

SECTION : II

SUB-SECTION : 1

REV 00

DATE: APRIL 2020

SHEET 1

SECTION-II

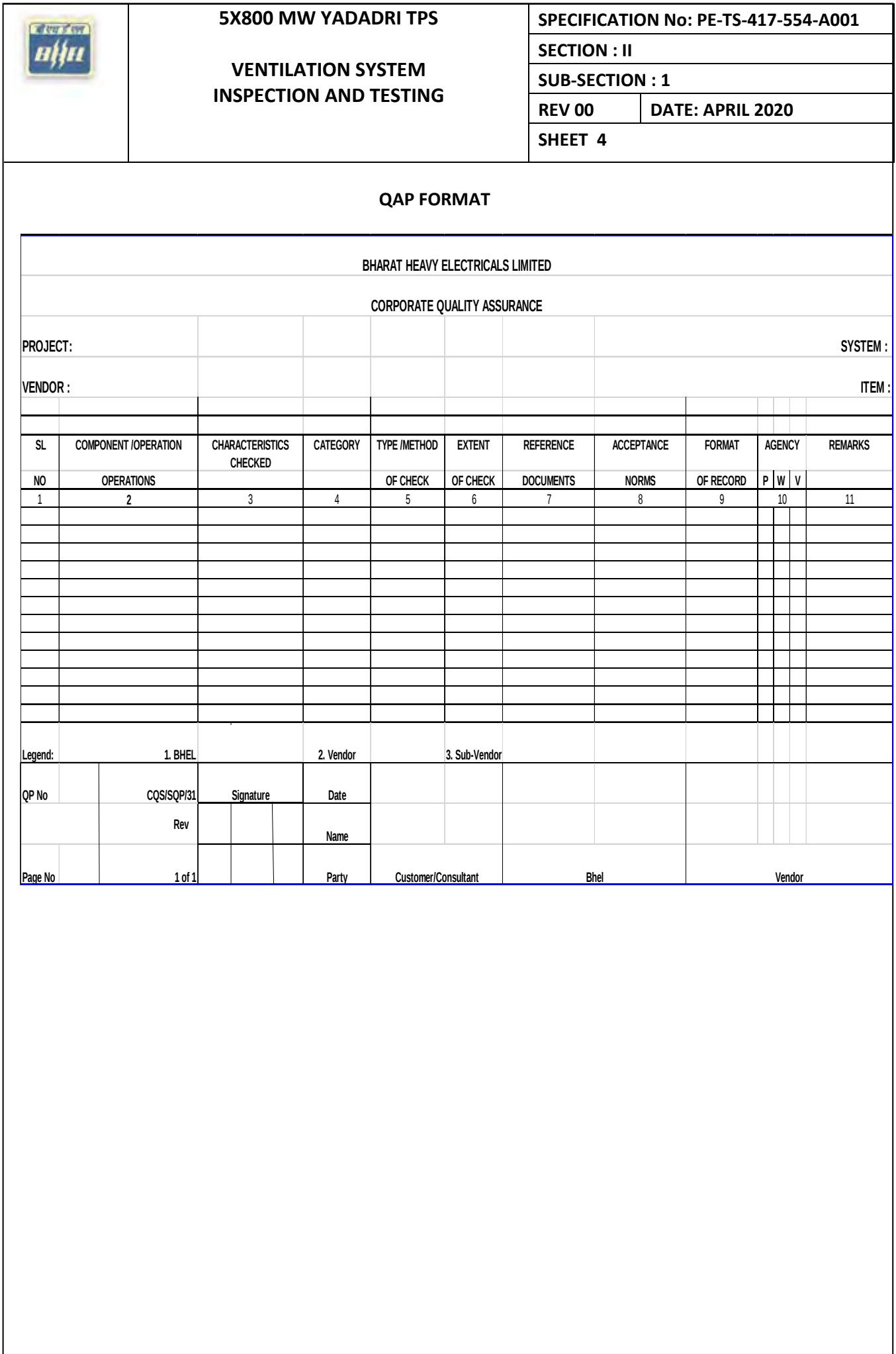
SUB-SECTION-1

INSPECTION AND TESTING

Note: For additional inspection, testing and quality related clauses refer Section-I, Sub-Section-C2B

	5X800 MW YADADRI TPS VENTILATION SYSTEM INSPECTION AND TESTING	SPECIFICATION No: PE-TS-417-554-A001	
		SECTION : II	
		SUB-SECTION : 1	
		REV 00	DATE: APRIL 2020
		SHEET 2	
1.01.00	Inspection and Tests during Manufacture.		
1.01.01	The method and techniques to be used by the Bidder for the control of quality during manufacture of all plant and equipment shall be agreed with the Owner.		
1.01.02	The Owner’s general requirements with respect to quality control and the required shop tests are set out elsewhere in this specification.		
1.01.03	Before any item of plant or equipment leaves its place of manufacture the Owner shall be given the option of witnessing inspections and tests for compliance with the specification and related standards.		
1.01.04	Advance notice shall be given to the Owner as agreed in the Contract, prior to the stage of manufacture being reached, and the piece of plant must be held at this stage until the Owner has inspected the piece, or has advised in writing that inspection is waived. If having consulted the Owner and given reasonable notice in writing of the date on which the piece of plant will be available for inspection, the Owner does not attend the Bidder may proceed with manufacture having forwarded to the Owner duly certified copies of his own inspection and test results. The owner’s representative shall have at all reasonable times access to bidder’s or his sub-vendor’s premises and shall have power to inspect/ examine materials and workmanship or equipment under manufacture. The Bidder shall forthwith forward to the engineer duly certified copies of the Test Certificates in six copies (one to the Purchaser and five to the Consulting Engineer) for approval. Further nine (9) copies of Shop Test Certificates shall be bound with Instruction Manuals referred to elsewhere. For electrical equipment, routine tests as per relevant IS spec are to be carried out on all equipment. Type tests are also to be carried out on selected equipment as detailed in the specs of concerned electrical equipment.		
1.01.05	Under no circumstances any repair or welding of castings be carried out without the consent of the Engineer. Proof of the effectiveness of each repair by radiographic and/or other non-destructive testing technique, shall be provided to the Engineer.		
1.01.06	All the individual and assembled rotating parts shall be statically and dynamically balanced in the works. Where accurate alignment is necessary for component parts of machinery normally assembled on site, the Bidder shall allow for trial assembly prior to despatch from place of manufacture.		
1.01.07	All materials used for the manufacture of equipment covered under this specification shall be of tested quality. Relevant test certificates shall be made available to the Purchaser. The certificates shall include tests for mechanical properties and chemical analysis of representative material. Equipment or parts coming under any statutory		

	5X800 MW YADADRI TPS VENTILATION SYSTEM INSPECTION AND TESTING		SPECIFICATION No: PE-TS-417-554-A001	
			SECTION : II	
			SUB-SECTION : 1	
			REV 00	DATE: APRIL 2020
			SHEET 3	
Regulations shall be certified by a Competent Authority under the regulations in the specified format. 1.01.08 All pressure parts connected to pumping main shall be subjected to hydraulic testing at a pressure of 150% of shut-off head for a period not less than one hour. Other parts shall be tested for one and half times the maximum operating pressure, for a period not less than one hour. 1.01.09 All necessary non-destructive examinations shall be performed to meet the applicable code requirements. 1.01.10 All welding procedures adopted for performing welding work shall be qualified in accordance with the requirements of Section-IX of ASME code or IBR as applicable. All welded joints for pressure parts shall be tested by liquid penetrant examination according to the method outlined in ASME Boiler and Pressure Vessel code. Radiography, magnetic particle examination magnuflux and ultrasonic testing shall be employed wherever necessary/ recommended by the applicable code. At least 10% of all major but welding joints shall be radiographed unless otherwise stipulated. Statutory payments in respect of IBR approvals including inspection shall be made by the bidder. Bidder’s scope shall include to preparation of all necessary documents, co-ordination and follow-up for above approval. Owner shall only forward assistance/endorsement of documents /design /drawings /reports/records to be submitted for approval as stipulated/ required by Statutory Authorities till registration of the unit and clearance for commercial operation. 1.02.00 Performance Tests at Site 1.02.01 The full requirements for testing the system shall be agreed between the Owner and the Bidder prior to Award of Contract. The completely erected System shall be tested by the Bidder on site under normal operating conditions. The Bidder shall also ensure the correct performance of the System under abnormal conditions, i.e. the correct working of the various emergency and safety devices, interlocks, etc. 1.02.02 The Bidder shall provide complete details of his normal procedures for testing, for the quality of erection and for the performance of the erected plant. These tests shall include site pressure test on all erected pipe work to demonstrate the quality of the piping and the adequacy of joints made at site. 1.02.03 The Bidder shall furnish the quality procedures to be adopted for assuring quality from the receipt of material at site, during storage, erection, pre-commissioning to tests on completion and commissioning of the complete system/equipment. 1.03.00 For details of specific tests required on individual equipment refer to respective section of this specification. All Statutory testing / clearance is in Bidder’s scope including payment of all fees, etc. as required				



	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
		PROJECT:		PO NO.:	DATE:
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II	SHEET 1 of 2

S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	C/ N				D	M	C	N	
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	-	MFG. SPEC.	MFG. SPEC.	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	VISUAL	100%	-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	LOG BOOK		P	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MFG.SPEC./	MFG.SPEC.	LOG BOOK		P	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	-	MFG. SPEC/ APPROVED DATASHEET	MFG. SPEC/ APPROVED DATASHEET	LOG BOOK	✓	P	V	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST	MA	VISUAL	100%	-	IS-325 / IS-12615/ APPROVED DATA SHEET	IS-325 / IS-12615/ APPROVED DATA SHEET	TEST/ INSPN. REPORT	✓	P	V*	-	* NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	-	APPROVED DRG/ DATA SHEET	APPROVED DRG/ DATA SHEET	TEST/ INSPN. REPORT	✓	P	V*	-	* NOTE -1 & NOTE-2

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	Sign & Date	Name		Sign & Date	Name
Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		RITESH KUMAR JAISWAL

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Seal	

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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO :		DATE:
			CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02		DATE: 17.04.2020
			PROJECT:		PO NO.:		DATE:
			ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II		SHEET 2 of 2

		3.NAMEPLATE DETAILS	MA	VISUAL	100%	-	IS-325 / IS-12615 / APPROVED DATA SHEET	SAME AS COL. 7	TEST/ INSPN. REPORT	✓	P	V	-	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MFG. STANDARD / (#)	AS PER MFG. STANDARD / (#).	INSPC. REPORT	✓	P	W	-	(#) REFER NOTE-8

NOTES:

1. Routine tests on 100% motors shall be done by the vendor. However, BHEL/ Customer shall witness routine tests on random samples. The sampling plan shall be mutually agreed upon.
2. For exhaust/ventilation fan motors of rating up to 1.5 KW, only routine test certificates shall be furnished for scrutiny.
3. In case test certificates for these tests on similar type, size and design of motor from independent laboratory are available, the same is valid for 5 years.
4. BHEL reserves the right to perform repeat test, if required.
5. After packing and prior to issue MDCC, photographs of items to be despatched shall be sent to BHEL for review.
6. In case of any changes in QP commented by customer at contract stage, same shall be carried out by bidder without any implication to BHEL/ Customer.
7. Project specific QP to be developed based on customer requirement.
8. For export job, BHEL technical specification for seaworthy packing to be followed.
9. Packing shall be suitable for storage at site in tropical climate conditions.
10. Latest revision/ year of issue of all the standards (IS/ ASME/ IEC etc.) indicated in QP shall be referred.

LEGENDS:

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

** **M:** SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **B:** MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C:** CUSTOMER,

P: PERFORM, **W:** WITNESS, **V:** VERIFICATION, AS APPROPRIATE

MA: MAJOR, **MI:** MINOR, **CR:** CRITICAL

D: DOCUMENTATION

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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO. :		DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 1 OF 9	

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY		
1	2	3	4	5	6		7	8	9	*	**		
					M	C/N				D	M	C	N
1.0	RAW MATERIAL & BOUGHT OUT CONTROL												
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	-		FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	P	-	-
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	LOG BOOK		P	-	-
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	SAMPLE	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TEST REPORT		P/V	-	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%	-		FREE FROM CRACKS, UN-EVENNESS ETC.	TEST REPORT		P	-	-
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TC		P/V	-	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%	-	MANUFACTURER'S DRG./SPEC	FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK		P/V	-	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TC		P/V	-	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG.	MANUFACTURER'S DRG.	LOG BOOK		P/V	-	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	LOG BOOK		P/V	-	

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Seal	

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		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	SECTION: II	SHEET 2 OF 9

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S DRG./ STD.	TC		P/V	-		
		3. DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S DRG.	LOG BOOK		P/V	-		
		4.INTERNAL FLAWS	CR	ULTRASONIC TEST	100%	-	ASTM-A388	MANUFACTURER'S STD.	INSPECTION REPORT	✓	P/W	V	-	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNec-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	100%	-	MANUFACTURER'S DRG./STD.	MANUFACTURER'S DRG./STD.	INSPECTION REPORT		P/V	-	-	
		2. PHYSICAL COND.	MA	VISUAL	100%	-	MANUFACTURER'S DRG./STD.	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	INSPECTION REPORT		P/V	-	-	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG./ STD	MANUFACTURER'S DRG. / STD.	INSPECTION REPORT		P/V	-	-	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-	MANUFACTURER'S DRG./ STD	MANUFACTURER'S DRG. / STD.	TEST REPORT		P/V	-	-	

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		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 3 OF 9	

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	-	NO VISUAL DEFECTS	TEST REPORT		P/V	-	-	
		2.DIMENSION/BORE DIA, WALL THICKNESS, BDV AS RECEIVED, BDV AFTER FOLDING AT 180°	MA	TEST	SAMPLE	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK AND OR SUPPLIER'S TC		P/V	-	-	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK		P	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG. .	MANUFACTURER'S DRG.	LOG BOOK		P/V	-	-	
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	SAMPLE	-	MANUFACTURER'S DRG./ STD.	MANUFACTURER'S DRG./ STD.	TC		P/V	-	-	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		*P/V	-	-	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY
		2.ELECT. PROP. & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S / SPEC.	TC & VENDOR'S TEST REPORTS		P/V	-	-	

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Seal	

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		PROJECT:		PO NO.:		
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SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	SAMPLES	-	MANUFACTURER'S DRG / SPEC.	MANUFACTURER'S / SPEC.	LOG BOOK		P/V	-	-	
		1.MAKE & TYPE	MA	VISUAL	100%	-	MANUFACTURER'S DRG./ APPROVED DATASHEET	MANUFACTURER'S DRG./ APPROVED DATASHEET			P/V	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	APPROVED DATASHEET	APPROVED DATASHEET/ BEARING MANUF'S CATALOGUES	LOG BOOK		P/V	-	-	
		3.SURFACE FINISH	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P/V	-	-	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	SAMPLE	-	MANUFACTURER'S STD./ APPROVED DATASHEET	MANUFACTURER'S STD./ APPROVED DATASHEET	LOG BOOK		P/V	-	-	
		4.HV/IR	MA	-DO-	100%	-	MANUFACTURER'S STD./ APPROVED DATASHEET	MANUFACTURER'S STD./ APPROVED DATASHEET	LOG BOOK		P/V	-	-	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	-	MANUFACTURER'S DRG/SPECS	MANUFACTURER'S DRG / SPECS.	LOG BOOK		P	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	

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SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
2.0	IN PROCESS													
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNES	MA	VISUAL	100%	-	MANUFACTURER'S DRG	GOOD FINISH	LOG BOOK		P/W	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-	-DO-	GOOD FINISH	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	100%	-	MANUFACTURER'S STD./ ASTM-E165	MANUFACTURER'S STD./ APPROVED DATASHEET.	LOG BOOK	✓	P	V	-	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		3.SHADE	MA	VISUAL	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	

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SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK		P	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK		P	-	-	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		2.CLEANLINESS	CR	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	100%	-	IS-325//IS-12615//IEC-60034 PART-1	IS-325//IS-12615//IEC-60034 PART-1	TEST/INSPC. REPORT	✓	P	V	-	
		4.RESISTANCE	CR	ELECT. TEST	100%	-	IS-325//IS-12615//IEC-60034 PART-1	IS-325//IS-12615//IEC-60034 PART-1	TEST/INSPC. REPORT	✓	P	V	-	
		5.INTERTURN INSULATION	CR	ELECT. TEST	100%	-	IS-325//IS-12615//IEC-60034 PART-1	IS-325//IS-12615//IEC-60034 PART-1	TEST/INSPC. REPORT		P	-	-	
2.6	IMPREGNATION	1.VISCOSITY	MA	PHY. TEST	AT STARTING	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		3.NO. OF DIPS	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK	✓	P	V	-	THREE DIPS TO BE GIVEN

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1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION 1.COMPACTNESS & CLEANLINESS	MA MA	PROCESS CHECK VISUAL	CONTINUOUS 100%	- -	MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD	LOG BOOK LOG BOOK	✓ 	P P	V -	- -	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	VISUAL	100%	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	100%	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	TEST/INSPC. REPORT	✓	P	V	-	
		3.HV	MA	ELECT. TEST	100%	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	TEST/INSPC. REPORT	✓	P	V	-	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	100%	-	MANUFACTURER'S SPEC./ ISO 1940	MANUFACTURER'S DWG.	LOG BOOK		P	-	-	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	TEST/INSPC. REPORT	✓	P	V	-	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		2.WORKMANSHIP	MA	VISUAL	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		3.AXIAL PLAY	MA	MEAS.	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK	✓	P	V	-	
		4.DIMENSIONS	MA	MEAS.	100%	-	MANUFACTURER'S DRG./ MANUFACTURER'S SPEC.	MANUFACTURER'S DRG./ MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK	✓	P	V	-	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :		DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:		SECTION: II

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	.	**			
					M	C/N				D	M	C	N	
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS	MA	ELECT.TEST	1/TYPE/SIZE	1/TYPE/SIZE	IS-325//IS-12615/APPROVED DATASHEET	IS-325//IS-12615/APPROVED DATASHEET	TEST REPORT	✓	P	W*	-	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST	MA	ELECT.TEST	100%	-	IS-325//IS-12615/APPROVED DATASHEET	IS-325//IS-12615/APPROVED DATASHEET	TEST REPORT	✓	P	V [§]	-	§ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	ELECT.TEST	100%	-	IS: 12075 / IEC 60034-14 & IS-12065	IS: 12075 / IEC 60034-14 & IS-12065	TEST REPORT	✓	P	V [§]	-	§ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET &	TEST/INSPC. REPORT	✓	P	W	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	-	IEC 60034-5//IS-12615	APPROVED DATASHEET	TC	✓	P	V	-	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	ELECT. & MECH. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1//IS: 12802	IS-325//IS-12615/IEC-60034 PART-1//IS: 12802	TC	✓	P	V [§]	-	§ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	ELECT. & MECH. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1	IS-325//IS-12615/IEC-60034 PART-1	TC	✓	P	V [§]	-	§ NOTE - 2
		8. NAME PLATE DETAILS	MA	VISUAL	100%	-	IS-325//IS-12615& DATA SHEET	IS-325//IS-12615 & DATA SHEET	TEST/INSPC. REPORT	✓	P	V [§]	-	§ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	-	IS 2148 / IEC 60079-1	IS 2148 / IEC 60079-1	TC	✓	P	V	-	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	SAMPLE	APPROVED DATASHEET	APPROVED DATASHEET	TC	✓	P	W [§]	-	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY § NOTE - 2

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :		DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	SECTION: II	SHEET 9 OF 9

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MANUFACT. STANDARD / (#)	AS PER MANUFACT. STANDARD / (#)	INSPC. REPORT	✓	P	W	-	(#): REFER NOTE-8

NOTES:

- 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.
- 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL/CUSTOMER SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.
- 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THE SAME IS VALID FOR 5 YEARS.
- 4 BHEL RESERVES THE RIGHT TO PERFORM REPEAT TEST, IF REQUIRED.
- 5 AFTER PACKING AND PRIOR TO ISSUE MDCC, PHOTOGRAPHS OF ITEMS TO BE DESPATCHED SHALL BE SENT TO BHEL PURCHASE GROUP FOR REVIEW.
- 6 IN CASE , ANY CHANGES IN QP COMMENTED BY CUSTOMER AT CONTRACT STAGE SHALL BE CARRIED OUT BY BIDDER WITHOUT ANY IMPLICATION TO BHEL/ CUSTOMER.
- 7 PROJECT SPECIFIC QP TO BE DEVELOPED BASED ON CUSTOMER REQUIREMENT.
- 8 FOR EXPORT JOB, BHEL TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING TO BE FOLLOWED.
- 9 PACKING SHALL BE SUITABLE FOR STORAGE AT SITE IN TROPICAL CLIMATE CONDITIONS.
- 10 LATEST REVISION/ YEAR OF ISSUE OF ALL THE STANDARDS (IS/ ASME/ IEC ETC.) INDICATED IN QP SHALL BE REFERRED.

LEGENDS:

*RECORDS, IDENTIFIED WITH "TICK"(\) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
**** M:** SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **B:** MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C:** CUSTOMER,
P: PERFORM, **W:** WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI:** MINOR, **CR:** CRITICAL
D: DOCUMENT

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	5X800 MW YADADRI TPS VENTILATION SYSTEM LIST OF DOCUMENTS TO BE SUBMITTED WITH BID	SPECIFICATION No: PE-TS-417-554-A001	
		SECTION : II	
		SUB-SECTION : 2	
		REV: 00	DATE: APRIL 2020
		SHEET 1 OF 1	

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

1. Compliance cum confirmation certificate
2. Guaranteed power consumption format (In the format attached in the specification) declaring guaranteed power consumption value in KW.
3. Un priced format for main package (mentioning quoted against each item)
4. Un priced format for mandatory spare (mentioning quoted against each item)
5. Un priced format for Tools and Tackles (mentioning quoted against each item)
6. Un priced format for Commissioning spare (mentioning quoted against each item)
7. Complete set of technical specification
8. No deviation certificate



5X800 MW YADADRI TPS

SPECIFICATION No: PE-TS-417-554-A001

SECTION : II

VENTILATION SYSTEM

SUB-SECTION : 3

**COMPLIANCE CUM CONFIRMATION
CERTIFICATE**

REV. NO. 00

DATE: APRIL 2020

SHEET: 1 OF 2

COMPLIANCE CUM CONFIRMATION CERTIFICATE

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

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions, other than those mentioned under "exclusion and those resolved as per 'Schedule of Deviations', with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL / CUSTOMER approval & customer hold points for inspection / testing shall be marked in the QP at the contract stage. Inspection / testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This is within the contracted price without any extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets / calculations etc. submitted along with the offer shall not be taken cognizance off.
- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified / intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre-bid discussions, otherwise BHEL / Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

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

- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- g) All sub vendors shall be subject to BHEL / CUSTOMER approval in the event of order.
- h) Guarantee for plant/equipment shall be as per relevant clause of GCC / SCC / Other Commercial Terms & Conditions
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities within the scope of work as tender specification. This clause will apply in case during site commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account

	5X800 MW YADADRI TPS VENTILATION SYSTEM COMPLIANCE CUM CONFIRMATION CERTIFICATE	SPECIFICATION No: PE-TS-417-554-A001	
		SECTION : II	
		SUB-SECTION : 3	
		REV. NO. 00	DATE: APRIL 2018
		SHEET: 2 OF 2	

j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL’s / Customer’s / Consultant’s office for across the table resolution of issues and to get documents approved in the stipulated time.

k) As built drawings shall be submitted as and when required during the project execution.

l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.

m) 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.

n) 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.

o) 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.



5X800 MW YADADRI TPS

VENTILATION SYSTEM
PRE-BID CLARIFICATION SCHEDULE

SPECIFICATION No: PE-TS-417-554-A001

SECTION : II

SUB-SECTION : 4

REV. NO. 00

DATE: APRIL 2020

SHEET: 1 OF 1

PRE-BID CLARIFICATION SCHEDULE

S. NO.	SECTION/CLAUSE/PAGE NO.	STATEMENT OF THE REFERRED CLAUSE	CLARIFICATION REQUIRED

The bidder hereby clarifies that above mentioned are the only clarifications required on the technical specification for the subject package.

Signature: _____

Name: _____

Designation: _____

Company: _____

Date: _____

Company Seal



5X800 MW YADADRI TPS

NO DEVIATION CERTIFICATE

SPECIFICATION No: PE-TS-417-554-A001

SECTION : II

SUB-SECTION : 5

REV: 00

DATE: APRIL 2020

SHEET 1

NO DEVIATION CERTIFICATE

Refer GCC, For Format of Deviation sheet (Cost of withdrawal)



5X800 MW YADADRI TPS

NO DEVIATION CERTIFICATE

SPECIFICATION No: PE-TS-417-554-A001

SECTION : II

SUB-SECTION : 5

REV: 00

DATE: APRIL 2018

SHEET 2

FORMAT FOR NO DEVIATION CERTIFICATE

(To be submitted in the bidder's letter head)

BHARAT HEAVY ELECTRICALS LIMITED,
Power Sector – Project Engineering Management,
PPEI Building, Plot No. 25, sector-16A
Noida -201301(U.P)

Sub	No Deviation Certificate	
	Design, engineering, manufacturing, supply, erection, commissioning etc of Ventilation System for Yadadri 5 x 800 MW TPS	
Ref	01	Tender No.
	02	BHEL 's NIT, vide reference no.
	03	BHEL's clarification / confirmation vide reference email dated
	04	Other reference (if any)/

Dear Sirs,

With reference to above, this is to confirm that as per tender conditions, we have visited site before submission of our offer and noted the job content & site conditions etc. We also confirm that we have not changed / modified the tender documents as appeared in the web site / issued by you and in case of such observance at any stage, it shall be treated as null and void.

We hereby confirm that we have not taken any deviation from tender clauses together with offer references as enumerated in the above referred NIT (besides the confirmations given at Sl. No. 03 under Ref.). We hereby confirm our unqualified acceptance to all terms & conditions, unqualified compliance to technical specification and acceptance to reverse auctioning process.

In the event of observance of any deviation in any part of our offer at a later date whether implicit or explicit, the deviations shall stand null & void.

We confirm to have submitted offer in accordance with tender instructions and as per aforesaid references.

Thanking you,

Yours faithfully,

(Signature, date & seal of authorized representative of the bidder)



5X800 MW YADADRI TPS

VENTILATION SYSTEM

SPECIFICATION No: PE-TS-417-554-A001

SECTION : II

SUB-SECTION : 6

REV 00

DATE: APRIL 2020

SHEET

SECTION-II

SUB-SECTION-6

GPC ANNEXURE-

GUARANTEE POWER CONSUMPTION

5 X 800 MW YADADRI TPS
VENTILATION SYSTEM
GPC ANNEXURE-GUARANTEED POWER CONSUMPTION FIGURES

S.NO. (1)	DESCRIPTION (2)	QUANTITY (WORKING) (3)	QUANTITY (STAND-BY) (4)	Total Guaranteed Power Consumption for Each Equipment at motor input terminal and control panel (5)	TOTAL POWER CONSUMPTION AS GUARANTEED (KW) (6) = (3)*(5)
1	Centrifugal fans for Air washer of power house (Stage I & II)	40	0		
2	Centrifugal pumps for above air washer fans of power house (Stage I & II)	20	20		
3	Centrifugal Fan for UAF for ESP buildings	5	0		
4	Centrifugal pumps for above UAF of ESP buildings	5	5		
5	Centrifugal Fan for UAF for FGD building (Stage I & II)	2	0		
6	Centrifugal pumps for above UAF for FGD building (Stage I & II)	2	2		
7	RE Units for Power house (Stage I & II)	75	0		
				TOTAL (KW)	

Note:

- 1 Base figure of aux power consumption as per above criterion for Ventilation System (for working drives only) shall be 3266 kW.
- 2 Bidder's guaranteed power consumption at motor input terminals (not shaft power) as furnished in guaranteed schedule shall be demonstrated by the successful bidder during performance testing at works/site.
- 3 The prices quoted by the bidders shall be loaded @ Rs. 2,00,000/- for each one KW increase in consumption from the base figure indicated at Note no 1 above during bid evaluation stage.
- 4 During actual performance testing at the manufacturing works / site, in case power consumption is noted higher than bidder's quoted guarantee power consumption, then penalty @ Rs. 2,00,000/- per KW shall be levied on the bidder for the increase in power consumption with respect to "higher of the base figure indicated at note no 1 above and bidders quoted guarantee power consumption".
- 5 The power consumption indicated above shall be proportionately considered for per unit basis auxiliary power consumption.



5X800 MW YADADRI TPS

VENTILATION SYSTEM

SPECIFICATION No: PE-TS-417-554-A001

SECTION : II

SUB-SECTION : 7

REV 00

DATE: APRIL 2020

SHEET

SECTION-II

SUB-SECTION-7

**SUGGESTIVE PRICE FORMAT INCLUDING MANDATORY
SPARES.**

(refer price format sheet provided with the NIT)



5X800 MW YADADRI TPS

VENTILATION SYSTEM

SPECIFICATION No: PE-TS-417-554-A001

SECTION : II

SUB-SECTION : 8

REV 00

DATE: APRIL 2020

SHEET

SECTION-II

SUB-SECTION-8

INPUT DRAWINGS (ONLY FOR TENDER PURPOSE)



5X800 MW YADADRI TPS

VENTILATION SYSTEM

SPECIFICATION No: PE-TS-417-554-A001

SECTION : II

SUB-SECTION : 8

REV 00

DATE: APRIL 2020

SHEET

SL.NO.	DESCRIPTION	NO. OF SHEETS
1	TG BUILDING	
2	ESP CONTROL BUILDING	
3	FGD CONTROL BUILDING STAGE #1	
4	FGD CONTROL BUILDING STAGE#2	
5	PLOT PLAN	

GENERAL NOTES:

- 1) THE DUCTWORK/THE DUCTING ARRANGEMENT SHOWN IN THE DRAWINGS ARE MINIMUM REQUIREMENT. HOWEVER, THE ROUTING SHALL BE STRICTLY FOLLOWED. NO DEVIATION DURING POST BID STAGE SHALL BE ACCEPTABLE.
- 2) ONLY VENTILATION WALL OPENINGS FOR THE VENTILATION SYSTEM SHOWN IN THE DRAWINGS SHALL BE USED FOR THE ROUTING OF DUCT WORKS.
- 3) THE INPUT DRAWINGS FOR THE SWITCHYARD AREA BUILDINGS HAVE BEEN INCLUDED IN SECTION-I, SUB-SECTION-C1B
- 4) THE LOCATION OF THE AIR WASHER/UAF'S INDICATED IN THE DRAWINGS ARE FINAL AND SHALL NOT CHANGE DURING DETAIL ENGINEERING.