

TECHNICAL SPECIFICATION
CONDENSER ON LOAD TUBE CLEANING SYSTEM
(COLTCS)

TSGENCO
5X800 MW YADADRI TPS

TANGEDCO
2X660 MW UDANGUDI TPS

Specification No. : PE-TS- 417/435-165-N002 (REV. 01)



BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
PPEI BLDG., SEC-16A, PLOT NO. 25
NOIDA – 201301 (UP)



TITLE:
**TECHNICAL SPECIFICATION
COLTCS**
SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-417/435-165-N002**
SECTION:
SUB-SECTION:
REV. NO. **00** DATE 07.09.2018
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SECTION - I

SPECIFIC TECHNICAL REQUIREMENTS

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SUB-SECTION – IA

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)



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1.0 GENERAL

1.1 This enquiry covers the design, manufacture, assembly, inspection and testing at manufacturer's and / or his sub-contractors works, proper packing for delivery installation checks, commissioning, Trail run and PG test for Condenser On-line Tube Cleaning System (COLTCS) with mandatory spares complete with all accessories as per the requirements specified in this specification.

The Condenser On load Tube Cleaning Systems (COLTCS) complete with all accessories shall conform to the standard technical specifications (Section-II) and Data Sheet-A enclosed herewith. In addition, the requirements of this section I including customer specification attached (as applicable) shall also be complied with. However, wherever the details given in Section-II and Data Sheet-A are different, the requirements of Data Sheet-A shall prevail. Similarly in the event of contradictions between Section-I/ customer specification (as applicable) / Section-II/ Data Sheet-A, the same shall prevail in the order as: customer specification (as applicable), Section-I, Datasheet-A, Section-II. The decision of BHEL shall be final in case of any discrepancy.

Section I consists of 4 Sub-Sections viz. Sub-Sec. IA, IB and IC for Mechanical, Electrical and C&I respectively and Sub-Sec. ID for Datasheet-A, the requirements of all 4 sub-sections shall be complied with.

1.2 The omission/ addition of specific reference to any component / accessory necessary for the proper performance of the equipment's shall not relieve the supplier of the responsibility of providing such facilities to complete the supply within the quoted prices.

1.3 The bids for each project shall be evaluated as per NIT.

1.4 Bidder to quote for items as per price schedule attached in NIT.

2.0 DESCRIPTION OF EQUIPMENTS :

3.0 CONDENSER ON LOAD TUBE CLEANING SYSTEMS (COLTCS) :

The condenser on load tube cleaning system (COLTCS) is intended to prevent formation of various forms of fouling and scaling in the condenser tubes. The cooling water system is of closed circuit type with cooling towers or open circuit type as specified. The water analysis is indicated with Datasheet-A.

4.0 SCOPE OF SUPPLY UNDER THE SPECIFICATION IN THE BIDDER'S SCOPE FOR COLTCS.

4.1 The details of COLTCS with quantities, design parameters, size and MOC's as per Data Sheet-A.

4.2 SCOPE OF SUPPLY IN THE BIDDER'S SCOPE FOR COLTCS:

4.2.1 Each set of COLTCS shall comprise following:

- a) One No. Ball Separator at Condenser CW outlet pipe.
- b) One No. Ball recirculation pump with drive motor.
- c) One No. Ball collector.
- d) One No. Manual ball sorter (Bucket type sorter with sieves to manually sort out the undersized balls by shaking the sieved bucket manually) for each set of COLTCS.



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- e) Differential pressure measuring system for ball separator.

For Yadadri TPS -DP measuring system shall comprise of 3 nos. DPT for each COLTCS.

For Udangudi STPP- DP measuring system shall comprise of 2 nos. DPT +1 no. DPG for each COLTCS.

Instrument shall be with Remote seal arrangement. Stubs for DPT and DPG shall be independent.

- f) Ball monitoring system comprising an independent balls recirculation monitor and an independent balls oversize monitor. If bidder is not manufacturing Ball over size monitor then they can offer other alternatives like automatic ball sorter etc.

- g) Length of Ball separator, Scope of Counter Flange, Nuts, bolts and gaskets shall be as per Datasheet-A. Thickness of body flange and counter flange shall be as per Drg no PE-DG-999-141-MO17 enclosed at enclosures at Annexure-II of Datasheet-A.

- h) For Clarified water :- Complete Pipe work, including interconnection piping, flanges/counter flanges for valves & pipes, bends, fittings, distributors, nozzles and support installation materials shall be in Bidder's scope. Bidder shall finalize the pipework to suit the layout at contract stage in such a way that no site welding is required for his pipework otherwise the same shall be carried out by bidder at site.

For Sea water :- Complete Pipe work, including interconnection piping, flanges/counter flanges for pipes, bends, fittings, distributors, nozzles and support installation materials shall be in Purchaser's scope. **However, valves along with its Flanges/Counter Flanges/Gaskets/Nuts & Bolts shall be in Bidder's Scope.** Isometric Drawing along with BOM for interconnection piping, flanges/counter flanges for pipes, bends, fittings, distributors, nozzles and support installation materials in line with approved Installation Drawing to be submitted by the Bidder within 4 weeks after approval of the Installation Plan.

- i) The Electrical and C&I item / accessory as specified in succeeding clause/ respective sections herein.

- j) Power and Control cables between starter Panel (Switch Gear) and various drives in bidder's scope of supply.

- k) Starter Panel (Switch Gear Panel) shall be as follows:

For each Unit, each side of COLTCS system- Left & Right, shall be supplied with its separate local control cum starter /Switch Gear panel and its MIMIC and annunciator for its operation. Extent of MIMICs and annunciators shall be decided during detailed engg.

Switch Gear Panel should have suitable arrangement like Bus Coupler for providing redundancy to incoming supply feeder (1Working + 1 Standby feeder).

- l) Control cables between field instruments and Switch gear panel.

- m) All the field instruments stipulated in this specification shall be in Bidder's scope.

- n) Commissioning balls and other commissioning spares on "As required basis" and to be supplied at the time of commissioning of COTCS system.



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- o) Balls required for Performance Guarantee test on "As required basis" and to be supplied at the time of PG test of COLTCS system.
- p) Set of mandatory spares as indicated in Data Sheet A. Spare balls (if applicable) to be carried at the time of commissioning of COLTCS system.
- q) Supporting arrangement complete with saddle support, foundation plates, anchor bolts, nuts, sleeves, inserts, all installation materials, fixing bolts, clamps and other accessories etc. for complete equipment supplied under this package.
- r) Finish paints for touch up painting of equipment after erection at site, in sealed containers.
- s) Set of special tools and tackles if required for maintenance and erection of the equipment supplied.
- t) Various drawings, data test reports/ certificates instruction manuals for erection operation and maintenance etc. as specified in Data Sheet-C. and cables schedule indicating BOQ for power & control cables.
- u) Panels & Instruments: Scope and Type as specified in C&I section wherever required.

Any item not specified but required to make COLTCS a complete package shall also be in bidder's scope.

5.0 SCOPE OF SERVICES INCLUDED IN THE BIDDER'S SCOPE :

The bidder's scope also includes following services at site, for scope under this specification for COLTCS:

- a) Installation checks (Erection in BHEL's scope).
- b) Commissioning of equipment.
- c) Trial run for requisite period
- d) Performance Testing.

The trial run of equipment shall be generally conducted immediately after commissioning while PG testing shall be conducted at a later date. These activities for different units shall be timed separately.

• **For drawings/documents approval**

In the event of order all drawings / documents in soft as well as hard copy shall be submitted as per cl. 10.0 (b) below.

Further on receipt of Customer comments, if required bidder's engineer shall visit BHEL/ Customer along with soft copy to resolve all issues and incorporate comments in the soft copy for across the table finalization and Category-I approval.

• **Site Visits for Installation Check, Commissioning, Trial Run & PG Testing:**

Bidder to consider cost of two site visits for three days each for installation check / commissioning of COLTCS for each unit i.e for 2 nos of COLTCS system.

Bidder to consider cost of two site visits for twenty days each for trial run and PG Testing of COLTCS for each unit i.e for 2 nos of COLTCS system.



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In case of non-completion of above activities in site visits stipulated above, for any reasons not attributable to vendor, vendor shall complete above activities in subsequent site visits for which cost shall be borne by BHEL on pro-rata basis on price of site visit quoted by bidder in price schedule. BHEL Site Certification is mandatory for extra stay at site.

6.0 EXCLUSIONS :

The following are excluded from the bidder's scope.

- 6.1 Civil foundation works required for installation
- 6.2 Erection of Equipment at site.

7.0 DESIGN CONSTRUCTION :

In addition to the requirements of Section-D the following shall also be complied.

- 7.1 Layout Piping Arrangement Drg. is enclosed in the specifications at Annexure-III of Datasheet-A.
- 7.2 Thickness of body flange and counter flange of COLTCS shall be as per Drg no PE-DG-999-141-MO17 enclosed at enclosures at Annexure-II of Datasheet-A.
- 7.3 The materials of construction specified in Data Sheet-A are minimum requirements and materials of construction for other components not specified shall be similarly selected by the bidder for the intended duty which shall be subject to purchaser's approval during detailed engineering in the event of order.
- 7.4 Housing/ body of COLTCS shall be designed and manufactured as per the applicable codes for pressure vessels and to take care of force and moments as enclosed in the specification. However in no case thickness of housing/ body shall be less than connecting pipe thickness as specified in Data Sheet-A of COLTCS.
- 7.5 Cathodic Protection for COLTCS along with Sacrificial Anode shall be provided by the bidder in the equipment (applicable for Udangudi STTP).

Adequate provision for future installation of Cathodic Protection for COLTCS (Sacrificial type) shall be kept by the bidder in the equipment. (Applicable for Yadadri TPS).
- 7.6 Flow straightener for streamlining the CW flow in balls collecting strainer if required shall be supplied by the bidder along with mounting arrangement and the fixing details.
- 7.7 Velocity in the pipe work shall be less than 1.5 m/ sec for pump suction and less than 2.0 m/ sec. in other pipe work. All valves upto 150 NB shall be ball valves. For higher sizes, gate/ globe/ B.F. valves shall be provided. All instrument valves shall be needle valves.

8.0 Performance Guarantee and Bid Evaluation criteria for Condenser on Load Tube Cleaning System.

Performance Parameters to be guaranteed by bidders under demonstration category under compulsory corrections shall be as under:

- i) Percentage recovery of balls (min. 90% recovery for 1000 hrs of normal plant operation with 8 hrs Operation of COLTCS per day).



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ii) Life of Sponge Rubber Ball (Min. 3 weeks with 8 hrs operation of COLTCS per day).

iii) Max. Pressure drop in ball separator in clean condition (Test to be conducted along with commissioning) – not exceeding 0.2 MWC. The Bids shall be technically rejected for pressure drop quoted higher than 0.2 MWC.

Any deviation to above balls life, percentage recovery and pressure drop will not be accepted.

In case the successful bidder fails to demonstrate any of these parameters he shall carry out modifications at his own cost, to purchaser's approval.

In case bidder fails to demonstrate above parameters to purchaser's satisfaction even after modification carried by him at site, the purchaser has the right to reject the equipment out rightly.

9.0 SPARES :

9.1 Mandatory Spares

Mandatory Spares shall be as per Data Sheet-A or annexure enclosed with data sheet A.

10.0 Quality Plan

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 and 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. Charges for 3rd party inspection (TUV/ equivalent) for imported components wherever required shall be included by bidder in the base price itself. If BHEL or BHEL customer decides to witness the tests along with third party, the cost of travel of BHEL or BHEL customer shall be borne by BHEL or BHEL customer themselves.

11.0 DELIVERY & DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE:

a. Delivery of Equipment shall be as per NIT.

b. The drawings to be submitted by bidder in event of award of contract.

PACKAG E	BHEL DRG NO	DRG TITLE	Drg Sch for vendors
COLTCS	Primary Documents -		
	PE-V2-XXX-165-N001	P&ID OF COLTCS SYSTEM	R-0 within 20 days (for all except Installation plan, for Installation Plan 30
	PE-V2-XXX-165-N002	TECHNICAL DATA SHEET-COLTCS	
	PE-V2-XXX-165-N003	INSTALLATION PLAN-COLTCS	
	PE-V2-XXX-165-	GENERAL	



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N004	ARRANGEMENT OF BALL SEPERATOR	Days) from LOI/PO & subsequent revisions within 10 days of comments received from BHEL.
PE-V2- XXX -165-N005	DETAILS OF BR SKID,BALL INJECTION PIPE & FIXING DETAILS	
PE-V2- XXX -165-N006	C&I Part-I,PANEL-TDS, I/O LIST, CABLE SCH AND CONTROL PHILOSPHY FOR COLTCS	
PE-V2- XXX -165-N008	QP-COLTCS	
PE-V2- XXX -165-N007	C&I Part-II, GA & WIRING DIAGRAM OF PANEL-COLTCS	R-0 within 30 days from Cat-I(or)II approval of C&I Part-I document & subsequent revisions within 10 days of comments received from BHEL.
Secondary Documents -		
PE-V2- XXX -165-N009	O& M MANUAL -COLTCS	Within 30 days from MDCC

12.0 The makes of various bought out items shall be subjected to approval of Customer/ BHEL in the event of order.

13.0 It is mandatory for the bidders to submit along with the bid the deviations if any whether major or minor in the schedule of deviations only. ***In the absence of deviations listed in the schedule of deviations the offer shall be deemed to be in full conformity with the specification "non-withstanding" anything else stated elsewhere in bidder's offer, data sheets etc. The implied/ indirect deviations in data sheets etc. Shall not be binding on the purchaser.***

14.0 The following documents shall be furnished by the bidder with his offer :

- Compliance certificate duly signed and stamped (Enclosed at section-III).
- Guarantee schedule duly signed and stamped (Enclosed at section-III).
- GA drawings of following with empty/ filled-ups.
 - Balls Collecting Strainers (as applicable).
 - Balls recirculating Skids.
 - Other equipments considered necessary for Layout/ Civil.
- Electrical Load Data (Enclosed at section-1B of Specification)
- Schedule of Deviation (As per NIT format)

The bidder to note that load requirement furnished and finalised during tender stage shall only be provided by BHEL and any changes or additional requirement of Electrical load by bidder during contract stage shall be provided by BHEL with cost repercussions to the bidder.



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NOTE: Apart from above, no other drawing/ document/ data sheet etc. shall be submitted along with the offer. If any drawing/ document etc. is submitted with the offer, same shall be considered as for 'Reference' purpose only and shall not be reviewed/ commented upon and any deviation, exclusion to scope, etc. taken in documents but not highlighted in the deviation schedule shall not be taken cognizance of.

15.0 COLTCS packing procedure before dispatch

The purpose of this procedure is to outline the requirements and procedures for protecting the equipment's during shipment and preserving during the storage.

15.1 Preparation for Packing:

- After hydro testing, operation, all fluids e.g. water etc., shall be completely drained from all COLTCS's parts, and the equipment blown dry.
- All material shall be cleaned internally and externally to remove, scale, rust fillings and any other foreign material.
- The COLTCS shall be placed on a strong wooden base & bolted to the wooden base using the foundation holes for further transportation up to site.

15.2 Protection of parts:

- BALL SEPARATOR) shall be packed in properly in high grad bubble plastic wrap for transportation, and long storage at site.
- Actuators shall be packed in separate wooden box of proper sizes.
- COLTCS items (EXCEPT BALL SEPARATOR) shall be packed in proper sizes of wooden cases. High grade woods like Rubber woods, jungle wood, hard wood, mango wood, pine wood, etc. is used for packing.
- Loose material, & Electrical & Electronics items shall be packed in corrugated box and plastic bags with proper tagging and marking of handle with care in proper sizes of wooden cases
- All finished (or) machined (External C.S. Surfaces shall be protected against corrosion with corrosion resisting coating, which is easily removable (Compound shall be such that it will remain on the surface at temperature normally encountered during shipping & storage).
- All machined surfaces shall be protected from mechanical damage. All external unfinished carbon steel surfaces shall be sand blasted & shall be coated with rust preventive primer.
- Flanged opening if any shall be covered with blank flanges sealed with blank gasket of natural rubber or equivalent. Butt welded opening shall be closed with temporary closing covers. Internal threads shall be protected with metal plug sealed with Teflon tape (if applicable). External thread shall be protected with PVC sleeve.
- Wooden cases shall be covered with HDPE cloth from inside wooden box and the top. All the opening in COLTCS shall be closed properly by suitably covering to prevent foreign material entering in COLTCS.
- All fabricated wooden cases & crates conform to the requirement as per table given below:

Gross Weight	Board Thickness	Batton / Rafter
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[Kgs.]		Thickness
2000 to 9000	Min. 30 mm	Min. 35 mm
9000 to 18000	Min. 50 mm	Min. 35 mm

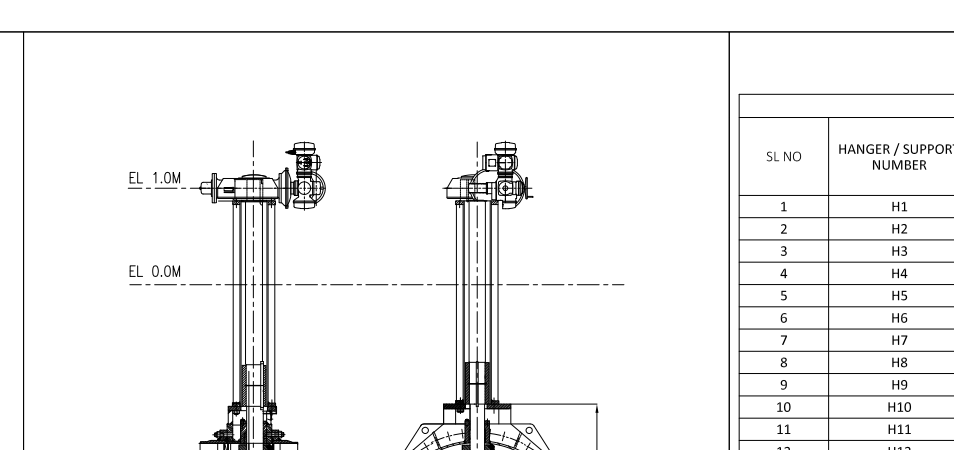
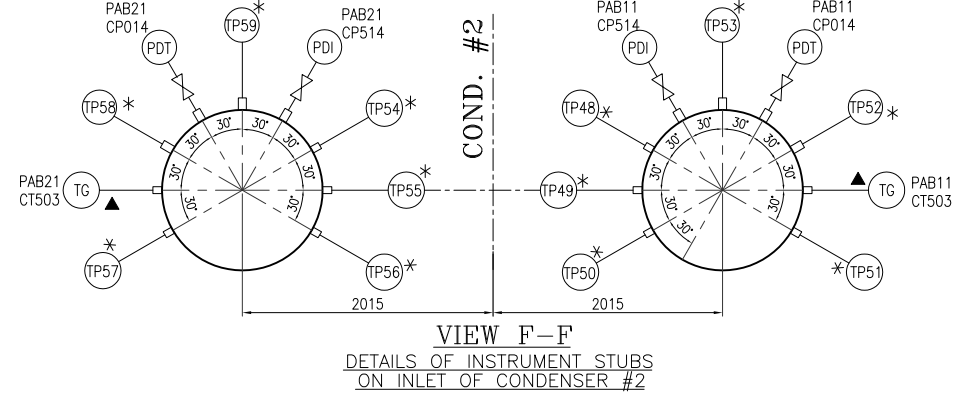
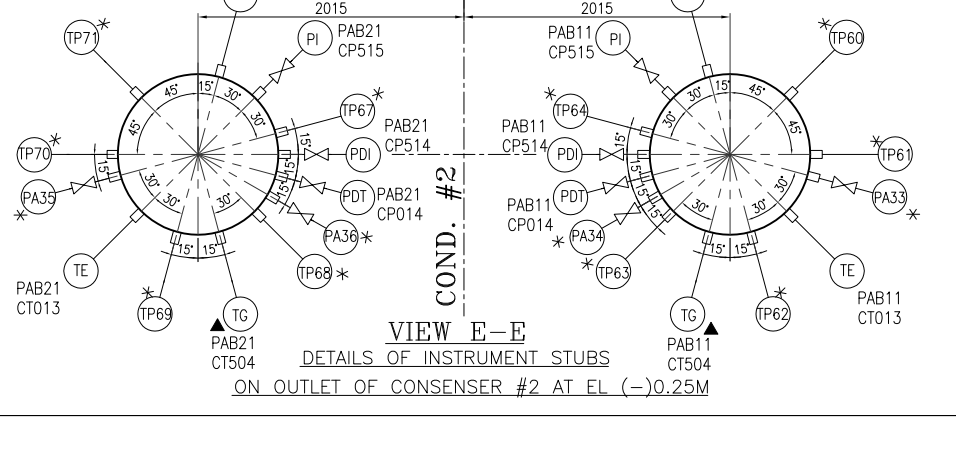
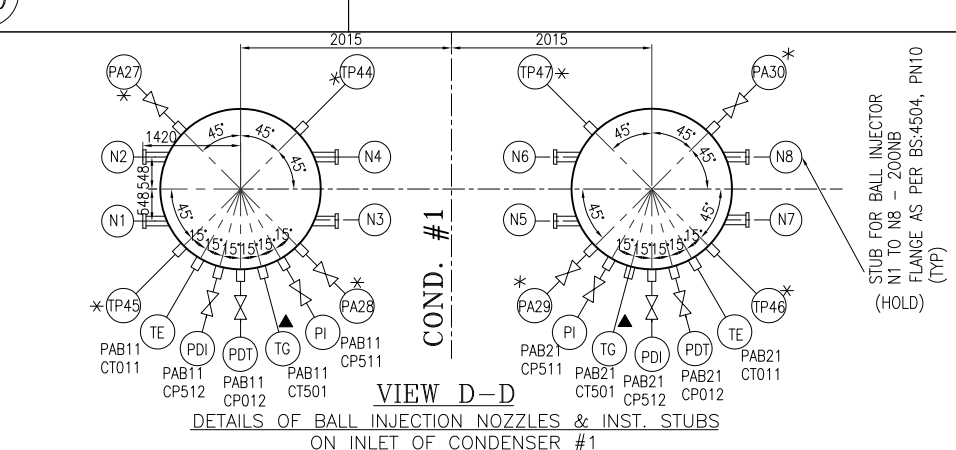
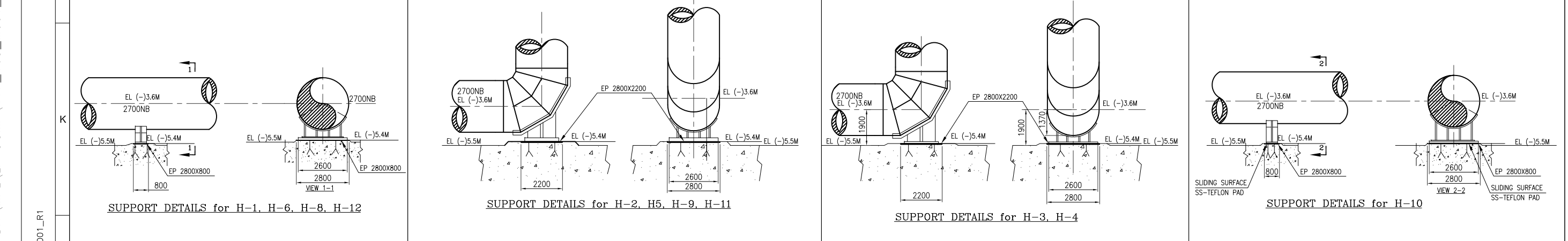
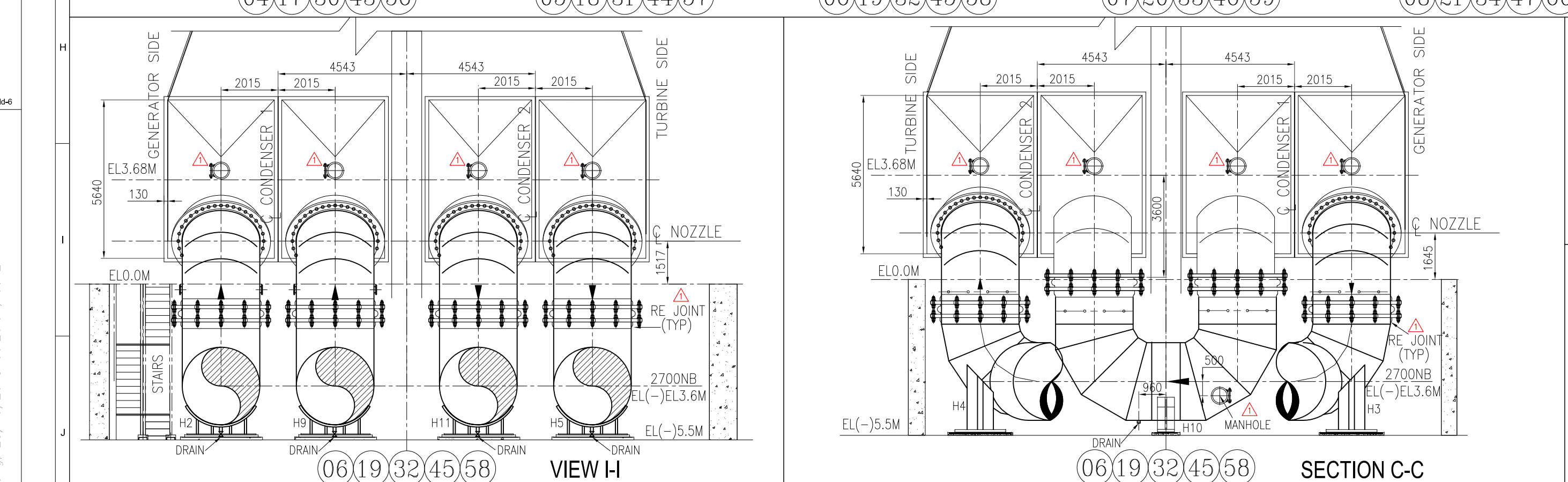
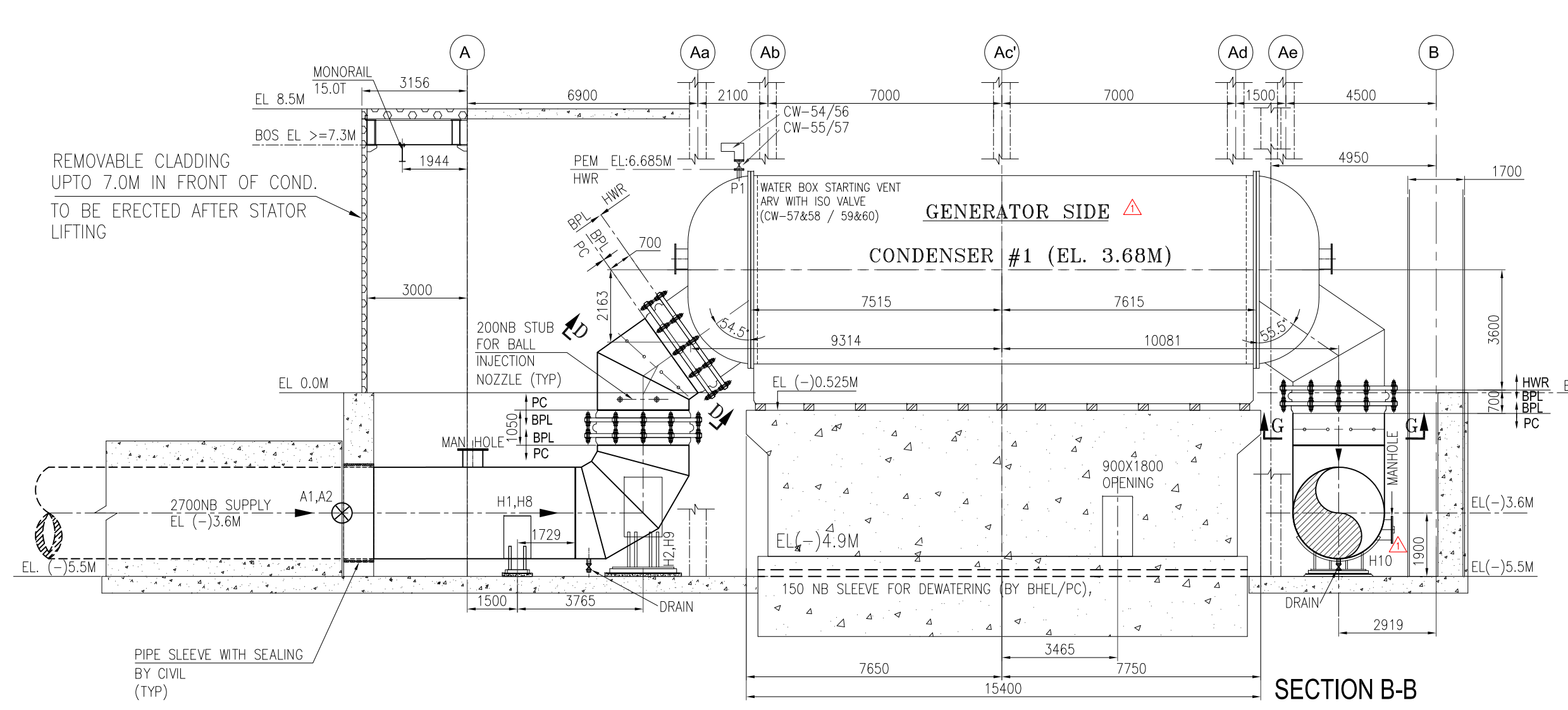
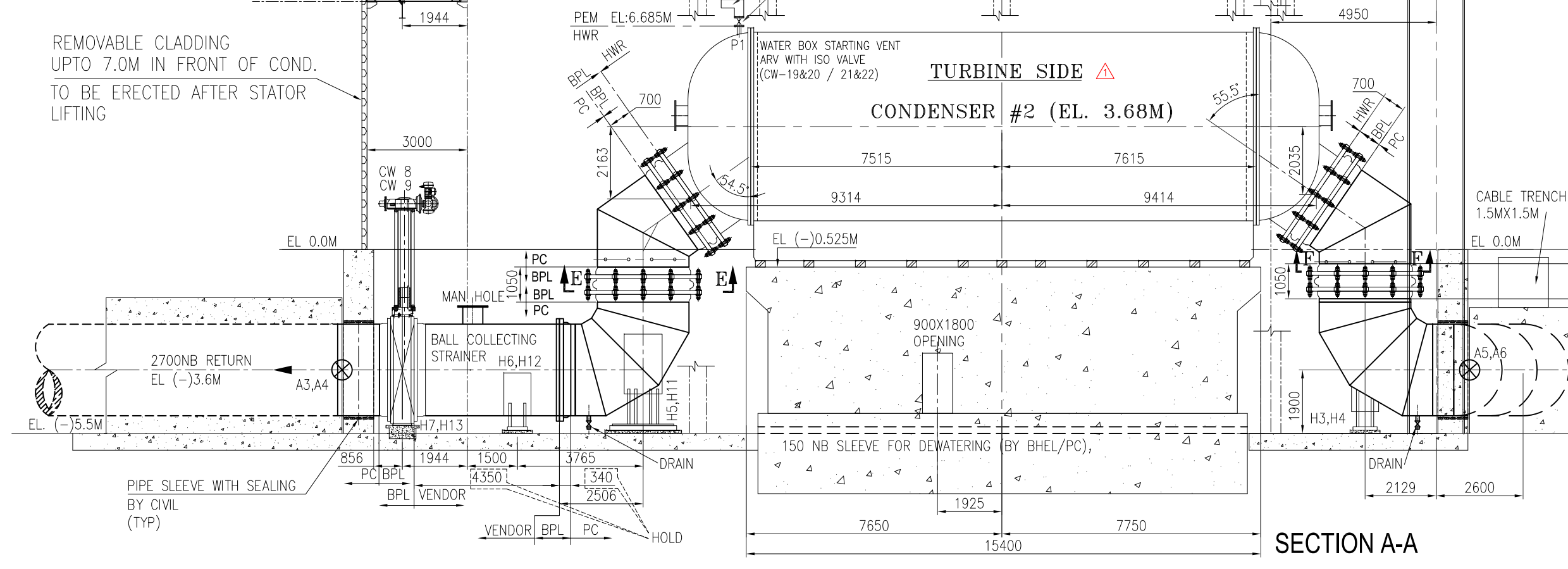
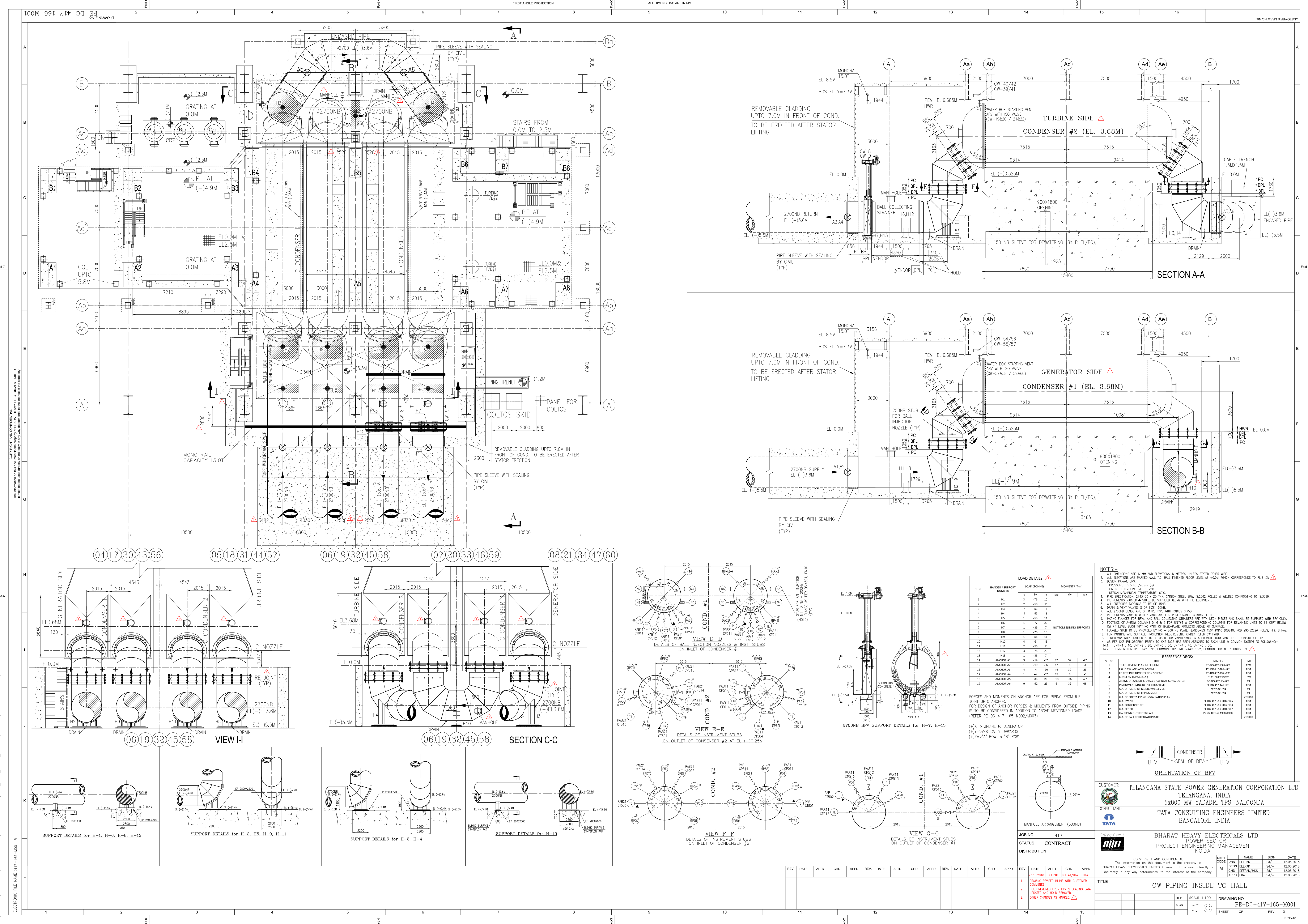
- All the equipment shall be protected for entire period of dispatch, storage and erection against corrosion, incidental damage due to vermin, sunlight, rain, high temperature, humid atmosphere, rough handling in transit and storage. All MS parts which are not painted shall be provided with coating of grease.
- Clay Desiccant or such other moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.

15.3 **Preservation**

The equipment's shall be stored under closed/open space in packed condition until installation. The packages containing loose items are to be protected from extreme climatic conditions.

15.4 **Photographs**

Bidder to take photographs of all parts like Ball separators, screen, pumps, piping, valves, instruments, actuators, panel (inside & outside) and sent to engineering deptt along with all inspection reports before final dispatch.



LOAD DETAILS			
SL NO	HANGER / SUPPORT NUMBER	LOAD (TONNES)	MOMENTS (t-m)
1	H1	3.78	30
2	H2	2.46	11
3	H3	7.20	4
4	H4	7.20	8
5	H5	1.06	11
6	H6	1.27	20
7	H7	1.26	7
8	H8	1.27	10
9	H9	1.56	11
10	H10	4.41	18
11	H11	2.46	11
12	H12	3.78	20
13	H13	1.26	7
14	ANCHOR A1	3.19	-37 17 32 -37
15	ANCHOR A2	1.19	-36 17 5 -4
16	ANCHOR A3	4.4	-46 14 39 28
17	ANCHOR A4	1.4	-47 15 8 5
18	ANCHOR A5	3.28	-38 -55 -77
19	ANCHOR A6	9.25	-41 32 68

SL NO	ITEM	NUMBER	UNIT
1	TG EQUIPMENT FLAT AT EL.0.0M	PE-00417-10-0001	PIST
2	PIPE SLOPE AND ANCHOR SYSTEM	PE-00417-10-0001	PIST
3	PIPE TEST INSTRUMENTATION SCHEME	PE-00417-10-0001	PIST
4	CONCRETE ANCHOR (A1-A6)	PE-00417-10-0001	PIST
5	PARALLEL OF 200NB FLANGE (CW NEAR COND. OUTLET)	PE-00417-10-0001	PIST
6	INSTRUMENT SUB DETAIL (PRESTRESS)	PE-00417-10-0001	PIST
7	ISA OF R.E. JOINT (CONC. W/NER-SS)	PE-00417-10-0001	PIST
8	ISA OF R.E. JOINT (PIPING SITE)	PE-00417-10-0001	PIST
9	ISA OF COUPLER PIPING INSTALLATION PLAN	PE-00417-10-0001	PIST
10	ISA CW RPT	PE-00417-10-0001	PIST
11	ISA CONDENSER RPT	PE-00417-10-0001	PIST
12	ISA CW RPT	PE-00417-10-0001	PIST
13	CW PIPING OUTSIDE TO HALL	PE-00417-10-0001	PIST
14	ISA OF BALL REGULATION TALL	PE-00417-10-0001	PIST

FORCES AND MOMENTS ON ANCHOR ARE FOR PIPING FROM R.E. JOINT UP TO ANCHOR. FOR DESIGN OF ANCHOR FORCES & MOMENTS FROM OUTSIDE PIPING IS TO BE CONSIDERED IN ADDITION TO ABOVE MENTIONED LOADS (REFER PE-DG-417-165-M002/M003)

(+)=>TOWARDS TO GENERATOR
(-)=>VERTICALLY UPWARDS
(+)=>"A" ROW TO "B" ROW

ORIENTATION OF BVF

MANHOLE ARRANGEMENT (600NB)

REV.	DATE	ALTD	CHD	APPO	REV.	DATE	ALTD	CHD	APPO	REV.	DATE	ALTD	CHD	APPO	REV.	DATE	ALTD	CHD	APPO
01	25.10.2018				02	25.10.2018				03	25.10.2018				04	25.10.2018			

DEPT.	SCALE	DRAWING NO.	SHEET	OF	REV.
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SUB-SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
COLTCS**

SPECIFICATION NO.

VOLUME NO. : II-B

SECTION : C

REV NO. : 00 DATE : 30/03/17

SHEET : 2 OF 3

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for COLTCS.
- 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 the general technical requirements for motor.
- i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

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

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

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



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
COLTCS**

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION : **C**

REV NO. : **00** DATE : 30/03/17

SHEET : 3 OF 3

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

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) General technical requirements for LV motors.
- c) Datasheet A & C.
- d) Quality plan for motors.
- e) Electrical Load data format (Annexure –II)
- f) BHEL cable listing format (Annexure –III)

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)**PACKAGES: COLTCS****SCOPE OF VENDOR: SUPPLY****PROJECT:**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC Starter cum control panel (if applicable)	BHEL Vendor	BHEL BHEL	415 V AC, 3 phase, 3 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 Vendor BHEL	BHEL BHEL 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. Cabling/ termination by BHEL.
4	Junction box for control & instrumentation cable	Vendor	BHEL	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	BHEL	Refer scope/ C&I portion of specification for scope of fibre Optical cables if used between PLC/ micro processor & DCS.
6	Cable trays, accessories & cable trays supporting system	BHEL	BHEL	
7	Cable glands and lugs for equipment supplied by Vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty copper lugs for power & control cables.
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	BHEL	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	

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)**PACKAGES: COLTCS****SCOPE OF VENDOR: SUPPLY****PROJECT:**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	BHEL	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
15	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	BHEL	
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 in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Equipment layout drawings	Vendor	-	For preparation of cabling layout drawings by BHEL, vendor shall furnish Electrical equipment 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,
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.

SPECIFIC TECHNICAL REQUIREMENTS - ELECTRICALS FOR COLTCS			
SL.NO.	PROJECT	5X800 MW YADRADRI TPS	3X660 MW UDANGUDI STPP
	PARAMETERS		
1	CODE AND STANDARDS	IS-325, IS-12615, IEC-60034	IS-325, IS-12615, IEC-60034
2	SERVICE CONDITIONS	Hot, Humid and Tropical Atmosphere highly polluted.	Motors shall be suitable for installation in hot, humid and tropical atmosphere and polluted at places with coal ash and or fly ash
3	TYPE AND RATING	General purpose, Constant speed, Squirrel cage, Three/Single phase, Induction type, Continuous duty, motor name-plate rating at 50°C shall have at least 15% margin	All AC motors shall be squirrel cage three phase/single phase induction motors. All the motor shall be designed for bi-directional rotation. All the motors shall be rated for S1 duty for continuous operation. Motors of crane and hoist application shall be intermittent duty. Whenever the basis for motor rating are not specified in the corresponding mechanical specification section maximum continuous motor rating shall be atleast 10% above the maximum load derived of the driven equipment under entire operating range including voltage & frequency variation.
4	EFFICIENCY CLASS	IE3 (As per latest BIS notification)	IE3 (As per latest BIS notification)
5	RUNNING REQUIREMENT	a) Motor shall run continuously at rated output over the entire range of 415V±10% voltage and 50Hz±3% to -5% frequency variations. b) The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals. c) The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.	A) The motor shall be capable of operating at full load at a supply voltage of 75% of the rated voltage for 5 minutes. B) The motors shall be suitable for bus transfer schemes provided on the 11 kV/6.6 kV/415 V systems without any injurious effect on its life. C) During fast changeover of power supply source, vector difference between the motor residual voltage and the incoming supply voltage shall be about 150% of the rated voltage and the motors shall withstand voltage stress and torque stress developed during that time, which may last for a period of one (1) second.
6	STARTING CURRENT	a) Motor shall be designed for direct online starting at full voltage. Breakaway starting current as percentage of full load current for various motor rating shall not exceed 600% subject to IS tolerance of plus 20%. b) The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage. c) Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminals. d) Two hot starts in succession with motor initially at normal running temperature. e) The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage.	• For energy efficient LT motors, locked rotor current shall be as per IS: 12615. • Locked rotor current of the VFD controlled AC motors shall be limited to 300% of the full load current, and is subject to IS tolerance. Motors subjected to reverse rotation shall be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125% of rated speed in reverse direction. Continuous duty motors shall be suitable for the following starting requirements under the specified conditions of load, torque and inertia. • No. of consecutive hot starts shall be 2 (with initial temperature of the motor at full load operating level). • No. of consecutive cold starts shall be 3 (with initial temperature of the motor at ambient temperature).
7	LOCKED ROTOR WITHSTAND TIME	a) Under hot condition at 110% rated voltage shall be more than motor starting time by at least 3 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time at minimum permissible voltage of 80% rated voltage.	• For the LT motors having starting time up to 20 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 seconds more than the starting time. • For the motors having starting time more than 20 seconds and up to 45 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 seconds more than the starting time. • For motors having starting time more than 45 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time. • Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met. • When a speed switch is mounted on the motor shaft, the same shall remain closed for speeds lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% over speed in either direction of rotation.
8	ENCLOSURE	All motor enclosures for outdoor, semi-outdoor & indoor application shall conform to the degree of protection IP-55. Motor for outdoor or semi-outdoor service shall be of weather-proof construction with canopy.	a) Motors shall have IP 55 degree of protection. b) For hazardous location, the enclosure of motors shall following have flame proof construction conforming to applicable standard. • Fuel oil area Group – IIB • Hydrogen generation plant area : Group – IIC)
9	COOLING	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).	LT motors shall be totally enclosed fan cooled (TEFC), type IC411. The cooling shall be effected by self-driven bi-directional centrifugal fan protected by fan cover. • The Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.
10	WINDING AND INSULATION	a) All insulated winding shall be of copper. b) Class F insulation but limited to class B temperature rise.	Winding shall be class F insulation with temperature limited to class B. Insulation shall be Non-hygroscopic, oil resistant, and flame resistant. Winding, fittings and hardware shall be corrosion resistant. Winding shall be tropicalized and suitably varnished, baked and treated for operating satisfactorily in humid and corrosive atmosphere.
11	TROPICAL PROTECTION	a) All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion. b) All fittings and hardwares shall be corrosion resistant.	Motors shall be suitable for installation in hot, humid and tropical atmosphere and polluted at places with coal ash and or fly ash.

SL.NO.	PROJECT	5X800 MW YADRADI TPS	3X660 MW UDANGUDI STPP
	PARAMETERS		
12	BEARINGS	a) 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. b) Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. c) Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area. d) Grease lubricated bearings shall be pre-lubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication. e) Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.	- Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area. - Sleeve bearings shall be split type, ring oiled with permanently aligned, close running shaft sleeves. Grease lubricated bearings shall be pre-lubricated and shall have provisions for in-service positive lubrication with grease nipple and relief holes. For sleeve bearings, the bearing housing shall be preferably in end shield itself. - Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. However, if anti-friction bearings can take vertical thrust, thrust and guide bearings are not required. - Lubricant shall not deteriorate under all service conditions. The lubricants shall be limited to normally available types. For motors rated 30 kW and above re-lubrication facility shall be provided. - For motor with forced lubrication, a shaft driven oil pump shall be provided along with an electrical auxiliary pump. Alternatively, two motor driven pumps may be provided, one working and one standby. All necessary auxiliaries and accessories shall be provided to complete the system. A pressure gauge and pressure switch for low oil pressure warning and to start the standby oil pump automatically shall also be provided. A motor driven jacking oil pump may be provided, for heavy shaft loads. - Flow switches shall be provided for monitoring oil flow of forced lubrication bearings, if used. Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC. - For bearing temperature measurement, duplex RTDs shall be provided for each bearing and shall be wired up to the terminal box. - Each bearing shall be provided with dial type thermometer. - For all VFD operated motors shall have insulated bearings to prevent flow of shaft currents. - All the motors rated <15 kW shall be provided with sealed ZZ bearings. - Lub oil pressure transmitters shall be provided to DCS for remote monitoring. Lub oil pressure very low trip to HT equipment shall be 2 out of 3 logic.
13	MOTOR TERMINAL BOX	(a) Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation. (b) Terminal box shall be capable of being turned 360 Deg. in steps of 90 degree for LV motors unless otherwise approved. (c) The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor. (d) Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame (e) The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor. (f) The terminal box shall be capable of withstanding maximum system fault current for a duration of 0.25 sec. (g) Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used. (h) Degree of protection for terminal boxes shall be IP 55 as per IS 4691. (i) unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end. (j) Connections shall be such that when the supply leads R, Y & B are connected to motor terminals B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.	- Separate terminal boxes of IP 55 degree of protection shall be provided for stator leads. For single core cables, gland plate shall be non-magnetic material. Terminal box of LT motors shall be capable of being turned 360° in steps of 90°. The terminal boxes shall be split type with removable cover with access to connections. - Terminals for motors shall be stud type, thoroughly insulated from the frame. The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor. - The terminal box shall be capable of withstanding maximum system fault current for 0.2 sec for all breaker operated motors and shall be provided with explosion vent. - For contactor operated LT motors, the terminal box shall be capable of withstanding the fault current for 0.2 sec minimum and operating time of MPCB/MCCB. - Removable gland plates of thickness not less than 2.5 mm sheet steel or 3 mm aluminium (for single core cables) shall be provided for cable boxes. - Cable spreader box shall be provided for larger cable sizes. - Separate terminal box for space heaters shall be provided. - A separate terminal box of IP 55 degree of protection shall be provided for temperature detectors. - All the accessory terminal boxes shall be located on the same side of the main (power) terminal box. - For LT motors, terminal box shall be located on top, unless otherwise specified.
14	MINIMUM PHASE TO PHASE & PHASE TO EARTH CLEARANCE FOR 415V	25 mm	As per relevant standard
15	GROUNDING	(a) The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer to accommodate Flat ground conductor (shall be finalised during detail engineering). (b) The cable terminal box shall have a separate grounding pad.	The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer. The terminal box shall have a separate grounding terminal.
	GROUNDING CONDUCTORS	Shall be finalised during detail engineering	Shall be finalised during detail engineering
16	RATING PLATE	In addition to the minimum information required by IS, the following information shall be shown on motor rating plate : a) Temperature rise in Deg.C under rated condition and method of measurement. b) Degree of protection. c) Bearing identification no. and recommended lubricant.	Motor shall have stainless steel nameplate(s) showing diagram or connections, all particulars as per IS: 325 / IS: 12615 and shall also have 'BEE' marking. In addition to the minimum information required by IEC/IS, the following information shall be shown on motor rating plate: - Temperature rise in °C under rated condition and method of measurement. - Degree of protection. - Bearing identification no. and recommended lubricant. - Location of insulated bearings.
17	DRAIN PLUG	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.	
18	LIFTING PROVISIONS	Motor weighing 20 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.	
19	PAINTING	Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions subject to Customer's approval during detailed engineering.	Painting shall be carried out by an approved process. Pretreatment shall conform to applicable standard. The equipment shall be subject to a coat of red oxide primer paint. All inside and outside surface shall be painted with epoxy based paint. The final thickness of paint film on steel shall not be less than 100 microns. Finish shade shall be 631 of IS: 5 (smoke grey)

SL.NO.	PROJECT	5X800 MW YADRADRI TPS	3X660 MW UDANGUDI STPP
	PARAMETERS		
20	TESTS	All motors shall be subjected to Type tests & routine tests as per IS: 325 and approved quality plan.	Equipment offered shall be of type tested and proven type. Type test certificates for test conducted earlier on similar rating shall be furnished for the motors rated 30 kW and above. The following type tests shall be conducted on LT motors. • Measurement of resistance of windings of stator and wound rotor. • No load test at rated voltage to determine input current power and speed • Full load test to determine efficiency power factor and slip. • Temperature rise test. • Momentary excess torque test. • High voltage test. • Test for vibration severity of motor. • Test for noise levels of motor • Test for degree of protection • Over speed test. The following routine tests shall be carried out for the motors as per applicable standards. • IR of Winding before and after HV tests • HV test on main winding space heater, RTD, BTD • Resistance measurement • No load run test Major Electrical • Phase sequence and direction of rotation • Vibration check Major Electrical • Reduced voltage running test • Locked rotor test at reduced voltage • Record of RTD & BTD resistance at the end of no load test • Test on space heater & RTD • Visual Control of terminal box and verification of construction with respect to short tested terminal box The following minimum tests/ checks shall be conducted at site. Any other tests/ checks as per the manufacturer's recommendation shall also be carried out • Measurement of vibration. • Measurement of insulation resistance and polarization index.
21	DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT	DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT a) OGA drawing showing the position of terminal boxes, earthing connections etc. b) Arrangement drawing of terminal boxes.	DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT a) OGA drawing showing the position of terminal boxes, earthing connections etc. b) Arrangement drawing of terminal boxes.
22	MINIMUM STARTING VOLTAGE FOR MOTOR	80% of rated voltage	80% of rated voltage
23	SHORT TIME RATING FOR TERMINAL BOXES		Fault withstand rating of motor terminal box (Breaker operated): 415 V system : 50/65 kA for 0.2 second

DATA SHEET OF LV MOTORS			
SL NO.	PROJECT DESCRIPTION	5X800 MW YADADRI TPS	3X660 MW UDANGUDI STPP
A	General		
1	Manufacturer & country of origin	DURING DETAILED ENGINEERING	DURING DETAILED ENGINEERING
2	Motor type	Squirrel cage induction AC motors	Squirrel cage induction AC motors
3	Efficiency class	IE3	IE3
4	Type of starting	DOL	DOL
5	Maximum acceptable kW rating of LV motor	Less than 175 kW	>0.2 kW and up to 200 kW. LT motors rated up to 125 kW shall be controlled through MPCB/MCCB and contactor. LT motors rated more than 125 kW shall be controlled through air circuit breaker.
6	Rating up to which Single phase motors permitted.	0.2 kW	up to 0.2 Kw
7	Installation (Indoors/ Outdoors)	indoor/outdoor	indoor/outdoor
8	Degree Of Protection	IP55	IP 55
9	Name of the equipment driven by motor & Quantity	DURING DETAILED ENGINEERING	DURING DETAILED ENGINEERING
10	Maximum Power requirement of driven equipment	DURING DETAILED ENGINEERING	DURING DETAILED ENGINEERING
11	Rated speed of Driven Equipment	As per system requirement	As per system requirement
12	Design ambient temperature (Degree Celcius)	50 deg C	50 deg C
B	Design and Performance Data		
1	Frame size & type designation	DURING DETAILED ENGINEERING	DURING DETAILED ENGINEERING
2	Type of duty	As per system requirement	AS PER REQUIREMENT
3	Rated Voltage	240/415 V	240/415 V
4	Rated Frequency	50 Hz	50 Hz
5	System fault level at rated voltage	50 kA for 1 sec.	50 kA for 1 sec.
6	LV System grounding	solidly grounded	solidly grounded
7	Permissible variation for		
a	Voltage	±10%	±10%
b	Frequency	+3% to -5%	+3% to -5%
c	Combined voltage & frequency	10%	10%
8	Rated output at design ambient temp (by resistance method)	As per system requirement	As per system requirement
9	Synchronous speed & Rated slip	As per system requirement	As per system requirement
10	Minimum permissible starting voltage	80% of rated voltage	80% of rated voltage. During fast changeover of power supply source, vector difference between the motor residual voltage and the incoming supply voltage shall be about 150% of the rated voltage and the motors shall withstand voltage stress and torque stress developed during that time, which may last for a period of one (1) second. c) The motor shall be capable of operating at full load at a supply voltage of 75% of the rated voltage for 5 minutes.
11	TYPE OF STARTER PROVIDED IN MCC	As per system requirement	As per system requirement
12	Starting time in sec with mechanism coupled		
a	At rated voltage	As per system requirement	As per system requirement
b	At min starting voltage		

DATA SHEET OF LV MOTORS			
SL NO.	PROJECT DESCRIPTION	5X800 MW YADADRI TPS	3X660 MW UDANGUDI STPP
13	Locked rotor current as percentage of FLC (including IS tolerance)	As per IS 12615/IEC 60034	For energy efficient LT motors, locked rotor current shall be as per IS: 12615. Locked rotor current of the VFD controlled AC motors shall be limited to 300% of the full load current, and is subject to IS tolerance
14	Torque		
a	Starting	As per system requirement	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. • Pull out torque at rated voltage shall not be less than 205% of full load torque. • Motors subjected to reverse rotation shall be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125% of rated speed in reverse direction.
b	Maximum		
15	Permissible temp rise at rated output over ambient temp & method	All motors shall have class F insulation but limited to class B temperature rise	Winding shall be class F insulation with temperature limited to class B
16	Noise level in (dB)	The noise level shall not exceed 85db (A) at 1.5 meters from the motor.	Motors shall be selected with low noise levels in accordance with IS 12065.
17	Amplitude of vibration	maximum double amplitude vibrations upto 1500 rpm shall be 40 microns and 15 microns upto 3000 rpm	The peak amplitude of the vibration shall also be within the specified limits of IS: 12075.
18	Efficiency & P.F. at rated voltage & frequency		
a	At 100% load	Efficiency as per IS 12615, IEC: 60034-30 (Latest revision), P.F. as per requirement.	Efficiency as per IS 12615, IEC: 60034-30 (Latest revision), P.F. as per requirement.
b	At 75% load		
c	At starting	Efficiency as per IS 12615, IEC: 60034-30 (Latest revision), P.F Minimum 0.2.	Efficiency as per IS 12615, IEC: 60034-30 (Latest revision), P.F in line with starting requirement as per IS.
C	Constructional Features		
1	Method of connection of motor driven equipment	As per system requirement	As per system requirement
2	Applicable Standard	as per relevant standard	as per relevant standard
3	DOP of Enclosure	IP55	IP55
4	Method of cooling	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).	LT motors shall be totally enclosed fan cooled (TEFC), type IC411. The cooling shall be effected by self-driven bi-directional centrifugal fan protected by fan cover. The Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.
5	Class of insulation	All motors shall have class F insulation but limited to class B temperature rise	All motors shall have class F insulation but limited to class B temperature rise
6	Main terminal box		
a	Type		
b	Power Cable details (Conductor, size, armour/unarmour)	1.1 kV XLPE armour cable, size shall be provided during detailed engineering	1.1 kV XLPE armour cable, size shall be provided during detailed engineering

DATA SHEET OF LV MOTORS			
SL NO.	PROJECT	5X800 MW YADADRI TPS	3X660 MW UDANGUDI STPP
	DESCRIPTION		
c	Cable Gland & lugs details (Size, type & material)	Refer Specific technical requirement for motors	The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer. The terminal box shall have a separate grounding terminal.
d	Permissible Fault level (kArms & duration in sec)		Fault withstand rating of motor terminal box (Breaker operated): 415 V system : 50/65 kA for 0.2 second
e	Degree of Protection		Refer Specific technical requirement for motors
7	Earth Conductor Size & Material		
8	Space heater details (30KW & ABOVE) (Voltage & watts)	Refer Specific technical requirement for motors	Space heaters rated for 240 V AC, 50 Hz supply shall be provided for motors rated 30 kW'and above to maintain windings in dry condition when motor is standstill.
9	Flame proof motor details (if applicable)	During detailed engineering	During detailed engineering
a	Enclosure		
b	suitability for hazardous area		
i	Zone O / I / II		
ii	Group IIA / IIB / IIC		
c	Degree of Protection		
9	No. of Stator winding	As per system requirement	As per system requirement
10	Winding connection	As per system requirement	As per system requirement
11	Kind of rotor winding	As per system requirement	As per system requirement
12	Kind of bearings	Refer Specific technical requirement for motors	Refer Specific technical requirement for motors
13	Direction of rotation when viewed from NDE	Motor shall be bi-directional	Motor shall be bi-directional
14	Paint Shade & type	The colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively, for details refer Specific technical requirement for motors	Finish shade shall be 631 of IS: 5 (smoke grey), for details refer Specific technical requirement for motors
15	Net weight of motor	DURING DETAILED ENGINEERING	DURING DETAILED ENGINEERING
16	Outline mounting drawing No (To be enclosed as annexure)	DURING DETAILED ENGINEERING	DURING DETAILED ENGINEERING
D	Characteristic curves/ drawings		
1	(To be enclosed for motors of rating >55KW)	DURING DETAILED ENGINEERING	DURING DETAILED ENGINEERING
2	Torque speed characteristic		
3	Thermal withstand characteristic		
4	Current vs time		
5	Speed vs time		
E	Tests on motors	licable (As per QAP/For Project specific requirement if any refer Specific technical requirement for r	



TITLE:
**TECHNICAL SPECIFICATION
COLTCS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-417/435-165-N002**

SECTION: **I**

SUB-SECTION: **IC**

REV. NO. **00** DATE **07.09.2018**

SHEET **1** OF **1**

SUB-SECTION – IC

SPECIFIC TECHNICAL REQUIREMENTS (C &I)

SCOPE MATRIX - CONDENSER ONLOAD TUBE CLEANING SYSTEM (COLTCS)		
S.No.	PROJECT	5X800 MW YADADRI TPS
1	SYSTEM APPLICABLE: CONDENSER ONLOAD TUBE CLEANING SYSTEM (COLTCS)	Y
2	SYSTEM CONFIGURATION: UNITISED OR COMMON OR AS APPLICABLE	UNITISED
3	CONTROL SYSTEM	REFER NOTE-1
4	LOCATION OF CONTROL SYSTEM	
5	CONTROL SYSTEM SCOPE (BIDDER /BHEL/ CUSTOMER)	
6	CONTROL FROM PUSH BUTTONS ON LOCAL CONTROL CUM STARTER PANEL	Y; REFER NOTE 4
7	ANNUNCIATION ON LOCAL CONTROL CUM STARTER PANEL (Y/N) -- IF Y, MIN NO. OF HARDWIRED ALARMS / INDICATIONS	Y; REFER NOTE-5
8	MIMIC ON LOCAL CONTROL CUM STARTER PANEL (Y/N)	Y; REFER NOTE-6
9	POWER SUPPLY AVAILABLE FOR BALL MONITORING SYSTEM IN BIDDERS'S SCOPE (24V DC / 110 V AC UPS / 230 V AC UPS)	To be finalised during detailed Engineering
10	PROTECTION CLASS FOR LOCAL CONTROL CUM STARTER PANEL	IP-55 and above
11	ACTUATOR WITH INTEGRAL STARTER (Y/N)	Y
12	DPG/ DPT PER COLTCS SYSTEM *	DPT= 3 NOS (ACROSS EACH FILTER)
13	SEA WATER APPLICATION	N
NOTES:		
1	Type of control system shall be DDCMIS (Station C&I) based, located in Central Control Room in BHEL scope. Field instrumentation and local control cum starter panel for the package are in bidder's scope of supply.	
2	For each Unit , each side of COLTCS system- Left & Right, shall be supplied with its local control cum starter panel and its MIMIC and annunciator for its operation. Extent of MIMICs and annunciators shall be decided during detailed engg.	
4	Push buttons and indication lamps for Open/Close and Start/Stop of drives/equipments shall be provided on the local control cum starter panel. Remote and local indication, indicating lamps / LED cluster for instruments/drives/equipments status and critical alarms shall be provided on the local control cum starter panel. Nos. of indication shall be decided during detailed engineering.	

5	No. of facia on local control cum starter panel shall be decided during detailed engineering.
6	Colored MIMICS on the panel is to be provided as per system flow diagram.
8	415 V, 3 phase AC power supply shall be provided by BHEL at a single point for the local control cum starter panel. Further any electrical distribution shall be in bidder's scope. Any other voltage requirement to be arranged/derived by bidder by providing suitable control transformer. local control cum starter panel in bidder's scope shall have provision for redundant feeder with fast automatic changeover.
9	Bidder to terminate all instrumentation and control elements in the local control cum starter panel for further cabling to DDCMIS.
10	Following documents shall be provided by bidder during detailed engineering for approval: a. Input/Output list, Drives list, b. Instrument datasheets and check lists/Quality plan, c. Panel external/internal GA drawing and termination details, d. Panel datasheet and QAP e. Recommended control logics / Control philosophy . f. Complete cable schedule & cable interconnection details
11	All the instruments along with necessary fittings, accessories and valve manifold etc., instrument rack and junction boxes, erection hardware shall be in bidder's scope of supply.
12	LIR (Instrument Rack) to be provided for mounting the instruments in the field.
13	Cable for local wiring, between field instruments to local control cum starter panel shall be screened with 1.5 mm ² minimum and shall be in bidder's scope. Refer 'electrical scope sheet between BHEL and bidder' attached in electrical specification for cable scope.
14	Mandatory spare list shall be referred in 'List of mandatory spares' attached elsewhere in the specification and shall be supplied by bidder.
15	*Instruments, root valves, impulse pipe shall be suitable for sea water application having corrosion resistance where media is sea water. The minimum requirement for Sea water application is: all wetted parts & diaphragm shall be suitable for sea water (Duplex Stainless Steel or better).
16	All the transmitters and gauges shall have remote seal type having 15 m SS armoured capillary length.
17	Open/close limit switch feedback of valves are to be connected to DCS for remote viewing and for interlock & protection.
18	The Vendor list/ sub-vendor list shall be subject to BHEL / Customer approval during contract stage.
19	The technical requirements for instruments mentioned in the specification are minimum requirements. Items not specifically mentioned and required for the completeness of the system shall be supplied by bidder without any implication.
20	Bidder to provide 2 Nos soft connection from BOM & BRM to DCS showing number of ball count. Hardware and software required for connectivity shall be provided by bidder for implementation in DCS.

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR COLTCS

- 1.1 The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. The Vendor list/ sub-vendor list shall be subject to BHEL / Customer approval during contract stage. No commercial implication in this regard shall be acceptable.
- 1.2 These requirements are to be read in conjunction with detailed Technical specification enclosed in the specification. In case of any conflict and repetition of clauses in the specification, the more stringent requirement as per interpretation of Customer shall prevail without any commercial implication. No deviations shall be acceptable.
- 1.3 Drawings/Documents and data to be furnished after award of the contract as per deliverables list attached elsewhere in the specification.
- 1.4 All local gauges as well as transmitters and sensors for parameters like pressure, temperature, flow etc. as required for the safe and efficient operation and maintenance under the scope of specification shall be provided. The necessary root valves, impulse piping, drain cock, gauge-zeroing cocks, valve manifolds, instrument racks and all the other accessories required for mounting / erection of these local instruments, transmitters and sensors shall be supplied by bidder even if not specifically asked for. Also the proposal shall include the necessary cables, flexible conduits, instrument racks, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg / Cm².
- 1.5 All local gauges, transmitters and sensors shall be mounted on suitable enclosures, Instrument racks (LIR) in bidder's scope subject to Customer's approval.
- 1.6 Type of control system shall be DDCMIS (Station C&I) based, located in Central Control Room in BHEL scope. Field instrumentation for the package is in bidder's scope.
- 1.7 The local control cum starter panel in bidder's scope shall be NEMA 4X. Suitable canopy on top shall be provided for the panel.
- 1.8 Push buttons and indication lamps for Open/Close and Start/Stop of drives/equipment's shall be provided on the starter panel. Remote and local indication, indicating lamps / LED cluster for instruments/drives/equipment's status and critical alarms shall be provided on the starter panel. Nos. shall be decided during detailed engineering.
- 1.9 Colored MIMICS on the panel is to be provided as per system flow diagram. No. of facia on Starter panel shall be decided during detailed engineering.

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR COLTCS

- 1.10 Bidder to terminate all instrumentation and control elements in the control panel for further cabling to DDCMIS by BHEL.
- 1.11 All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. The enclosures of all electronic instruments shall conform to IP-65 unless otherwise specified (Explosion proof for NEC article 500, class 1, Division 1 area & flame proof) and an anticorrosive paint shall be applied to the field mounted enclosures / instruments. All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland. Gaskets, Fasteners, Counter and mating flange shall also be included wherever required with the field instruments.
- 1.12 Sea or saline water media is applicable for Type-IV COLTCS. The minimum requirement for sea water or saline water media is as below:
- a. Instruments shall be suitable for sea or saline water application. MOC of impulse tubing and impulse pipe shall be CPVC (3/8") Sch 80 or better, Industrial grade up to manifold. MOC of impulse tubing, fittings (from manifold to instrument) and manifold shall be Super Duplex stainless steel.
 - b. MOC of all wetted parts, fittings, sampling pipes, tubes, fittings, diaphragm and all types of erection hardware of instrument/drives/equipment, shall be Duplex stainless steel or better suitable for sea or saline water application.
- 1.13 Epoxy coated painting is required for all I & C equipment.
- 1.14 All valve actuator shall be provided with conventional actuators with integral starter for ON/OFF valves. Non-contact type electronic 2-wire position transmitters shall be provided for all inching type motorized valves and dampers. The detailed specification of actuator is given elsewhere in the specification.
- 1.15 Differential pressure indicators & Differential pressure Transmitters across COLTCS shall be provided with independent impulse & isolation valves. Remote & Local indication DP transmitters & gauges across COLTCS shall be provided.
- 1.16 All the transmitters and gauges shall have remote seal type having 15m capillary length minimum.
- 1.17 All the instruments/equipment's/electrical items shall be provided & designed with maximum star rating as available in line with energy conservation policies notified by BEE, GOI at the time of supply.
- 1.18 All primary instruments shall be with protection class of IP 65 or better.
- 1.19 Transmitter should not be mounted directly on the manifold, Manifold shall be non-integral and standalone type.

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR COLTCS

- 1.20 LVDT type instrument is not acceptable.
- 1.21 All limit switch shall be conforming to IEC-60947-5-1.
- 1.22 Each switching element including the limit and torque switches of valve actuators shall be provided with minimum two SPDT OR DPDT contacts each for close, open and adjustable.
- 1.23 All transmitters shall be smart and electronic type, microprocessor based and HART compatible. All instruments should be supplied with valid calibration and test certificates provided by OEM.
- 1.24 The system shall be provided with annunciation system. It shall be an integral part of the control system. All the field contact shall be acquired through control system. The annunciation sequence/ logic shall conform to ISA sequence ISA-2A. The window lamps for the system shall be driven through output modules of the control system.
- 1.25 For plug in type instruments, the plug & sockets shall be polarized to prevent wrong connections and have facility for secure coupling in plug-in position to prevent loose connections.
- 1.26 Signal/Electrical connection shall be screwed connection with double compression type Nickel-plated brass cable glands.
- 1.27 All the field instruments shall also be provided with SS tag nameplate.
- 1.28 Cable scope shall be referred in Electrical scope sheet attached in the Electrical portion of the specification.
- 1.29 Push buttons and indication lamps for Open/Close and Start/Stop of drives/equipment's shall be provided on the starter panel in Bidder's scope. Remote and local indication, indicating lamps / LED cluster for instruments/drives/equipment's status and critical alarms shall be provided on the starter panel. Nos. shall be decided during detailed engineering.
- 1.30 Mandatory spare list shall be referred in 'List of mandatory spares' attached elsewhere in the specification and shall be supplied by bidder.
- 1.31 Power Supply Requirement:
415 V, 3 phase AC power supply shall be provided by Customer for the local control cum starter panel at a single point. Further any electrical distribution shall be in bidder's scope. Any other voltage requirement to be arranged/derived by bidder by providing suitable control transformer. Starter panel in bidder's scope shall have provision for redundant feeder with fast automatic changeover.

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR COLTCS

- 1.32 Bidder shall provide an unlimited warranty on all equipment and software for three years after the start of the warranty period, i.e. after satisfactory completion of initial operations. This warranty shall include repair, replacement or correction of identified software or hardware discrepancies at no cost to owner.
- 1.33 Bidder to delegate /depute their persons/experts as per Customer's requirement.
- 1.34 Bidder must offer general tools and tackles and special calibration instruments required during start-up, trial run, operation and maintenance of the system.
- 1.35 The technical requirements for instruments/ equipment's/panels mentioned in the specification are minimum requirements. Items not specifically mentioned and required for the completeness of the system shall be supplied by bidder.

2.0 Requirements for flanged remote seal diaphragm:

Maximum pressure rating: To meet 200 percent of process pressure,
Availability of seals: for both high and low pressure sides with capillary connection in case of differential pressure measurements.

Single Capillary connection for pressure transmitters.

Capillary length: 15.0 m

Fill fluid: Suitable oil

Process connection size: 1 inch

Flange size and Accessories: As per process requirement.

Flange pressure rating: Required Class (ANSI)

Process fluid temperature: 25°C to 60°C

Diaphragm and wetted part material: Suitable for sea water (Duplex SS or better)

Flushing option: To be made available with 1/4 inch (necessary drain and gasket suitable for sea water application to be provided).

Snubbers /Pulsation dampeners shall be used where the process media is unstable for measurement such as the discharge of a pump.



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GENERAL*	* PROJECT				
	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	* 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)	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) A: ☐ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ☐ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram			
	COLOUR SHADE	☐ BLUE (RAL 5012) ☐			
	PAINT TYPE (## Refer Notes)	☐ ENAMEL ☒ EPOXY ☐			
	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			



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	@ ENCLOSURE CLASS OF MOTOR	☒ IP 68 ☐ FLAME PROOF		
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B		
	@ WINDING TEMP PROTECTION	☒ THERMOSTAT (3 Nos., 1 IN EACH PHASE) ☐ -----		
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED		
INTEGRAL STARTER	INTEGRAL STARTER	☒ REQUIRED ☐ NOT REQUIRED		
	TYPE OF SWITCHING DEVICE	☒ CONTACTORS ☐ THYRISTORS		
	TYPE	☒ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)		
	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	REQUIRED (MOTOR THERMOSTAT TRIP, O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, PHASE LOSS, S/S IN LOCAL/ OFF MODE, STOP PB OPTD, TORQUE OPEN/CLOSE CUTOFF)		
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	☒ INTERPOSING RELAY ☒ OPTO COUPLER ☐ EITHER		
	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, 0.5A 220V DC, and 10A, 250 V AC		
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE		
	ACCURACY	+3% OF SET VALUE		
LIMIT SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN : INT : CLOSE	☐ 1 No. ☒ 2 Nos.	2 Nos. (ADJ.)	☐ 1 No. ☒ 2Nos.
	CONTACT TYPE	2 NO + 2 NC		
	RATING (AC / DC)	5A 240V AC, 0.5A 220V DC and 10A, 250 V AC		



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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 ☒ 240V 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 (9 PIN/ 11 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	☒ REQUIRED ☐ NOT REQUIRED ☒ 2 NOS. ☐	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE: suitable for 3Cx2.5sq mm Cu	
	@ SPACE HEATER CABLE GLAND		
	OTHER CONTROL CABLE GLANDS-1	1 no. for BFV of CW pump (Cable size 2PX1.5mm2)	
	OTHER CONTROL CABLE GLANDS-2	1 no. suitable for 8Px0.5 sq m Additional 1 no. suitable for 2P x 0.5 sq mm.	



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WEIGHT

TOTAL WEIGHT (ACTUATOR + ACCESSORIES)

BIDDER TO SPECIFY

_____ Kg.

NOTES:

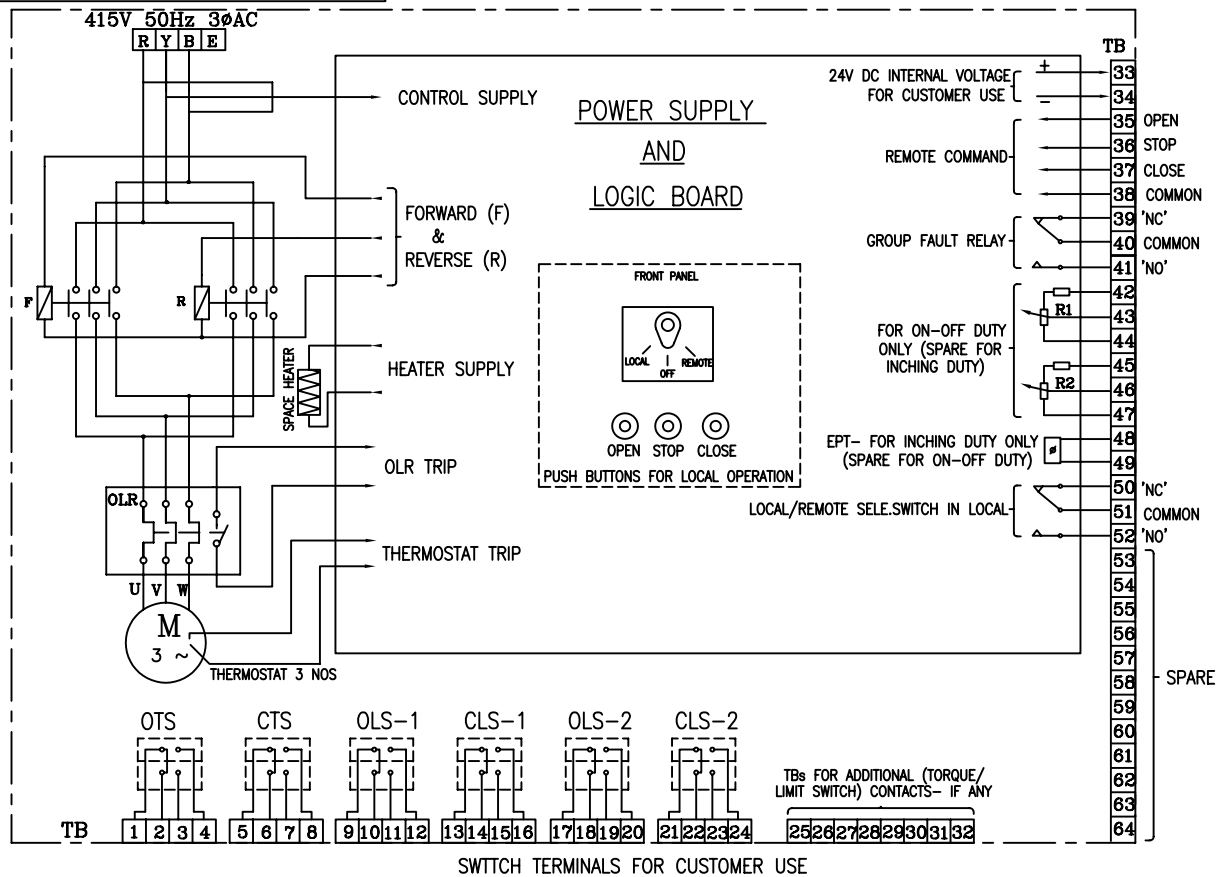
1. **SCOPE:** DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
 2. **CODES & STANDARDS:** DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
 3. **ACTUATOR SHALL HAVE HARDWIRED CONTACTS FOR FOLLOWING SIGNALS (a) ACTUATOR IN LOCAL MODE (b) ACTUATOR IN REMOTE MODE.**
 4. BIDDER TO ENSURE AVAILABILITY OF SPARE 1NO + 1NC LIMIT SWITCH & TORQUE SWITCH.
 5. SS TAG NAME PLATE SHALL BE PROVIDED.
 6. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
 7. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, Ni PLATED BRASS MATERIAL SHALL BE PROVIDED.
 8. 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.
 9. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
 10. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.
 11. IT SHOULD BE POSSIBLE TO OPERATE THE ACTUATOR LOCALLY. LOCKABLE LOCAL/REMOTE SELECTION SHALL BE PROVIDED ON THE ACTUATOR.
 12. POSITION INDICATOR SHALL BE PROVIDED FOR 0 TO 100 % TRAVEL
 13. WIRING SHALL BE SUITABLE VOLTAGE GRADE COPPER WIRE 1.5 SQ. MM.
 14. 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.
 15. THE ACTUATORS SHALL BE DESIGNED TO BE SELF-LOCKING UPON LOSS OF POWER. MOTOR SHALL BE DESIGNED TO CLOSE IN 30 SECS. FROM FULL OPEN POSITION AND SHALL HAVE ADEQUATE CAPACITY TO OPEN AND CLOSE UNDER FULL UNBALANCED DESIGN PRESSURE.
 16. ALL SIX (6) LIMIT SWITCHES SHALL BE CHANGEOVER TYPE AND ADJUSTABLE BESIDES HAVING THE SNAP FACILITY.
 17. THE INTEGRAL STARTER WHICH SHALL HAVE SOPHISTICATED ELECTRONIC CONTROLS WITH FIELD PROGRAMMING FEATURE. IT SHALL BE DESIGNED FOR REMOTE CONTROL FROM DCS/RESPECTIVE CONTROL SYSTEM. REQUIRED INTERPOSING RELAYS FOR RECEIVING OPEN/CLOSE/STOP COMMAND FROM DCS/RESPECTIVE CONTROL SYSTEM SHALL BE PROVIDED. POTENTIAL FREE CONTACTS AND TRANSDUCERS SHALL BE PROVIDED TO PROVIDE STATUS INDICATION AT REMOTE DCS/RESPECTIVE CONTROL SYSTEM.
 18. THE REMOTE COMMAND SIGNAL (OPEN-STOP-CLOSE) FROM DCS/RESPECTIVE CONTROL SYSTEM/CONTROL PANEL SHALL BE ISOLATED FROM CONTROL ELECTRONICS THROUGH OPTO-ISOLATOR.
 19. THE FOLLOWING INDIVIDUAL STATUS ANNUNCIATION LED'S (COLOUR-GREEN) SHALL BE PROVIDED LOCALLY (INTEGRAL TO ACTUATOR) TO ANNUNCIATE THE FOLLOWING FOR EASY LOCAL MONITORING.

 ACTUATOR IN LOCAL MODE
 ACTUATOR IN REMOTE MODE
 ACTUATOR RUNNING IN OPEN DIRECTION
 ACTUATOR RUNNING IN CLOSE DIRECTION
 ACTUATOR IN INCHING MODE
 ACTUATOR IN SELF-RETAINING MODE
 LIMIT SWITCH OPEN TRIP
 LIMIT SWITCH CLOSE TRIP
 CONTROL VOLTAGE AVAILABILITY
- \$\$ 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				NAME
SIGNATURE				SIGNATURE
DATE				DATE

3-V-MISC-24227

DRAWING NO.



CONTACT DEVELOPMENT DIAGRAM

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

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH

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

NOTE:-

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

REV	DATE	ALTERED
		CHD & APPD

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)							
 365-121		BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI-620014.		DRN	NAME N.P.ESWAR	SIGN N.P.	DATE 07.10.04	NO.OF VAR.	
				CHD	D.DINAKARAN	D.D	07.10.04		
				APPD	K.ARUNACHALAM	K.A	07.10.04		
DEPT	VL		SCALE	WEIGHT (KG).	REFERENCE INFORMATION				NO. OF ITEMS
CODE									
TITLE				CARD CODE	DRAWING NO.				REV
WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER				U 01	3-V-MISC-24227				0



DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER FOR COLTCS

SPECIFICATION NO.: PE-TS-XXX-145-I100

VOLUME

SECTION

REV. NO.

00

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SHEET

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TAG No. Qty.....

Data Sheet No.: PES-145-01-DS1-0

Data Sheet A & B

DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER
(TO BE FILLED BY PURCHASER)

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

	MANUFACTURER		
	MODEL NUMBER		
TECHNICAL	TYPE	☐ CAPACITANCE ☐ SILICON RESONANCE TYPE	SMART TRANSMITTER OF ELECTRONIC TYPE, MICROPROCESSOR BASED, HART COMPATIBLE
	POWER SUPPLY	☐ 24V DC NOMINAL	
	TRANSMITTER MEASUREMENT	☐ PRESSURE ☐ DIFF. PRESSURE	
	OUTPUT SIGNAL	☐ 4 to 20 m Amp. DC	
	NO. OF WIRE	☐ TWO	
	ACCURACY	☐ ± 0.04% of span or better	
	LINEARITY, HYSTERESIS, DEAD BAND AND REPEATABILITY	☐ ± 0.05 % of span or better	
	STABILITY	☐ ± 0.1 % OF URL FOR 10 years	
	SENSITIVITY	☐ ± 0.05% OF SPAN	
	<u>MATERIAL</u>	THE MINIMUM REQUIREMENT FOR SEA WATER APPLICATION : ALL WETTED PARTS & DIAPHRAGM SHALL BE SUITABLE FOR SEA WATER (DUPLEX SS OR BETTER)	
	A) BODY	☐ 316 SS	
	B) ELEMENT	☐ 316 SS	
	C) DIAPHRAGM	☐ 316 SS	
	C) SEAL	☐ TEFLON	
	FLANGED REMOTE SEAL DIAPHRAGM	AS REQUIRED	
	CAPILLARY LENGTH	☐ MINIMUM LENGTH OF 15 M REQUIRED	
	CONTINUOUSLY ADJUSTABLE SPAN AND ZERO ADJUSTMENT PROVIDED	☐ YES, Locally adjustable, non-interacting ☐ NO	
	MOUNTING	☐ WALL/PIPE STAND ☐ INSTRUMENT RACK	
	ENCLOSURE	☐ NEMA-4 ☐ NEMA-7 ☐ IP-65 WITH CORROSION RESISTANCE EPOXY COATING	
	PAINT	☐ EPOXY COATING FOR ALL C&I EQUIPMENT ☐ Anticorrosive paint shall be applied to field mounted enclosures / instruments.	
	TURN DOWN RATIO	☐ 100:1 in general	



DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER FOR COLTCS

SPECIFICATION NO.: PE-TS-XXX-145-I100

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TAG No. Qty.....

Data Sheet No.: PES-145-01-DS1-0

Data Sheet A & B

DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER
(TO BE FILLED BY PURCHASER)

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

INSULATION RESISTANCE

TO BE SPECIFIED BY BIDDER

OVER PRESSURE

☒ 150% OF MAX. OPR. PRESS

ZERO SUPPRESSION/ ELEVATION RANGE

☒ At least 100% of Span

INTEGRAL INDICATOR

☒ YES, LCD indicator (5 digit) with scale of Engg. unit
☐ NO

RESPONSE TIME

☒ 150 msec.

TRANSMITTER SHALL BE ABLE TO
DRIVE LOAD IMPEDANCE OF 500
OHMS(min.) WITH DRIVE CAPABILITY OF
600OHMS NOMINAL

☒ YES ☐ NO

ELECTRICAL CONNECTION

☒ PLUG & SOCKET TYPE

PROCESS CONNECTION

☒ 1/2 " NPT (F)

ZERO & SPAN DRIFT

☒ ± 0.015 % PER DEG.C AT MAX. SPAN
☒ ± 0.11 % PER DEG.C AT MIN. SPAN

DIAGNOSTICS

☒ SELF INDICATING FEATURE
MANIFOLD

a) PRESSURE MEASUREMENT

☒ 2 WAY ☒ MATERIAL: 316 SS

B) DIFFERENTIAL PRESSURE MEASUREMENT

☒ 5 WAY ☒ MATERIAL: 316 SS

CABLE ENTRY DETAIL

SUITABLE FOR DIA OF 17.5 mm

NOTES:

1. TRANSMITTERS SHOULD NOT BE MOUNTED DIRECTLY ON MANIFOLD. MANIFOLD SHOULD BE NON-INTEGRAL AND STAND ALONE TYPE.
2. TRANSMITTERS TO BE EQUIPPED WITH MOUNTING BRACKETS.
3. ALL THE FIELD INSTRUMENTS SHALL BE PROVIDED WITH SS TAG NAME PLATE.

PREPARED BY**CHECKED BY****APPROVED BY**

COMPANY SEAL

NAME

NAME

SIGNATURE

SIGNATURE

DATE

DATE



DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER

SPECIFICATION NO.: PE-TS-XXX-145-I100

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TAG No. Qty.....

Data Sheet No.: **PES-145-01-DS2-0**

Data Sheet C

DATA SHEET-C FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

MANUFACTURER	
MODEL NUMBER	
TYPE	
POWER SUPPLY	
TRANSMITTER MEASUREMENT	
OUTPUT SIGNAL	
NO. OF WIRE	
ACCURACY	
LINEARITY, HYSTERESIS, DEAD BAND AND REPEATABILITY	
STABILITY	
SENSITIVITY	
<u>MATERIAL</u>	
A) BODY	
B) ELEMENT	
C) DIAPHRAGM	
C) SEAL	
CONTINUOUSLY ADJUSTABLE SPAN AND ZERO ADJUSTMENT PROVIDED	
MOUNTING	
ENCLOSURE	
PAINT	
TURN DOWN RATIO	
INSULATION RESISTANCE	
OVER PRESSURE	
ZERO SUPPRESSION/ ELEVATION RANGE	

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER	SPECIFICATION NO.: PE-TS-XXX-145-I100	
		VOLUME	
		SECTION	
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TAG No. Qty.....		Data Sheet No.: PES-145-01-DS2-0	
Data Sheet C			
DATA SHEET-C FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)			
INTEGRAL INDICATOR			
RESPONSE TIME			
TRANSMITTER SHALL BE ABLE TO DRIVE LOAD IMPEDANCE OF 500 OHMS(min.) WITH DRIVE CAPABILITY OF 600OHMS NOMINAL			
ELECTRICAL CONNECTION			
PROCESS CONNECTION			
ZERO & SPAN DRIFT			
DIAGNOSTICS			
<u>MANIFOLD</u>			
b) PRESSURE MEASUREMENT			
B) DIFFERENTIAL PRESSURE MEASUREMENT			
CABLE ENTRY DETAIL			

NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL NAME SIGNATURE DATE

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE FOR COLTCS		SPECIFICATION NO.: PE-TS-XXX-145-I100	
			VOLUME	
			SECTION	
			REV. NO. 00	DATE: 25.04.2018
			SHEET 1	OF 3
TAG No. Qty.....			Data Sheet No.: PE-DC-999-145-I026	
Data Sheet A & B				
DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL	MANUFACTURER			
	MODEL NUMBER			
TECHNICAL	PRESSURE ELEMENT	☐ BOURDON ☐ DIAPHRAGM ☐ BELLOW		
	MATERIAL	THE MINIMUM REQUIREMENT FOR SEA WATER APPLICATION : ALL WETTED PARTS & DIAPHRAGM SHALL BE SUITABLE FOR SEA WATER (DUPLEX SS OR BETTER)		
	A) BELLOW	■ 316 SS		
	B) BOURDON TUBE	■ 316 SS		
	C) MOVEMENT	■ 316 SS		
	D) CASE ENCLOSURE	■ 316 SS		
	E) PROTECTIVE DIAPHRAGM	■ TEFLON COATED SEALS		
	ENCLOSURE	■ IP-65 OR BETTER		
	DIAL	SIZE: ☐ 100MM ■ 150MM WITH SHATTER PROOF GLASS COLOR: WHITE NUMERALS: BLACK SCALE: ■ LINEAR, 270 DEG ARC GRADUATED IN METRIC UNITS		
	CASE	COLOUR : BLACK		
	MOUNTING	■ LOCAL/FRAME MOUNTED ■ INSTRUMENT RACK		
	OVER RANGE PROTECTION	☐ 115% OF MAX. OF SCALE ■ 150% OF MAX. OF SCALE		
	CAPILLARY LENGTH	■ MINIMUM LENGTH OF 15 M REQUIRED		
	BLOW OUT DISC	■ REQUIRED WITH OPEN FRONT CONSTRUCTION OF SUITABLE MATERIAL		
	SWITCHING FACILITY (if applicable)	■ YES ☐ NO ☐ MICRO SWITCH ☐ OTHER 2 NOS. SPDT 5A 230V AC, 0.25A 220V DC FIELD ADJUSTABLE OVER FULL RANGE; COVERS 125% OF MAX. OF SCALE REPEATABILITY ± 1% OF FSR POWER SUPPLY ☐ 230V AC ☐ 110V AC		
	OVER RANGE TEST	TEST PR. FOR THE ASSEMBLY SHALL BE 1.5 TO THE MAX. DESIGN PRESSURE AT 38 DEG C.		
ZERO/ SPAN ADJUSTMENT	■ MICROMETER SCREW EXTERNAL FOR ZERO ADJUSTMENT ■ MICROMETER SCREW INTERNAL FOR RANGE ADJUSTMENT			

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE FOR COLTCS			SPECIFICATION NO.: PE-TS-XXX-145-I100		
				VOLUME		
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TAG No. Qty.....			Data Sheet No.: PE-DC-999-145-I026			
Data Sheet A & B						
DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE (TO BE FILLED BY PURCHASER)				DATA SHEET-B (TO BE FILLED-UP BY BIDDER)		
PERFORMANCE	ACCURACY	± 1% OR BETTER OF FULL SCALE DEFLECTION				
CONNECTION	PROCESS	½ " NPT (M)				
	LOCATION	☐ BACK ☐ BOTTOM				
ACCESSORIES	NAME PLATE / METAL TAG	SS				
	MOUNTING	☐ WALL ☐ PIPE – U CLAMPS & BOLTS ☐ PANEL / RACK TO BE DECIDED DURING DETAILED ENGG.				
		3 WAY NEEDLE VALVE / MANIFOLDS PROTECTIVE SEPARATING, CHEMICAL SEAL DIAPHRAGM – FOR CORROSIVE LIQUID LINES Union, nut & tail piece and other Installation accessories as required. 3-Way SS316 Gauge cock for pressure gauges				
NAME				NAME		
SIGNATURE				SIGNATURE		
DATE				DATE		



DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE

SPECIFICATION NO.: PE-TS-XXX-145-I100

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Data Sheet No.: PE-DC-999-145-I026

Data Sheet C

DATA SHEET-C FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

GENERAL	MANUFACTURER			
	MODEL NUMBER			
TECHNICAL	PRESSURE ELEMENT			
	MATERIAL			
	ENCLOSURE			
	DIAL			
	CASE			
	ADJUSTMENT			
	MOUNTING			
	OVER RANGE PROTECTION			
	BLOW OUT DISC			
	SWITCHING FACILITY TYPE NO. / TYPE OF CONTACTS CONTACT RATING SETTING RANGE REPEATABILITY POWER SUPPLY			
	PERFORMANCE	ACCURACY		
CONNECTION	PROCESS			
	LOCATION			
ACCESSORIES	NAME PLATE / METAL TAG			
	MOUNTING			
	OTHER			
NAME SIGNATURE DATE				NAME SIGNATURE DATE



**SPECIFICATION FOR
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FOR COLTCS**

SPECIFICATION NO.: PE-SS -999- 145 -054A	
VOLUME	II B
SECTION	D
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1.0 SCOPE

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

2.0 CODES AND STANDARDS

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

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

- a) IS-6005 : 1998 : Code of practice for phosphating of iron and steel.
- b) IS-5 : 2007 : Colors for ready mixed paints and enamels.
- c) IS-1248:2003 : Direct Acting Indicating Analog Elec Measuring Instruments.
- d) IS/IEC 60947:Part 1:2004 : Low Voltage switchgear & control gear: Part-I (General Rules)
- e) IS-8828:1996 : Circuit breaker for household and similar installations.
- f) IS-13947 (Part-I):1993 : Low Voltage switchgear & control gear : Part-I (General Rules)
- g) ISA-18.1:1979 : Annunciator Sequences and Specification
- h) NFPA-496:2003 : Purged & Pressurized 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 550mm. The doors shall be provided with suitable stiffeners to prevent buckling. The handle shall be on the right side of the door. The door shall be removable type with concealed hinges to facilitate maintenance work. Suitable pocket inside the door shall be provided for keeping the drawings / documents. Double door shall be provided with suitable glass windows, as per the requirement.

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



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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 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.



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

3.2 Hazardous Area Panel Requirement

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

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

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

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

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

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

3.3 Control & Monitoring devices

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

3.3.2 Alarm Annunciator System

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

3.3.3 Relays

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

3.3.4 Timers

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

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



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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

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

4.3 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.

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.



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4.3.2 Type Tests

1. Enclosure Class Test

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

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

5.2. Mandatory Spares

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

5.3. Recommended Spares

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

6.0 DRAWINGS AND DOCUMENTS

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

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

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

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

7.0 MARKING AND PACKING

7.1 Panel with all instruments / devices mounted on it shall be suitably packed & protected for the entire period of dispatch, 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 FOR COLTCS

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

VOLUME

SECTION

REV. NO.

00

DATE: 25.04.2018

SHEET

1

OF

3

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

☐ 3.0 mm

OTHER

☐ 2.0 mm

DOOR

☐ 2 mm

HEIGHT

☐ 2365 mm for stand-alone panels (THIS SHALL BE DECIDED BY BHEL DURING DETAILED ENGG.)

OTHER

☐ Load bearing sheet front shall have 3mm thickness

TECHNICAL

INPUT POWER SUPPLY *

☐ 240V 50 Hz AC☐ 220V DC

(ANY OTHER POWER REQUIREMENT TO BE DERIVED FROM THIS SUPPLY ONLY)

☒ 415V 3 PHASE

Kindly refer Electrical scope sheet

NO. OF FEEDERS

☐ ONE☒ TWO

STARTER WITH MCC

☒ REQUIRED☐ NOT REQUIRED

IPR POSITION

☐ MCC☒ CONTROL PANEL

CONTACT RATING OF RELAY

☒ 5 Amp, 230 V AC☒ 0.25 Amp, 220V DC

CONTROL SUPPLY

☐ 10V AC☐ 220V AC☒ 220V DC☐ Other.

(As per requirement)

ALARM ANNUNCIATOR WINDOW
(EXCLUDING SPARES)☒ REQUIRED 10 nos. Actual no. shall be decided during detailed engg.

TEMP SCANNER

(IF REQUIRED –NO. OF CHANNELS TO BE SPECIFIED UNDER SEC-C)

☐ REQUIRED☒ NOT REQUIRED

PAINT TYPE

☒ EPOXY ENAMEL☐ EPOXY POWDER COATED OR BETTER

MIMIC (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)☐ RAL 7032

SHALL BE DECIDED DURING DETAILED ENGINEERING

FINISH (EXTERNAL)

☐ MATT☐ GLOSSY☐ SEMI GLOSSY

PANEL COLOUR (INTERNAL)

☐ WHITE☐ CREAM☐ OFF WHITE

SHALL BE DECIDED DURING DETAILED ENGINEERING

FINISH (INTERNAL)

☐ MATT☒ GLOSSY☐ SEMI GLOSSY

SHALL BE DECIDED DURING DETAILED ENGINEERING



DATA SHEET FOR LOCAL PANELS FOR COLTCS

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

VOLUME

SECTION

REV. NO.

00

DATE: 25.04.2018

SHEET

2

OF

3

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)

CLASS OF PROTECTION

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

CONTROL HARDWARE

☐ RELAY BASED

FOUNDATION ARRANGEMENT

☐ FOUNDATION BOLTS ☐ ANCHOR FASTENERS

WEIGHT OF PANEL (Kg.)

.....(Vendor to specify)

PANEL TYPE

☐ PRESSURISED ☒ UNPRESSURISED

As per Requirement

CABLE GLAND

☒ DOUBLE COMPRESSION

AMMETER (TYPE OF INPUT)

☐ 1 Amp CT ☐ 4-20 Ma

NOT REQUIRED BELOW 30KW.

SCOPE OF SUPERVISION FOR
ERECTION & COMMISSIONING☐ APPLICABLE☐ NA

NAME
DESIGNATION
SIGNATURE
DATE

PREPARED BY

CHECKED BY

APPROVED BY

COMPANY SEAL

NAME:

SIGNATURE:

DATE:



DATA SHEET FOR LOCAL PANELS FOR COLTCS

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

VOLUME

SECTION

REV. NO.

00

DATE: 26.04.2018

SHEET

3

OF

3

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)		
	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 FOR SELF CLEANING STRAINERS

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

VOLUME

SECTION

REV. NO.

00

DATE: 26.04.2018

SHEET

3

OF

3

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:

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 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 1100V 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

Supply	Description	Consumer
L.V. Supply (i)	415V, 3Ø, 3W, 50 Hz Effectively earthed	Motors above 0.2kW upto 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	Lighting, Space heating, A.C supply for Control & 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 :

Voltage	:	± 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
---------	---	------------

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

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 | : | ± 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 | : | 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

- 1.00.00 **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 - tong 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 atleast 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 &

- accessories as required for completeness of the system.
- 2.01.02 The design shall conform to the EN ISO 11064 (Ergonomical design of Control Room), Part 1, 2 and 3.
- 2.01.03 The exact dimensions, material, construction details, grounding, general arrangement etc. shall be as per actual requirement and shall be finalized during detail engineering and subjected to Owner's approval.
- 2.01.04 Incoming power supply feeders shall be duplicated. Alarm shall be provided for failure of a power supply feed.
- 2.01.05 For Control desk/ panel mounted instruments/ devices etc. which are to be powered from UPS, all required conversion of interface equipments/ accessories to make such devices compatible with UPS supply shall be provided. All necessary hardware like input switches/ fuse unit for each feeder as well as switch fuse unit for each instrument/ device on the power supply line shall be provided. From UPS redundant feeders shall be provided with suitably rated MCB and provision of fast auto changeover of UPS feeders.
- 2.01.06 Crating of the panels and desks shall be suitable for protection against shock, vibration, inappropriate handling and inclement weather conditions during transportation and warehousing. Mounted equipment shall have adequate protection against damage during handling, transit and storage. Suitable desiccant shall be used inside the packing case.
- 2.01.07 Nameplate
- a) Nameplate shall be provided for instrument or device mounted on the panel.
 - b) Nameplates for panels shall be provided both in front and rear.
- 2.02.00 CONTROL DESK
- 2.02.01 Control desk shall be free standing, floor mounting, table top type with doors at back and shall be constructed of 3 mm thick (minimum) CRCA steel or Aluminium extrusion. Aluminium structure shall be anodized or powder coated paint finish. The top surface of control desk shall be 30 mm (minimum) thick with the top 12 mm (minimum) of acrylic solid surface and the remaining 18 mm of laminated medium density fibre (MDF) board.
- 2.02.02 Monitors with retractable keyboard shall be provided on the desk. Desk shall be arranged in arc-like shape without any sharp edges. Edges shall be extruded PVC or rounded post-formed laminate.
- 2.02.03 Desks shall be of modular, scalable and industrially ruggedized design and shall have connections for PA system handsets & telephone sets.
- 2.02.04 Desks shall have concealed cable trays for wire dressing. Both Horizontal & Side Managers (2 separate horizontal cable routing wire baskets for power & data cables) shall be provided.

Each User station will be provided with 2 separate power distribution units (1 for Main line & 1 for UPS line). Each power distribution unit will have 6 points of 5/13 Amp sockets, Mains MCB On/Off Switch & Indicator.

Adequate heat management provision for Exhaust of heat from within the Console Desk Assembly shall be provided. There will be multiple fans provided in the Main Control Desk. Each Fan will be of 230 VAC 250 CFM Ball Bearing based. Ventilation louvers will be provided on both Front & Rear Modesty with special Air Filters. Adequate space for CPU & Other equipments placed with in the desk.

2.02.05 Design shall include Earthing bolts.

2.02.06 Back installed items shall be suitably concealed from front view.

2.02.07 All operator workstations for SG, TG, Auxiliaries & Off-site Plants shall be mounted on this Control Desk. The cabling / wiring between OWS & CPUs, power supply cables etc. shall be aesthetically routed and concealed from view.

2.02.08 HARDWIRED DEVICES ON CONTROL DESK (DRAW OUT SECTION)

Release and Lamp Test push buttons shall be provided for a set of push buttons (decided during detail engineering stage). Depending on the type of control/ function, required number of push buttons/ indicating LEDs & their color, push button stations shall be selected. The size of push button stations shall be 24 x 48 mm or 25 x 50 mm and shall have service inscription details at the front. Emergency push buttons (with cover) shall be mounted on top of Control Desk.

2.03.00 BACK UP PANEL

2.03.01 Construction shall be from CRCA steel of thickness not less than 3mm.

2.03.02 Upright back-up panel shall be provided where hardwired devices shall be mounted on a mosaic grid type console. The mosaic grid tiles shall be of 24 mm x 48 mm (or 25 mm x 50 mm) size, made of heat & flame retardant, self extinguishing and non-hygroscopic material with flat matt finish without glare and non reflecting type.

2.03.03 DDCMIS Back-up Panel (referred as Unit Control Panel-UCP) shall also mount annunciation fascia (minimum 500 nos.) and the flame monitoring cameras along with other hardwired devices as decided during detail engineering stage by Owner. Color coding shall also subject to Owner's approval.

2.03.04 Colored Mimic for different Off-site plant control systems (as enumerated elsewhere in this specification) and hardwired annunciation system shall also

be mounted on the back up panels.

2.04.00 PANELS/CABINETS

2.04.01 All DDCMIS 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 Coal 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 ISMC – 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 tack 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 work station 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 CWS/LVS etc. in control room. For each PC / workstation / monitor at least one chair shall be included.

2.05.03 CHAIRS

Industry standard revolving chairs with wheels and with provision for adjustment of height (hydraulically/gas lift) shall be provided for the operators, unit-in-charge & other personnel in control room area. These shall be designed for sitting for long duration such that these are comfortable for the back.

2.05.04 TABLES

Industry standard computer tables shall be provided & shall be as approved by Owner during detailed Engineering. Glass top teak wood horse shoe shaped table with vertical file mounting arrangement (two layers to house approx. 40 Nos of files and lockable drawers at both ends) for Engineering Room shall be provided.

2.05.05 ALMIRAHs

Steel Almirahs shall be provided for keeping documents in the documentation room. Glass doors for each rack shall be provided such that the documents are visible from outside. Size of the rack shall be sufficient to easily fit technical manuals. The exact details shall be approved by Owner during detailed Engineering.

2.05.06 KEYPAD

One keypad per unit shall be provided for the storing of keys of relevant areas of the unit in the control room.

2.05.07 LOCKERS

Suitable lockers shall be provided in the room adjacent to the control room for storing of personal articles of control room personnel. Also, lockers of bigger size shall be provided in documentation Room for storing of personal documents. Details shall be finalized and approved by Employer during detailed engineering.

3.00.00 LVS PANEL

3.01.00 An arc shaped Large Video Screen (LVS) panel shall be supplied for mounting large video screens in number of tiers in various Control rooms as specified elsewhere in this specification.

Bidder shall provide and fix ACP cladding around the LVS screen including covering the LVS back side and LVS stand. The cladding will be from floor finish to 600 mm above LVS screen like a self-standing partition with necessary openings for system requirement. ACP paneling shall be with 304 grade & approx. 0.5 mm mirror finish SS strip.

3.02.00 The profile, dimensions and the general arrangement shall be finalized & approved by Owner during detailed engineering. Recommendations, if any, for the control room lighting in order to ensure continuous proper viewing of the LVS screen by the operator & shift incharge (without any fatigue) shall be

- clearly brought out by the Contractor in his offer, alongwith 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 bulkhead plates of thickness not less than 6 mm shall be mounted at the racks with suitable high temperature gasket. Impulse lines within the enclosures shall be properly clamped.
- 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 CRCA 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 / fiberglass 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 : 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.

- g) Bidder's scope of work shall also include cabling from trans-receiver units to local junction box or electrical unit; providing air purge connection up to trans-receiver units and routing of air lines up to the required point with valves, air filter regulators, pneumatic lines.
- h) Field mounted electronic unit (if any) shall be installed on site fabricated stands/ stanchions/ enclosures.
- 3.01.10 Ambient Air Quality Monitoring System
- Bidder's scope of work shall include erection and commissioning of Analysers, Metrological monitoring system, DAS, AAQMS station etc.
- 3.01.11 Steam and Water Analysis System (SWAS)
- a) The scope of work shall include installation of panels and the skid mounted equipment; connecting incoming sample lines / cooling water lines to the sample conditioning panel bulkhead, laying of cooling water lines up to and inside SWAS room; connecting drain headers to the nearest system drain, installation of the chilled water compressor system with associated cooling water and chilled water connection to the bath/ heat exchangers, insulation of chilled water lines; laying of all special / prefab cables, mounting of instruments / equipment in position.
- b) Bidder shall take care in handling the pre-tubed and pre-wired panel sections during transportation and installation.
- c) The general guidelines for installation of SWAS panels shall be as per panel erection specification , written elsewhere in this specification.
- 3.01.12 CHP Related Instruments
- Instruments like Zero Speed Switch, Belt Sway switch, Pull Cord Switch, Chute Jam Switch , Belt Weighing System , Coal Bunker level transmitter etc. shall be installed and commissioned as per good engineering practice.
- 3.02.00 Local Panels, Racks, Cubicles, Gauge Boards and Enclosures
- Local racks, panels, gauge boards, cubicles shall be installed at specified locations as indicated in layout drawings. Work shall also include fabrication and installation of gauge boards, stands, mounting brackets and frames, drain headers etc. with associated painting and civil work.
- a) Bidder shall erect panels / cubicles / enclosures etc. only after ensuring availability of work front.
- b) The panels shall be issued from warehouse or storage yard on the same day when the actual erection is performed.
- c) Panel, once uncrated, must be installed on the same day.
- d) Panels supplied in packed condition, will be properly slinged for lifting. When lifting unpacked panels eye-bolts shall be used. Unpacking should be done at store or installation site only.
- e) During slinging or lifting of the panel, care shall be taken not to damage the structure or any instrument/equipment mounted on the panel.
- f) Panels shall be slowly lowered on its foundations and shall not be subjected on unnecessary jerk or bounce.

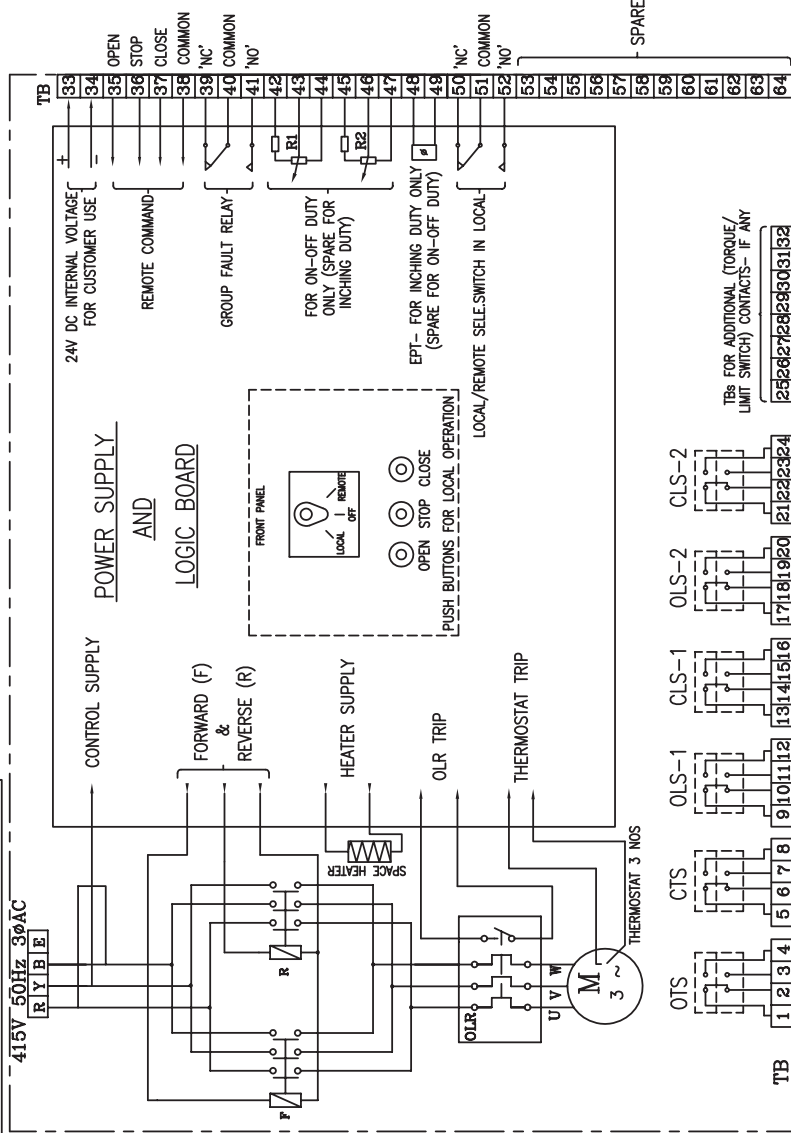
- g) Prior to the installation of panels, the foundation shall be inspected for presence of foreign matters and existence of possible defects or damage. Positions, shape and dimensions of the foundation shall be verified against corresponding drawing. Pockets for grouting shall normally be on the concrete base. Bidder shall arrange anchor bolts or grouting spikes and grout the same in the pocket.
- h) Accurate center lines and auxiliary lines shall be marked-off with due consideration of proper alignment and level. Base channel of panel shall be dismantled from the panel and shall be positioned and set by grouted anchor bolts. Before fixing the bolts, the panels must be properly aligned and plumbed. Only brass shims may be used for leveling of the panels. Leveling of panel should be done by the help of spirit level or similar device.
- i) Bidder shall arrange to provide suitable protective coverings for the panels since unpacking and after erection to avoid any damage due to movement of men and materials in the vicinity.
- j) Retouching work of painted surface of panels shall be carried out wherever required.
- k) During installation of panels and panel instruments the panels must be kept in perfectly clean condition.
- l) All panels shall be suitably earthed as per guidelines furnished in the specification.
- m) Only construction power shall be utilized during erection of panels. Under no circumstances power lines shall be tapped-off from the panels.

3.02.01 Junction Boxes and Pull Boxes

Bidder's scope of erection of junction boxes shall include mounting in appropriate locations indicated in the drawings, fabrication of necessary supports, pedestals, brackets, frameworks etc., for erection and final painting of the structures.

- a) Before installation, gland plates shall be drilled / knock-outs shall be removed.
- b) As required, pedestals may be fabricated and grouted / bolted to structure.
- c) Unused knock-outs in the junction boxes shall be left plugged to prevent dust and moisture entry.
- d) Necessary nuts, bolts, screws, fixtures etc. for mounting and supporting shall be supplied by Bidder.
- e) Identification tags for cables shall be provided near the junction boxes close to the glanding point. All junction boxes shall be engraved with junction box number and inside the box on the side cover the tag no, description of tag and termination details shall be engraved in black letters. Wherever required, Bidder shall arrange to perform retouching of paint on the junction boxes. Proper identification numbers shall be labeled on the junction boxes for ease of identification.
- f) Wherever required, Bidder shall arrange to perform retouching of paint on the junction boxes. Proper identification numbers shall be labeled on the junction boxes for ease of identification.

DRAWING NO. 3-V-MISC-24227



NOTE:-

1. 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
2. CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE)
3. OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN)
4. OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN
5. CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE
6. EPT - ELECTRONIC POSITION TRANSMITTER
(Contactless , FOR INCHING DUTY)
7. R1-R2-POTENTIOMETER 2 x 100 OHMS (FOR ON-OFF DUTY)
8. FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
9. M - MOTOR 3Ø 415V 50 Hz AC SUPPLY

SWITCH TERMINALS FOR CUSTOMER USE

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	OPEN
	11-12	STOP
CLS-1	13-14	CLOSE
	15-16	COMMON
OLS-2	17-18	OPEN
	19-20	STOP
CLS-2	21-22	CLOSE
	23-24	COMMON
SWITCH NO.	TERMINAL NO.	INTERMEDIATE POSITION
	a	b
FULL OPEN	FULL CLOSE	FULL CLOSE

INDICATES CONTACT CLOSED
INDICATES CONTACT OPEN

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

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)				

TYPE OF PRODUCT ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS
OR NAME OF CUSTOMER/PROJECT (DRAWN FOR INTERMEDIATE POSITION OF VALVES)



BHARAT HEAVY ELECTRICALS LTD.,
UNIT: HIGH PRESSURE BOILER PLANT,
TRUCHIRAPALLI-620014.

DEPT	VL	SCALE	WEIGHT (KG)	REFERENCE INFORMATION	NO. OF TIMES
365-121					

CODE	CODE	CODE	CODE	CODE	CODE

TITLE	WIRING DIAGRAM (TERMINAL PLAN)	CARD CODE	DRAWING NO.	REV

FOR ACTUATOR WITH INTEGRAL STARTER	U 01	3-V-MISC-24227	0
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	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR COLTCS	

**TECHNICAL SPECIFICATION
(CONTROL AND INSTRUMENTATION)
FOR COLTCS**



	2x660 MW UDANGUDI STPP (UNIT#1&2)	DESG	PJ
	JOB NO: 435	CHKD	MK
REV. NO. 00	DATE: 15.10.2018	APPD	BS

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR COLTCS	

**SPECIFIC TECHNICAL REQUIREMENTS
(C&I)**

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR COLTCS FOR 2X660 MW UDANGUDI STPP

- 1.1 The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. The Vendor list/ sub-vendor list shall be subject to BHEL / Customer approval during contract stage. No commercial implication in this regard shall be acceptable.
- 1.2 These requirements are to be read in conjunction with detailed Technical specification enclosed in the specification. In case of any conflict and repetition of clauses in the specification, the more stringent requirement as per interpretation of Customer shall prevail without any commercial implication. No deviations shall be acceptable.
- 1.3 Drawings/Documents and data to be furnished after award of the contract as per deliverables list attached elsewhere in the specification.
- 1.4 All local gauges as well as transmitters and sensors for parameters like pressure, temperature, flow etc. as required for the safe and efficient operation and maintenance under the scope of specification shall be provided. The necessary root valves, impulse piping, drain cock, gauge-zeroing cocks, valve manifolds, instrument racks and all the other accessories required for mounting / erection of these local instruments, transmitters and sensors shall be supplied by bidder even if not specifically asked for. Also the proposal shall include the necessary cables, flexible conduits, instrument racks, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg / Cm².
- 1.5 All local gauges, transmitters and sensors shall be mounted on suitable enclosures, Instrument racks (LIR) in bidder's scope subject to Customer's approval.
- 1.6 Type of control system shall be DDCMIS (Station C&I) based, located in Central Control Room in BHEL scope. Field instrumentation for the package is in bidder's scope.
- 1.7 The local control cum starter panel in bidder's scope shall be NEMA 4X. Suitable canopy on top shall be provided for the panel.

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR COLTCS FOR 2X660 MW UDANGUDI STPP

- 1.8 Push buttons and indication lamps for Open/Close and Start/Stop of drives/equipment's shall be provided on the starter panel. Remote and local indication, indicating lamps / LED cluster for instruments/drives/equipment's status and critical alarms shall be provided on the starter panel. Nos. shall be decided during detailed engineering.
- 1.9 Colored MIMICS on the panel is to be provided as per system flow diagram. No. of facia on Starter panel shall be decided during detailed engineering.
- 1.10 Bidder to terminate all instrumentation and control elements in the control panel for further cabling to DDCMIS by BHEL.
- 1.11 All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. The enclosures of all electronic instruments shall conform to IP-65 unless otherwise specified (Explosion proof for NEC article 500, class 1, Division 1 area & flame proof) and an anticorrosive paint shall be applied to the field mounted enclosures / instruments. All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland. Gaskets, Fasteners, Counter and mating flange shall also be included wherever required with the field instruments.
- 1.12 Sea or saline water media is applicable for the project. The minimum requirement for sea water or saline water media is as below:
- a. Instruments shall be suitable for sea or saline water application. MOC of impulse tubing and impulse pipe shall be CPVC (3/8") Sch 80 or better, Industrial grade up to manifold. MOC of impulse tubing, fittings (from manifold to instrument) and manifold shall be Super Duplex stainless steel.
 - b. MOC of all wetted parts, fittings, sampling pipes, tubes, fittings, diaphragm and all types of erection hardware of instrument/drives/equipment, shall be Duplex stainless steel or better suitable for sea or saline water application.

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR COLTCS FOR 2X660 MW UDANGUDI STPP

- 1.13 Epoxy coated painting is required for all I & C equipment.
- 1.14 All valve actuator shall be provided with conventional actuators with integral starter for ON/OFF valves. Non-contact type electronic 2-wire position transmitters shall be provided for all inching type motorized valves and dampers. The detailed specification of actuator is given elsewhere in the specification.
- 1.15 Differential pressure indicators & Differential pressure Transmitters across COLTCS shall be provided with independent impulse & isolation valves. Remote & Local indication DP transmitters & gauges across COLTCS shall be provided.
- 1.16 All the transmitters and gauges shall have remote seal type having 15m capillary length minimum.
- 1.17 All the instruments/equipment's/electrical items shall be provided & designed with maximum star rating as available in line with energy conservation policies notified by BEE, GOI at the time of supply.
- 1.18 All primary instruments shall be with protection class of IP 65 or better.
- 1.19 Transmitter should not be mounted directly on the manifold, Manifold shall be non-integral and standalone type.
- 1.20 LVDT type instrument is not acceptable.
- 1.21 All limit switch shall be conforming to IEC-60947-5-1.
- 1.22 Each switching element including the limit and torque switches of valve actuators shall be provided with minimum two SPDT OR DPDT contacts each for close, open and adjustable.
- 1.23 All transmitters shall be smart and electronic type, microprocessor based and HART compatible. All instruments should be supplied with valid calibration and test certificates provided by OEM.
- 1.24 The system shall be provided with annunciation system. It shall be an integral part of the control system. All the field contact shall be acquired through control system. The annunciation sequence/ logic shall conform

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR COLTCS FOR 2X660 MW UDANGUDI STPP

- 1.25 to ISA sequence ISA-2A. The window lamps for the system shall be driven through output modules of the control system.
- 1.26 For plug in type instruments, the plug & sockets shall be polarized to prevent wrong connections and have facility for secure coupling in plug-in position to prevent loose connections.
- 1.27 Signal/Electrical connection shall be screwed connection with double compression type Nickel-plated brass cable glands.
- 1.28 All the field instruments shall also be provided with SS tag nameplate.
- 1.29 Cable scope shall be referred in Electrical scope sheet attached in the Electrical portion of the specification.
- 1.30 Push buttons and indication lamps for Open/Close and Start/Stop of drives/equipment's shall be provided on the starter panel in Bidder's scope. Remote and local indication, indicating lamps / LED cluster for instruments/drives/equipment's status and critical alarms shall be provided on the starter panel. Nos. shall be decided during detailed engineering.
- 1.31 Mandatory spare list shall be referred in 'List of mandatory spares' attached elsewhere in the specification and shall be supplied by bidder.
- 1.32 Power Supply Requirement:
415 V, 3 phase AC power supply shall be provided by Customer for the local control cum starter panel at a single point. Further any electrical distribution shall be in bidder's scope. Any other voltage requirement to be arranged/derived by bidder by providing suitable control transformer. Starter panel in bidder's scope shall have provision for redundant feeder with fast automatic changeover.

**SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR COLTCS FOR 2X660 MW UDANGUDI STPP**

- 1.33 Bidder shall provide an unlimited warranty on all equipment and software for three years after the start of the warranty period, i.e. after satisfactory completion of initial operations. This warranty shall include repair, replacement or correction of identified software or hardware discrepancies at no cost to owner.
- 1.34 Bidder to delegate /depute their persons/experts as per Customer's requirement.
- 1.35 Bidder must offer general tools and tackles and special calibration instruments required during start-up, trial run, operation and maintenance of the system.
- 1.36 The technical requirements for instruments/ equipment's/panels mentioned in the specification are minimum requirements. Items not specifically mentioned and required for the completeness of the system shall be supplied by bidder.

2.0 Requirements for flanged remote seal diaphragm:

Maximum pressure rating: To meet 200 percent of process pressure,
Availability of seals: for both high and low pressure sides with capillary connection in case of differential pressure measurements.
Single Capillary connection for pressure transmitters.
Capillary length: 15.0 m
Fill fluid: Suitable oil
Process connection size: 1 inch
Flange size and Accessories: As per process requirement.
Flange pressure rating: Required Class (ANSI)
Process fluid temperature: 25°C to 60°C
Diaphragm and wetted part material: Suitable for sea water (Duplex SS or better)
Flushing option: To be made available with 1/4 inch (necessary drain and gasket suitable for sea water application to be provided).
Snubbers /Pulsation dampeners shall be used where the process media is unstable for measurement such as the discharge of a pump.

SCOPE MATRIX - CONDENSER ONLOAD TUBE CLEANING SYSTEM (COLTCS)		
S.No.	PROJECT	2X660 MW UDANGUDI STPP
1	SYSTEM APPLICABLE: CONDENSER ONLOAD TUBE CLEANING SYSTEM (COLTCS)	Y
2	SYSTEM CONFIGURATION: UNITISED OR COMMON OR AS APPLICABLE	UNITISED
3	CONTROL SYSTEM	REFER NOTE-1
4	LOCATION OF CONTROL SYSTEM	
5	CONTROL SYSTEM SCOPE (BIDDER /BHEL/ CUSTOMER)	
6	CONTROL FROM PUSH BUTTONS ON LOCAL CONTROL CUM STARTER PANEL	Y; REFER NOTE 4
7	ANNUNCIATION ON LOCAL CONTROL CUM STARTER PANEL (Y/N) -- IF Y, MIN NO. OF HARDWIRED ALARMS / INDICATIONS	Y; REFER NOTE-5
8	MIMIC ON LOCAL CONTROL CUM STARTER PANEL (Y/N)	Y; REFER NOTE-6
9	POWER SUPPLY AVAILABLE FOR BALL MONITORING SYSTEM IN BIDDERS'S SCOPE (24V DC / 110 V AC UPS / 230 V AC UPS)	To be finalised during detailed Engineering
10	PROTECTION CLASS FOR LOCAL CONTROL CUM STARTER PANEL	IP-55 and above
11	ACTUATOR WITH INTEGRAL STARTER (Y/N)	Y
12	DPG/ DPT PER COLTCS SYSTEM *	DIFFERENTIAL PRESSURE TRANSMITTER = 2 nos. (Across each Filter) DIFFERENTIAL PRESSURE GAUGE = 1 no. (Across each Filter)
13	SEA WATER APPLICATION	Y

	NOTES:
1	Type of control system shall be DDCMIS (Station C&I) based, located in Central Control Room in BHEL scope. Field instrumentation and local control cum starter panel for the package are in bidder's scope of supply.
2	For each Unit , each side of COLTCS system- Left & Right, shall be supplied with its local control cum starter panel and its MIMIC and annunciator for its operation. Extent of MIMICs and annunciators shall be decided during detailed engg.
4	Push buttons and indication lamps for Open/Close and Start/Stop of drives/equipments shall be provided on the local control cum starter panel. Remote and local indication, indicating lamps / LED cluster for instruments/drives/equipments status and critical alarms shall be provided on the local control cum starter panel. Nos. of indication shall be decided during detailed engineering.
5	No. of facia on local control cum starter panel shall be decided during detailed engineering.
6	Colored MIMICS on the panel is to be provided as per system flow diagram.
8	415 V, 3 phase AC power supply shall be provided by BHEL at a single point for the local control cum starter panel. Further any electrical distribution shall be in bidder's scope. Any other voltage requirement to be arranged/derived by bidder by providing suitable control transformer. local control cum starter panel in bidder's scope shall have provision for redundant feeder with fast automatic changeover.
9	Bidder to terminate all instrumentation and control elements in the local control cum starter panel for further cabling to DDCMIS.
10	Following documents shall be provided by bidder during detailed engineering for approval: a. Input/Output list, Drives list, b. Instrument datasheets and check lists/Quality plan, c. Panel external/internal GA drawing and termination details, d. Panel datasheet and QAP e. Recommended control logics / Control philosophy . f. Complete cable schedule & cable interconnection details
11	All the instruments along with necessary fittings, accessories and valve manifold etc., instrument rack and junction boxes, erection hardware shall be in bidder's scope of supply.
12	LIR (Instrument Rack) to be provided for mounting the instruments in the field.
13	Cable for local wiring, between field instruments to local control cum starter panel shall be screened with 1.5 mm2 minimum and shall be in bidder's scope. Refer 'electrical scope sheet between BHEL and bidder' attached in electrical specification for cable scope.
14	Mandatory spare list shall be referred in 'List of mandatory spares' attached elsewhere in the specification and shall be supplied by bidder.
15	*Instruments, root valves, impulse pipe shall be suitable for sea water application having corrosion resistance where media is sea water. The minimum requirement for Sea water application is: all wetted parts & diaphragm shall be suitable for sea water (Duplex Stainless Steel or better).

16	All the transmitters and gauges shall have remote seal type having 15 m SS armoured capillary length.
17	Open/close limit switch feedback of valves are to be connected to DCS for remote viewing and for interlock & protection.
18	The Vendor list/ sub-vendor list shall be subject to BHEL / Customer approval during contract stage.
19	The technical requirements for instruments mentioned in the specification are minimum requirements. Items not specifically mentioned and required for the completeness of the system shall be supplied by bidder without any implication.
20	Bidder to provide 2 Nos soft connection from BOM & BRM to DCS showing number of ball count. Hardware and software required for connectivity shall be provided by bidder for implementation in DCS.

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR COLTCS	
SPECIFICATION FOR MEASURING INSTRUMENTS (PRIMARY & SECONDARY), TRANSMITTERS,		



E. Pressure Gauge and Differential Pressure Gauge

- | | | |
|---------------------------|---|--|
| 01. Type | : | Bourdon/Bellows/Diaphragm |
| 02. MOC Sensing & Socket | : | AISI-316 SS |
| 03. Movement Material | : | AISI-304 SS |
| 04. Case Material | : | Stainless steel casing bayonet type. Enclosure IP-65. |
| 05. Dial Size | : | Generally 150 mm (100 mm for SWAS gauges) |
| 06. Scale | : | Black lettering on white background in 270 Deg. arcs. |
| 07. Window | : | shatterproof toughened glass |
| 08. Range Selection | : | Normal process pressure – 50 ~ 70 % of range (approximately). |
| 09. Over-range Protection | : | 125% of maximum range by internal stop. External stop at zero |
| 10. Adjustment | : | Micrometer screw for zero adjustment. Internal micrometer screw for range adjustment. |
| 11. Element Connection | : | Argon welding |
| 12. Process Connection | : | 1/2" NPT (M) Bottom connection for local mounting, back connection for panel mounting. |
| 13. Performance | : | Accuracy of ± 1.0 % of span or better for Pressure gauge |



- Accuracy of ± 1.6 % of span or better for Differential Pressure gauge
- | | | | |
|-----|-------------------------------|---|--|
| 14. | Operating ambient Temperature | : | 0 - 50 °C |
| 15. | Safety Feature | : | Blow out disc. /diaphragm at the back |
| 16. | Accessories | : | a) Snubbers and Glycerin filled for pulsating fluid applications and at pump discharge.
b) Stainless steel 316 Diaphragm with Teflon coated seals for corrosive, viscous and solid-bearing or slurry type process fluids.
c) 3-Way stainless steel Gauge cock for pressure gauges. Process connection 1/2" NPT.
d) 5-valve SS316 manifold constructed from barstock for differential pressure gauge. Process connection 1/2" NPT.
e) Union, nut & tail piece and other Installation accessories as required. |
| 17. | Applicable standard | : | IS-3624 / 1996 |
| 18. | Electrical Contact rating | : | 240V, 5A AC/ 220V, 0.5A DC (for gauges with alarm contact). Number of Contacts:2 SPDT |
| 19. | Nameplate | : | Tag number, service engraved in stainless steel tag plate |

**B. Differential Pressure Transmitter**

- | | | | |
|-----|------------------------------------|---|--|
| 01. | Working Principle | : | Smart |
| 02. | Type | : | 2-Wire |
| 03. | Output signal | : | Simultaneous transmission of digital and 4-20 mA DC signal isolated linear standard protocol -HART. |
| 04. | Signal Processing Unit | : | Silicon solid-state electronic circuitry |
| 05. | Measuring element | : | Capsule/Diaphragm |
| 06. | Measuring element Material | : | AISI-316 (Stainless Steel) |
| 07. | Static Pressure/ Overload Pressure | : | Maximum line (or static) pressure on either side without permanent deformation or loss of accuracy |
| 08. | Turn-down ratio | : | 100: 1 minimum |
| 09. | Span and Zero | : | Locally adjustable, non-interacting |
| 10. | Enclosure class | : | IP-65 (Explosion proof for NEC Class-1, Division 1 area) |
| 11. | Zero suppression / Elevation | : | At least 100% of Span |
| 12. | Output Indicator (Digital display) | : | LCD type in % and Engineering units |
| 13. | Nameplate | : | Tag number and Service engraved in stainless steel tag plate |
| 14. | Body | : | Forged Carbon Steel (SS for DM Water) |
| 15. | Ambient temperature | : | 0 - 85 °C |
| 16. | Operating Voltage | : | 18 - 36 Volts DC |
| 17. | Load | : | 750 Ohms at 24 Volts DC |
| 18. | Performance:- | | |
| | i) Accuracy | : | ± 0.025 % of calibrated span or better |
| | ii) Repeatability | : | ± 0.05 % of calibrated span or better |
| 19. | Sealing/Isolation | : | 6 meters SS armoured capillary with suitable fill fluid and flange remote seal diaphragm of SS 316 or suitable material as per application, for corrosive, viscous and dirty fluid application. Flange size and pressure rating as per application. |
| 20. | Accessories | : | a) Universal mounting bracket suitable for 2" pipe and wall mounting.
b) High tensile carbon steel U-bolts.
c) Installation accessories as per relevant installation drawing.
d) Syphons for steam and hot water services.
l) ½" NPT 5-valve stainless steel manifold, constructed from SS316 bar stock.
e) Companion flange with nuts, bolts and gaskets.
f) Hand held configurator kit for diagnosis and calibration of Smart Transmitter.
g) ¾" ET cable gland |



- h) Flushing facility at process end diaphragm.
- i) Reverse polarity protection required.

Notes

- .
1) Differential pressure transmitters of the capacitance type, regardless of the applied service, shall be capable of withstanding a differential pressure equal to full process pressure on either side of the measurement element without damage or loss of calibration.
- .
2) Differential pressure transmitters will be supplied with integral mounted three valve manifolds for air service and 5 way valve manifold for steam & water service.
- .
3) Response time for pressure and differential pressure transmitter shall be 100 ms.



VOLUME II
SUB-SECTION 4.21
C&I ERECTION

1.0.0 TECHNICAL REQUIREMENT

1.1.0 Panels

Panels and control desk shall be freestanding type and fabricated preferably from 2.5 mm thick cold rolled steel sheet. Angle iron framework shall use a minimum section of 50 × 50 × 6 mm angle. The finish shall include sand blasting, grinding, chemical cleaning, and surface finishing by suitable filter and two coats of high-grade lacquer with wet sanding between coats. Two coats of paint in panel color shall be given for non-glossy high stain finish. Panel face final color in general shall be RAL 7035. A final coat of paint shall be given at site.

Panels and control desk shall have removable hinged doors, generally at the back for easy maintenance and accessibility of the instruments. Doors shall be double leaved type with handle and shall be provided with lock and key. Adequate illumination shall be provided inside the panel. All light fittings shall be suitable for 230V, 50Hz A.C.

The local panel construction shall be suitable for the site condition and shall meet IEC requirements in accordance with electrical area classification. Pressurization or purging shall be as per NFPA 496 or equivalent.

No process fluid except air shall be piped to the control panel.

Mounting heights

1. Annunciators (top row)
2. Miniature and subminiature instruments (next 3 rows)
3. Electric push buttons (last row)

Control room panels shall have IP protection of IP 32 if mounted in an air- conditioning room and IP-45 if mounted inside a room and IP-55 if mounted outside.

**D. CONTROL BOARD****I. Control Desk / Console / Panel Construction**

- | | | |
|--------------------------------|---|--|
| 01. Applicable for | : | Indoor Panel, Desk & console. |
| 02. Material of construction | : | Cold rolled steel sheet (Metal and plastic - Heat resistant, shrinkage free for mosaic tiles). |
| 03. Thickness of Sheet | : | a) 3.2 mm for faces supporting instruments / terminals.
b) 2 mm for other sides and top. |
| 04. Construction | : | Welded throughout as per (metallic parts) approved National Standards. |
| 05. i) Corners | : | 7 mm inner radius |
| ii) Dimensional Tolerances | : | a) In height & length - 3 mm
b) In height between adjacent sections - 2 mm.
c) Total for a group - 6 mm |
| 06. Doors | : | Double, recessed, turned back edges |
| i) Thickness of Sheet | : | 2 mm |
| ii) Hinges | : | Stainless steel |
| iii) Door latches | : | Three point type |
| iv) Door gaskets | : | Neoprene rubber on fixed frame to result dust proof / weatherproof enclosure. |
| v) Opening of the doors | : | Outward |
| vi) Louvers | : | With removable wire mesh to ensure dust and vermin proof. |
| 07. Color of interior | : | Glossy white |
| 08. Colour external | : | IS 5 No. 628 (Typical) [To be decided later] |
| 09. Protection of painting | : | Plastic peel coating |
| 10. Gland plates | : | Removable 4 mm thick (bottom) |
| 11. Cable entry | : | Bottom |
| 12. Hardware | : | a) Vibration dampeners
b) Predrilled base channel ISMC - 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) Power supply points 5/15 A plug point with indication lamp 5 Nos. |
| 13. Enclosure Protection Class | : | IP-42 or as per environment condition. |
| 14. Earthing | : | 4 per standards |



1.8.0 **Junction Boxes**

Bidder shall supply junction boxes wherever required. These shall be of Industrial grade Fibre glass Reinforced Polyester (FRP) to weather proof, with cable entering on bottom and side entry shall be provided.

These boxes shall have terminals suitable for min 2.5 mm² cable termination (klip on) mounted on rails. 30% spare terminals shall be supplied in each junction box.

Junction box shall be provided with double compression glands.

Telephone socket shall be provided in junction boxes. Each junction box shall have a minimum of 20% or 2 nos., whichever is more, spare entry duly provided with plugs (weather proof/explosion proof, as applicable). Protection class shall be IP-65 minimum for JB and enclosures.

In general junction boxes shall be designed in accordance with NEC, Article 370, paragraphs 18, 19 and 20 or equivalent standards. Junction boxes for use in outdoor or damp locations shall be galvanized malleable iron or steel coated inside and outside. The enclosure shall conform to NEMA-4 with hinged door lockable type. Conduit and cable shall enter the lower portion of the box in such a manner that all terminals strips are above conduit entry points.

08. Junction Boxes

Type
Enclosure

: Flame proof/weather proof
: IP-65/Explosion/Flame Proof as per area
classification.



Material	:	FRP with protective Coating
Cable entry	:	Bottom or Side
Cable glands	:	Double compression type – Nickel plated brass with PVC hoods.
Mounting	:	Indoor/Outdoor
No. of terminals	:	As required with standardization with 20% spare of each size & type.
Terminals	:	Phoenix/Wago (screw less cage clamp type spring loaded)
Grounding	:	Two terminals for body and shield ground
Door	:	Hinged, lockable type.

Suitable mounting clamps and other accessories shall be in scope of bidder.

The brackets, bolts, nuts, screws, glands, lugs required for erection shall be of brass, included in bidder scope of supply. High voltage & insulation resistance test shall also be conducted.

M6 Ni plated Brass earthing stud shall be provided (external 2 nos. internal 1 no.)
Gasket (Normal)- Neoprene thickness 6.0 mm

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR COLTCS	

LIST OF DOCUMENTS/DELIVERABLES

C&I DELIVERABLES LIST FOR COLTCSFOR 2X660 MW UDANGUDI PROJECT

Sl.No.	DRAWING NO.	DRAWING/DOCUMENT TITLE	CATEGORY
INSTRUMENTATION			
1	PE-V9-412-165-I901A	INSTRUMENT DATA SHEETS	A
2	PE-V9-412-165-I902A	BOQ	I
3	PE-V9-412-165-I903A	INSTRUMENT QP / CHECK LIST	A
RELAY BASED LCP			
1	PE-V9-412-165-I950A	LOCAL CONTROL PANEL DATA SHEET	A
2	PE-V9-412-165-I951A	WIRING DIAGRAM	A
3	PE-V9-412-165-I952A	PANEL EXTERNAL GA DRAWING (INCLUDING FOUNDATION DETAILS & FLOOR CUT-OUT)	A
4	PE-V9-412-165-I953A	PANEL INTERNAL GA DRAWING	A
5	PE-V9-412-165-I954A	PANEL FRONT VIEW DRAWING	A
6	PE-V9-412-165-I955A	LIST OF HARDWIRED SIGNAL EXCHANGE WITH DDCMIS	A
7	PE-V9-412-165-I956A	BILL OF MATERIAL	I
8	PE-V9-412-165-I957A	LOCAL CONTROL PANEL QUALITY PLAN	A
9	PE-V9-412-165-I958A	RELAY BASED PANEL O & M MANUAL	I

NOTES:

- 1) ANY OTHER DOCUMENT DECIDED DURING DETAILED ENGINEERING SHALL BE PROVIDED BY BIDDER WITHOUT ANY COMMERCIAL/TECHNICAL IMPLICATION.
- 2) CONTRACTOR TO SUBMIT REUSABLE DATABASE FORMATS IN BHEL/CUSTOMER APPROVED FORMATS LIKE MS EXCEL, MS ACCESS OF DOCUMENTS LIKE INSTRUMENT SCHEDULE, I/O LIST, DRIVE LIST, FIELD JB TERMINATION S, CABLE SCHEDULE & INTERCONNECTION, etc. SOFT COPY OF FORMATS SHALL BE PROVIDED TO SUCCESSFUL BIDDERS.

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR COLTCS	
DATA SHEETS FOR MOTORISED VALVE ACTUATOR		



SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SPECIFICATION NO.:

VOLUME II B

SECTION D

REV. NO. 01

DATE: 06.08.18

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	2 X 660 MW UDANGUDI TPP	
	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 -20 to 70 DEG C AND RELATIVE HUMIDITY OF 0-95% IN HOT HUMID AND TROPICAL ATMOSPHERE AND HIGHLY POLLUTED AT PLACES OF COAL DUST AND FLY DUST	
	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, DUST TIGHT SUITABLE FOR OUTDOOR USE WITHOUT CANOPY, NEMA6/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 90% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING SERVICE - 150 STARTS/HR MINIMUM.	
HANDWHEEL	* 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)	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) A: ☐ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ☒ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram	
	COLOUR SHADE	☐ BLUE (RAL 5012) ☒ SIEMENS GRAY RAL 7030	
	PAINT TYPE (## Refer Notes)	☐ ENAMEL ☒ EPOXY ☐	
	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 +/- 10%, 3 Phase, 3 Wire 50HZ +/-5%	
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☒ 110 V	



SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SPECIFICATION NO.:

VOLUME II B

SECTION D

REV. NO. 01

DATE: 06.08.18

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)

	@ ENCLOSURE CLASS OF MOTOR	☐ IP 68 ☐ FLAME PROOF		
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B		
	@ WINDING TEMP PROTECTION	☒ THERMOSTAT (3 Nos., 1 IN EACH PHASE) ☐ -----		
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED		
INTEGRAL STARTER	INTEGRAL STARTER	☒ REQUIRED ☐ NOT REQUIRED		
	TYPE OF SWITCHING DEVICE	☒ CONTACTORS(Reversing type) ☐ THYRISTORS		
	TYPE	☒ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)		
	IF SMART			
	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-STOP-CLOSE PB(running open/close LED) THREE POSITION SELECTOR SWITCH	☒ REQUIRED ☐ NOT REQUIRED		
	INDICATING LAMPS	☒ REQUIRED ☐ NOT REQUIRED		
	LOCAL-OFF- REMOTE S/S(THREE POSITION SELECTOR SWITCH)	☒ REQUIRED ☐ NOT REQUIRED		
	STATUS CONTACTS FOR MONITORING	☒ REQUIRED ☐ NOT REQUIRED		
INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (MOTOR THERMOSTAT TRIP/O/L RELAY OPERATED, CONT. /POWER SUPPLY FAILED, S/S IN LOCAL/REMOTE/OFF MODE, TORQUE SWITCH OPEN/CLOSE CUT OFF/STOP PB OPTD.)			
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	☐ INTERPOSING RELAY ☒ OPTO COUPLER ☐ EITHER		
	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	10A 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 Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN : INT : CLOSE	☒ 2 Nos. 2 nos(adj) 1 No.	☒ 2Nos.	
	CONTACT TYPE	2 NO + 2 NC		
	RATING (AC / DC)	10A 240V AC AND 0.5A 220V DC		



**SPECIFICATION
FOR
MOTORISED VALVE ACTUATOR**

SPECIFICATION NO.:

VOLUME II B

SECTION D

REV. NO.

01

DATE: 06.08.18

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)

POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)	REQUIRED for regulating/inching duty only.	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ☒ ELECTRONIC (2 WIRE) contactless inductive type	
	SUPPLY	☒ 24V DC ☐	
	OUTPUT	☒ 4-20mA	
	ACCURACY	± 1% FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY (NON INTEGRAL)	240V 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 @ ☐ NEMA6	
	@ EARTHING TERMINAL	REQUIRED	
	PLUG & SOCKET(9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	☒ REQUIRED ☐ NOT REQUIRED ☒ 2 NOS. ☐	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:-----	
	@ SPACE HEATER CABLE GLAND	SIZE:-----	
	OTHER CONTROL CABLE GLANDS-1	☐ 1No. for BFV of CW PUMP(Cable size 2Px1.5mm2)	
	OTHER CONTROL CABLE GLANDS-2	1 no suitable for 8P X 0.5 sq mm Additional 1 no suitable for 2P X 0.5 sq mm(inching duty only)	



SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SPECIFICATION NO.:

VOLUME II B

SECTION D

REV. NO. 01

DATE: 06.08.18

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)

WEIGHTTOTAL WEIGHT (ACTUATOR +
ACCESSORIES)

BIDDER TO SPECIFY

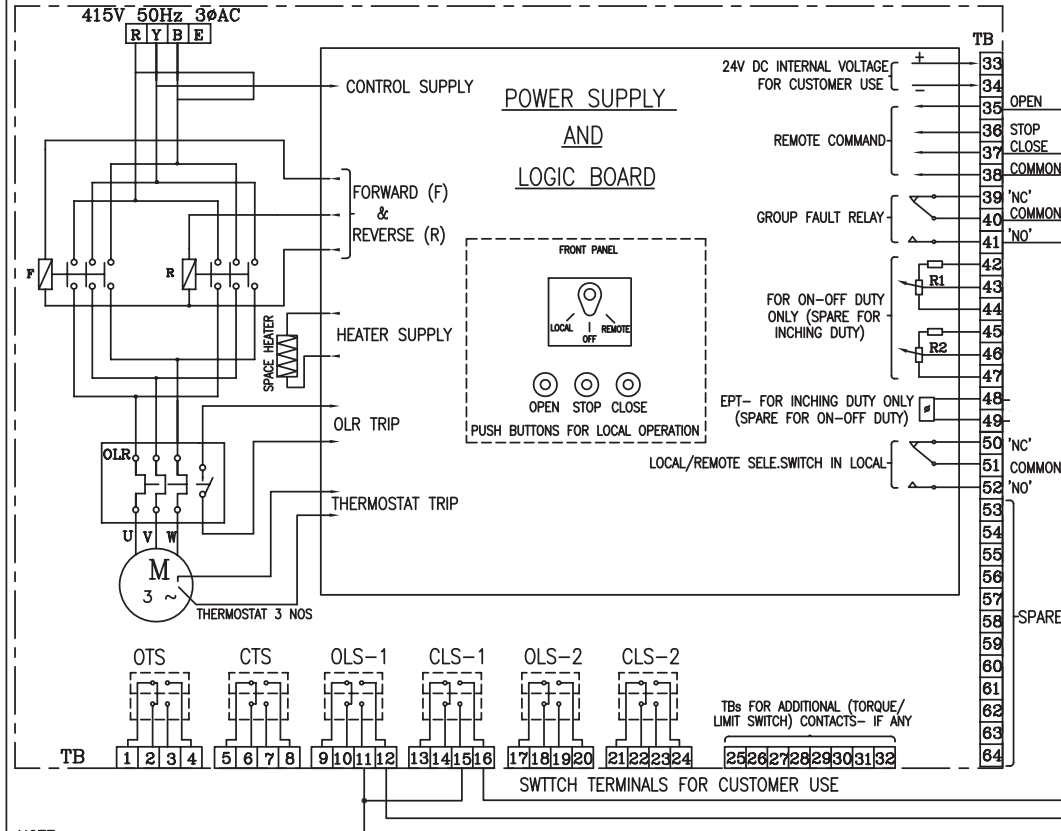
_____ Kg.

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 AND IS-4722
 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 OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
 7. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.
- \$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.**
- ## EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.**
8. IT SHOULD BE POSSIBLE TO OPERATE THE ACTUATOR LOCALLY. LOCKABLE LOCAL/REMOTE SELECTION SHALL BE PROVIDED ON THE ACTUATOR.
 9. POSITION INDICATOR SHALL BE PROVIDED FOR 0 TO 100 % TRAVEL
 10. WIRING SHALL BE SUITABLE VOLTAGE GRADE COPPER WIRE 1.5 SQ. MM.
 11. 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.
 12. THE ACTUATORS SHALL BE DESIGNED TO BE SELF-LOCKING UPON LOSS OF POWER. MOTOR SHALL BE DESIGNED TO CLOSE IN 30 SECS. FROM FULL OPEN POSITION AND SHALL HAVE ADEQUATE CAPACITY TO OPEN AND CLOSE UNDER FULL UNBALANCED DESIGN PRESSURE.
 13. THE INTEGRAL STARTER WHICH SHALL HAVE SOPHISTICATED ELECTRONIC CONTROLS WITH FIELD PROGRAMMING FEATURE. IT SHALL BE DESIGNED FOR REMOTE CONTROL FROM DCS/RESPECTIVE CONTROL SYSTEM. REQUIRED INTERPOSING RELAYS FOR RECEIVING OPEN/CLOSE/STOP COMMAND FROM DCS/RESPECTIVE CONTROL SYSTEM SHALL BE PROVIDED. POTENTIAL FREE CONTACTS AND TRANSDUCERS SHALL BE PROVIDED TO PROVIDE STATUS INDICATION AT REMOTE DCS/RESPECTIVE CONTROL SYSTEM.
 14. THE REMOTE COMMAND SIGNAL (OPEN-STOP-CLOSE) FROM DCS/RESPECTIVE CONTROL SYSTEM/CONTROL PANEL SHALL BE ISOLATED FROM CONTROL ELECTRONICS THROUGH OPTO-ISOLATOR.
 15. THE FOLLOWING INDIVIDUAL STATUS ANNUNCIATION LED'S (COLOUR-GREEN) SHALL BE PROVIDED LOCALLY (INTEGRAL TO ACTUATOR) TO ANNUNCIATE THE FOLLOWING FOR EASY LOCAL MONITORING.
 ACTUATOR IN LOCAL MODE
 ACTUATOR IN REMOTE MODE
 ACTUATOR RUNNING IN OPEN DIRECTION
 ACTUATOR RUNNING IN CLOSE DIRECTION
 ACTUATOR IN INCHING MODE.
 ACTUATOR IN SELF-RETAINING MODE
 LIMIT SWITCH OPEN TRIP
 LIMIT SWITCH CLOSE TRIP
 CONTROL VOLTAGE AVAILABILITY
 16. AUTOMATIC PHASE CORRECTION FACILITY AND POTENTIAL FREE CONTACT FOR ANNUNCIATION OF POWER FAILURE SHALL BE PROVIDED.

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

@= TO BE FILLED BY ES

3-V-MISC-24283
DRAWING NO.

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 INCHING DUTY)
- R1-R2-POTENTIOMETER 2 x 100 OHMS (FOR ON-OFF DUTY)
- FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
- M - MOTOR 3φ 415V 50 Hz AC SUPPLY
- TORQUE SWITCH BYPASS WITH LIMITSWITCH BOTH ON OPEN & CLOSE DIRECTION TO BE DONE INTERNALLY.

REV	DATE	ALTERED
		CHD & APPD

CAUTION: The information on this drawing 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

ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS

2 X 800 MW UPPUR TPP

(DRAWN FOR INTERMEDIATE POSITION OF VALVES)



BHARAT HEAVY ELECTRICALS LTD.,

UNIT: HIGH PRESSURE BOILER PLANT.

TIRUCHIRAPALLI-620014.

365-121

DEPT

VL

CODE



SCALE

NTS

WEIGHT (KG).

-

TITLE

WIRING DIAGRAM (TERMINAL PLAN)

FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET

DRN
CHD
APPDNAME
N.P.ESWAR
D.DINAKARAN
K.ARUNACHALAMSIGN
N.P.
D.D.
K.A.DATE
17.03.05
17.03.05
17.03.05NO. OF
VAR.
-
-

REFERENCE INFORMATIONS

-

DRAWING NO.

3-V-MISC-24283

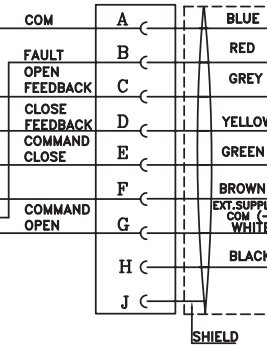
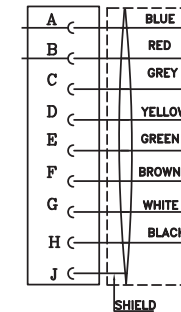
REV

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CONTACT DEVELOPMENT DIAGRAM

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

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

9 PIN PLUG & SOCKET
(FOR ALL ACTUATORS)9 pin PLUG & SOCKET
(FOR ALL ACTUATOR)

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)				



SECTION-3.17: ELECTRICAL ACTUATORS

1.0.0 INTENT OF SPECIFICATION

This section covers the requirements of motor operated electrical actuators.

2.0.0 CODES AND STANDARDS

The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest edition (including amendments) of the applicable Indian Standards (IS), IEC publications and other codes except where modified and /or supplemented by this specification.

3.0.0 TECHNICAL REQUIREMENTS

3.1.0 Electric actuators shall be provided as specified in Mechanical and C&I section. It shall be equipped with 3 phase induction motor, rated for S2-15 minutes duty for ON/OFF valve and intermittent duty for inching duty

3.2.0 Motor shall be class F insulated with temperature rise limited to class B. Motor shall be of class H insulation with temperature limited to class B used for high pressure and high temperature valves.

3.3.0 Motor shall be surface cooled designed for enclosure protection class of IP 67. Motor shall be suitable for starting direct on-line.

3.4.0 For installation in potentially hazardous areas, the actuators shall have suitable explosion proof / flame proof type enclosure.

3.5.0 Actuators shall be suitable for operation at an ambient temperature of 50 degree C and relative humidity of 95%.

3.6.0 Maximum continuous motor rating shall be atleast 10% above the maximum load derived of the driven equipment under entire operating range including voltage & frequency variation.

3.7.0 Motors shall be capable of operating under following supply variations without exceeding its guaranteed temperature limits.

- Frequency variation : (+) 3% and (-) 5% of 50 Hz
- Voltage variation for LT motors : (±) 10% of 415 V
- Combined variation of voltage and frequency: 10% (absolute sum)

3.8.0 All actuators shall be of integral type. Duty cycle of actuators shall suit the system requirement. The actuators shall be capable of giving the required torque at the output shaft. The actuators shall be designed to take the full thrust.

3.9.0 Electrical Actuators of Inching type position transmitters of non contact type shall be interfaced to DCS.

3.10.0 Actuators shall be of totally enclosed weather proof and dust proof construction with NEMA-6/IP 65 enclosure and shall be suitable for outdoor application without the necessity for a canopy. The actuator shall be suitable for mounting directly on the valve. The actuator shall be capable of giving the required torque, rpm and thrust without the help of any spur gear arrangement. The actuator shall be suitable for mounting in any position. **Actuators shall be provided with integral starters.**



- 3.11.0 The actuator shall be complete with motor, reduction gears, change gears, terminal compartment, switch compartment with limit switches and torque switches, local position indicator, position transmitter for remote position indicator, thermistor, space heaters, cable glands, mechanical position indicator, hand wheel for manual operation, valve attachment etc.
- 3.12.0 Each actuator shall have a hand wheel fitted on it for emergency operation. The hand wheel shall be designed such that it is declutched automatically when the power supply to the motor is restored. The material of the hand wheel shall be either malleable iron or steel. The hand wheel shall have adequate clearance from housing for each gripping and operation. Actuators offered shall be with self-locking worm.
- 3.13.0 Two number adjustable torque switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts shall be provided. It is required to have calibration for the torque switches so that the switches can be easily set to any value desired.
- 3.14.0 Two numbers of position limit switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts shall be provided. Two auxiliary limit switches (one for open and one for close) with 2 NO and 2 NC potential free contacts shall also be provided. The limit switches shall be of independently adjustable type. Limit switches and actuating mechanism shall be rust proof suitable for damp atmospheres. Limit switch compartment shall be weather proof and spacious enough for easy setting. The limit switches shall be suitable for the following ratings, both 240 Volts AC, 10 A and 220 V DC, 0.5 Amps.
- 3.15.0 Each actuator shall have a space heater in the limit switch compartment suitable for 240 V AC 50 Hz single phase supply.
- 3.16.0 The wiring from the limit switches, torque switches etc. shall be brought out in a separate terminal box of adequate size, so as to easily terminate the control cables.
- 3.17.0 Actuators shall be supplied with integral starter which shall have sophisticated electronic controls with field programming feature. It shall be designed for remote control from DCS/Respective control system. Required interposing relays for receiving open/close/stop command from DCS/Respective control system shall be provided. Potential free contacts and transducers shall be provided to provide status indication at remote DCS/Respective control system..
- 3.18.0 A three position selector switch (marked as LOCAL-OFF-REMOTE) and push buttons OPEN-STOP-CLOSE (for local operation) with indication lamps for running OPEN and running CLOSE shall be provided.
- 3.19.0 The Remote command signal (OPEN-STOP-CLOSE) from DCS/Respective control system/Control panel shall be isolated from control electronics through opto-isolator.
- 3.20.0 The following individual sStatus annunciation LED's and fault annunciation LED's shall be provided locally (Integral to actuator) to annunciate the following for easy local monitoring.
- Actuator in local mode
 - Actuator in remote mode
 - Actuator running in OPEN direction
 - Actuator running in CLOSE direction
 - Actuator in inching mode.
 - Actuator in self-retaining mode
 - Limit switch OPEN trip
 - Limit switch CLOSE trip
 - Control voltage availability
- 3.21.0 The following individual fault annunciation LED's (Colour-Red) shall be provided locally. (Integral to Actuator)



- Torque switch OPEN
- Torque switch CLOSE
- Thermo switch trip
- Electronic overload relay trip
- Motor single phasing
- Common fault (Inclusive of any one or combination of above fault)

3.22.0 View port shall be provided on integral starter unit to monitor the above status annunciation and fault annunciation.

3.23.0 Electronic Overload relay shall be provided to trip actuator in case of overload. Plug in connections/design shall be provided between:-

- Integral starter unit and basic actuator
- Between external customer connections and actuator.

3.24.0 OPEN-CLOSE indication /LED shall be provided for indication of full open/close position.

3.25.0 Automatic phase correction facility and potential free contact for annunciation of power failure shall be provided.

3.26.0 The following individual potential free relay contacts shall be provided in the actuator for remote annunciation to facilitate continuous monitoring of the actuator.

- Actuator (valve) running in OPEN direction.
- Actuator (valve) running in CLOSE direction.
- Actuator in remote mode.
- Actuator in local mode.
- Actuator power switched off /single phasing.
- Torque switch trip, thermo switch trip and overload relay trip

4.0.0 TESTING AND INSPECTION

Equipment offered shall be of type tested and proven type. Routine tests shall be carried out for all the equipment as per applicable standards. Copies of certified reports of all tests carried out at the works shall be furnished.

The following minimum tests/ checks shall be conducted at site. Any other tests/ checks as per the manufacturer's recommendation shall also be carried out.

- Measurement of insulation resistance.
- Measurement of full load current.
- Test running of the motors.

5.0.0 DRAWINGS & DOCUMENTS

The following drawings and documents shall be submitted for approval during detail engineering stage.

- Integral starter details
- Technical particulars of actuator
- Wiring diagram
- General arrangement drawings
- Test reports
- Manufacturing quality plan
- Field quality plan

	2x660 MW UDANGUDI STPP DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER FOR DEBRIS FILTER		SPECIFICATION NO.: PE-TS-XXX-145-I100	
			VOLUME	
			SECTION	
			REV. NO. 00	DATE: 12.10.2018
			SHEET 1	OF 2
TAG No. Qty.....			Data Sheet No.: PES-145-01-DS1-0	
Data Sheet A & B				
DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
	MANUFACTURER			
	MODEL NUMBER			
TECHNICAL	TYPE	☐ CAPACITANCE ☐ SILICON RESONANCE TYPE	SMART TRANSMITTER OF ELECTRONIC TYPE, MICROPROCESSOR BASED, HART COMPATIBLE	
	POWER SUPPLY	☐ 24V DC NOMINAL		
	TRANSMITTER MEASUREMENT	☐ PRESSURE ☐ DIFF. PRESSURE		
	OUTPUT SIGNAL	☐ 4 to 20 m Amp. DC		
	NO. OF WIRE	☐ TWO		
	ACCURACY	☐ ± 0.04% of span or better		
	LINEARITY, HYSTERESIS, DEAD BAND AND REPEATABILITY	☐ ± 0.05 % of span or better		
	STABILITY	☐ ± 0.1 % OF URL FOR 10 years		
	SENSITIVITY	☐ ± 0.05% OF SPAN		
	<u>MATERIAL</u>	THE MINIMUM REQUIREMENT FOR SEA WATER APPLICATION : ALL WETTED PARTS & DIAPHRAGM SHALL BE SUITABLE FOR SEA WATER (DUPLEX SS OR BETTER)		
	A) BODY	☐ 316 SS		
	B) ELEMENT	☐ 316 SS		
	C) DIAPHRAGM	☐ 316 SS		
	C) SEAL	☐ TEFLON		
	FLANGED REMOTE SEAL DIAPHRAGM	AS REQUIRED		
	CAPILLARY LENGTH	☐ MINIMUM LENGTH OF 15 M REQUIRED		
	CONTINUOUSLY ADJUSTABLE SPAN AND ZERO ADJUSTMENT PROVIDED	☐ YES, Locally adjustable, non-interacting ☐ NO		
	MOUNTING	☐ WALL/PIPE STAND ☐ INSTRUMENT RACK		
	ENCLOSURE	☐ NEMA-4 ☐ NEMA-7 ☐ IP-65 WITH CORROSION RESISTANCE EPOXY COATING		
	PAINT	☐ EPOXY COATING FOR ALL C&I EQUIPMENT ☐ Anticorrosive paint shall be applied to field mounted enclosures / instruments.		
TURN DOWN RATIO	☐ 100:1 in general			

	2x660 MW UDANGUDI STPP DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER FOR DEBRIS FILTER			SPECIFICATION NO.: PE-TS-XXX-145-I100	
				VOLUME	
	SECTION		REV. NO. 00		DATE: 12.10.2018
	SHEET 2 OF 2				
	TAG No. Qty.....			Data Sheet No.: PES-145-01-DS1-0	
Data Sheet A & B					
DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (TO BE FILLED BY PURCHASER)				DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
	INSULATION RESISTANCE		TO BE SPECIFIED BY BIDDER		
	OVER PRESSURE		■ 150% OF MAX. OPR. PRESS		
	ZERO SUPPRESSION/ ELEVATION RANGE		■ At least 100% of Span		
	INTEGRAL INDICATOR		■ YES, LCD indicator (5 digit) with scale of Engg. unit ☐ NO		
	RESPONSE TIME		■ 150 msec.		
	TRANSMITTER SHALL BE ABLE TO DRIVE LOAD IMPEDANCE OF 500 OHMS(min.) WITH DRIVE CAPABILITY OF 600OHMS NOMINAL		■ YES ☐ NO		
	ELECTRICAL CONNECTION		■ PLUG & SOCKET TYPE		
	PROCESS CONNECTION		■ 1/2 " NPT (F)		
	ZERO & SPAN DRIFT		■ ± 0.015 % PER DEG.C AT MAX. SPAN ■ ± 0.11 % PER DEG.C AT MIN. SPAN		
	DIAGNOSTICS		■ SELF INDICATING FEATURE		
	<u>MANIFOLD</u>				
	a)	PRESSURE MEASUREMENT	■ 2 WAY ■ MATERIAL: 316 SS		
	B)	DIFFERENTIAL PRESSURE MEASUREMENT	■ 5 WAY ■ MATERIAL: 316 SS		
	CABLE ENTRY DETAIL		SUITABLE FOR DIA OF 17.5 mm		
	NOTES: 1. TRANSMITTERS SHOULD NOT BE MOUNTED DIRECTLY ON MANIFOLD. MANIFOLD SHOULD BE NON-INTEGRAL AND STAND ALONE TYPE. 2. TRANSMITTERS TO BE EQUIPPED WITH MOUNTING BRACKETS. 3. ALL THE FIELD INSTRUMENTS SHALL BE PROVIDED WITH SS TAG NAME PLATE.				
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL NAME SIGNATURE DATE	

	2x660 MW UDANGUDI STPP DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER	SPECIFICATION NO.: PE-TS-XXX-145-I100	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE: 12.10.2018
		SHEET 1	OF 2
TAG No. Qty.....		Data Sheet No.: PES-145-01-DS2-0	
Data Sheet C			
DATA SHEET-C FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)			
MANUFACTURER			
MODEL NUMBER			
TYPE			
POWER SUPPLY			
TRANSMITTER MEASUREMENT			
OUTPUT SIGNAL			
NO. OF WIRE			
ACCURACY			
LINEARITY, HYSTERESIS, DEAD BAND AND REPEATABILITY			
STABILITY			
SENSITIVITY			
<u>MATERIAL</u>			
A)	BODY		
B)	ELEMENT		
C)	DIAPHRAGM		
C)	SEAL		
CONTINUOUSLY ADJUSTABLE SPAN AND ZERO ADJUSTMENT PROVIDED			
MOUNTING			
ENCLOSURE			
PAINT			
TURN DOWN RATIO			
INSULATION RESISTANCE			
OVER PRESSURE			
ZERO SUPPRESSION/ ELEVATION RANGE			

	2x660 MW UDANGUDI STPP DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER	SPECIFICATION NO.: PE-TS-XXX-145-I100	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE: 12.10.2018
SHEET 2 OF 2			
TAG No. Qty.....		Data Sheet No.: PES-145-01-DS2-0	
Data Sheet C			
DATA SHEET-C FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)			
INTEGRAL INDICATOR			
RESPONSE TIME			
TRANSMITTER SHALL BE ABLE TO DRIVE LOAD IMPEDANCE OF 500 OHMS(min.) WITH DRIVE CAPABILITY OF 600OHMS NOMINAL			
ELECTRICAL CONNECTION			
PROCESS CONNECTION			
ZERO & SPAN DRIFT			
DIAGNOSTICS			
<u>MANIFOLD</u>			
b) PRESSURE MEASUREMENT			
B) DIFFERENTIAL PRESSURE MEASUREMENT			
CABLE ENTRY DETAIL			

	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL NAME SIGNATURE DATE
NAME				
SIGNATURE				
DATE				

	2x660 MW UDANGUDI STPP DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE FOR DEBRIS FILTER		SPECIFICATION NO.: PE-TS-435-145-I100	
			VOLUME	
			SECTION	
			REV. NO. 00	DATE: 12.10.2018
			SHEET 1	OF 3
TAG No. Qty.....			Data Sheet No.: PE-DC-999-145-I026	
Data Sheet A & B				
DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL	MANUFACTURER			
	MODEL NUMBER			
TECHNICAL	PRESSURE ELEMENT	☐ BOURDON ☐ DIAPHRAGM ☐ BELLOW		
	MATERIAL	THE MINIMUM REQUIREMENT FOR SEA WATER APPLICATION : ALL WETTED PARTS & DIAPHRAGM SHALL BE SUITABLE FOR SEA WATER (DUPLEX SS OR BETTER)		
	A) BELLOW	☒ 316 SS		
	B) BOURDON TUBE	☒ 316 SS		
	C) MOVEMENT	☒ 316 SS		
	D) CASE ENCLOSURE	☒ 316 SS		
	E) PROTECTIVE DIAPHRAGM	☒ TEFLON COATED SEALS		
	ENCLOSURE	☒ IP-65 OR BETTER		
	DIAL	SIZE: ☐ 100MM ☒ 150MM WITH SHATTER PROOF GLASS COLOR: WHITE NUMERALS: BLACK SCALE: ☒ LINEAR, 270 DEG ARC GRADUATED IN METRIC UNITS		
	CASE	COLOUR : BLACK		
	MOUNTING	☒ LOCAL/FRAME MOUNTED ☒ INSTRUMENT RACK		
	OVER RANGE PROTECTION	☐ 115% OF MAX. OF SCALE ☒ 150% OF MAX. OF SCALE		
	CAPILLARY LENGTH	☒ MINIMUM LENGTH OF 15 M REQUIRED		
	BLOW OUT DISC	☒ REQUIRED WITH OPEN FRONT CONSTRUCTION OF SUITABLE MATERIAL		
	SWITCHING FACILITY (if applicable)	☒ YES ☐ NO		
TYPE	☐ MICRO SWITCH ☐ OTHER			
NO. / TYPE OF CONTACTS	2 NOS. SPDT			
CONTACT RATING	5A 230V AC, 0.25A 220V DC			
SETTING RANGE	FIELD ADJUSTABLE OVER FULL RANGE;			
RANGE SELECTION	COVERS 125% OF MAX. OF SCALE			
REPEATABILITY	± 1% OF FSR			
POWER SUPPLY	☐ 230V AC ☐ 110V AC			
	OVER RANGE TEST	TEST PR. FOR THE ASSEMBLY SHALL BE 1.5 TO THE MAX. DESIGN PRESSURE AT 38 DEG C.		
	ZERO/ SPAN ADJUSTMENT	☒ MICROMETER SCREW EXTERNAL FOR ZERO ADJUSTMENT ☒ MICROMETER SCREW INTERNAL FOR RANGE ADJUSTMENT		

	2x660 MW UDANGUDI STPP DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE FOR DEBRIS FILTER			SPECIFICATION NO.: PE-TS-435-145-I100	
				VOLUME	
				SECTION	
				REV. NO. 00	DATE: 12.10.2018
TAG No. Qty.....			Data Sheet No.: PE-DC-999-145-I026		
Data Sheet A & B					
DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE (TO BE FILLED BY PURCHASER)				DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
PERFORMANCE	ACCURACY	± 1% OR BETTER OF FULL SCALE DEFLECTION			
CONNECTION	PROCESS	½ " NPT (M)			
	LOCATION	☐ BACK ☐ BOTTOM			
ACCESSORIES	NAME PLATE / METAL TAG	SS			
	MOUNTING	☐ WALL ☐ PIPE – U CLAMPS & BOLTS ☐ PANEL / RACK TO BE DECIDED DURING DETAILED ENGG.			
		3 WAY NEEDLE VALVE / MANIFOLDS PROTECTIVE SEPARATING, CHEMICAL SEAL DIAPHRAGM – FOR CORROSIVE LIQUID LINES Union, nut & tail piece and other Installation accessories as required. 3-Way SS316 Gauge cock for pressure gauges			
NAME				NAME	
SIGNATURE				SIGNATURE	
DATE				DATE	



2x660 MW UDANGUDI STPP

DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE

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SHEET 1 OF 2

TAG No. Qty.....

Data Sheet No.: **PE-DC-999-145-I026**

Data Sheet C

DATA SHEET-C FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

GENERAL	MANUFACTURER			
	MODEL NUMBER			
TECHNICAL	PRESSURE ELEMENT			
	MATERIAL			
	ENCLOSURE			
	DIAL			
	CASE			
	ADJUSTMENT			
	MOUNTING			
	OVER RANGE PROTECTION			
	BLOW OUT DISC			
	SWITCHING FACILITY TYPE NO. / TYPE OF CONTACTS CONTACT RATING SETTING RANGE REPEATABILITY POWER SUPPLY			
PERFORMANCE	ACCURACY			
CONNECTION	PROCESS			
	LOCATION			
ACCESSORIES	NAME PLATE / METAL TAG			
	MOUNTING			
	OTHER			
NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

**2x660 MW UDANGUDI STPP****SPECIFICATION FOR
LOCAL CONTROL CUM STARTER PANELS**

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

VOLUME II B

SECTION D

REV. NO. 00

DATE : 12.10.2018

SHEET 1 OF 5

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 Self-cleaning strainers.

2.0 CODES AND STANDARDS

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

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

- a) IS-6005 : 1998 : Code of practice for phosphating of iron and steel.
- b) IS-5 : 2007 : Colors for ready mixed paints and enamels.
- c) IS-1248:2003 : Direct Acting Indicating Analog Elec Measuring Instruments.
- d) IS/IEC 60947:Part 1:2004 : Low Voltage switchgear & control gear: Part-I (General Rules)
- e) IS-8828:1996 : Circuit breaker for household and similar installations.
- f) IS-13947 (Part-I):1993 : Low Voltage switchgear & control gear : Part-I (General Rules)
- g) ISA-18.1:1979 : Annunciator Sequences and Specification
- h) NFPA-496:2003 : Purged & Pressurized 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 550mm. The doors shall be provided with suitable stiffeners to prevent buckling. The handle shall be on the right side of the door. The door shall be removable type with concealed hinges to facilitate maintenance work. Suitable pocket inside the door shall be provided for keeping the drawings / documents. Double door shall be provided with suitable glass windows, as per the requirement.

3.1.7 3.1.6 Suitable neoprene gasket shall be provided on all doors and removable covers. Suitable ventilation system along with louvers shall be provided at bottom and top of the doors covered with removable wire mesh.

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3.1.7 The class of protection shall be in accordance with IP-42 unless otherwise specified 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 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.

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

3.2 Hazardous Area Panel Requirement

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

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

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

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

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

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

3.3 Control & Monitoring devices

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

3.3.2 Alarm Annunciator System

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

3.3.3 Relays

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

3.3.4 Timers

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

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



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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

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

4.3 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.

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.

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4.3.2 Type Tests

1. Enclosure Class Test

5.0 SPARES AND CONSUMABLES**5.1 Commissioning Spares and consumables**

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

5.2. Mandatory Spares

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

5.3. Recommended Spares

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

6.0 DRAWINGS AND DOCUMENTS**6.1** The bidder shall furnish the following documents in required number of copies along with the bid :

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

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

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

7.0 MARKING AND PACKING**7.1** Panel with all instruments / devices mounted on it shall be suitably packed & protected for the entire period of dispatch, 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 |



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DATA SHEET FOR LOCAL PANELS

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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	☒ 3.0 mm		
		OTHER	☒ 2.0 mm		
		DOOR	☒ 2 mm		
HEIGHT		☒ 2365 mm for stand-alone panels (THIS SHALL BE DECIDED BY BHEL DURING DETAILED ENGG.)			
	OTHER	☒ Load bearing sheet front shall have 3mm thickness			
TECHNICAL	INPUT POWER SUPPLY *		☐ 240V 50 Hz AC ☐ 220V DC ☒ 415V 3 PHASE Kindly refer Electrical scope sheet		
	(ANY OTHER POWER REQUIREMENT TO BE DERIVED FROM THIS SUPPLY ONLY)				
	NO. OF FEEDERS		☐ ONE ☒ TWO		
	STARTER WITH MCC		☒ REQUIRED ☐ NOT REQUIRED		
	IPR POSITION		☐ MCC ☒ CONTROL PANEL		
	CONTACT RATING OF RELAY		☒ 5 Amp, 230 V AC ☒ 0.25 Amp, 220V DC		
	CONTROL SUPPLY		☐ 10V AC ☐ 220V AC ☒ 220V DC ☐ Other. (As per requirement)		
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		☒ REQUIRED 10 nos. Actual no. shall be decided during detailed engg.		
	TEMP SCANNER (IF REQUIRED –NO. OF CHANNELS TO BE SPECIFIED UNDER SEC-C)		☐ REQUIRED ☒ NOT REQUIRED		
	PAINT TYPE		☒ EPOXY ENAMEL ☐ EPOXY POWDER COATED OR BETTER		
	MIMIC (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) ☐ RAL 7032 SHALL BE DECIDED DURING DETAILED ENGINEERING		
	FINISH (EXTERNAL)		☐ MATT ☐ GLOSSY ☐ SEMI GLOSSY		
	PANEL COLOUR (INTERNAL)		☐ WHITE ☐ CREAM ☐ OFF WHITE SHALL BE DECIDED DURING DETAILED ENGINEERING		
FINISH (INTERNAL)		☐ MATT ☒ GLOSSY ☐ SEMI GLOSSY SHALL BE DECIDED DURING DETAILED ENGINEERING			

	2x660 MW UDANGUDI STPP DATA SHEET FOR LOCAL PANELS			SPECIFICATION NO.: PE-SS-999-145-054A	
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				SHEET 2	OF 3
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)	
	CLASS OF PROTECTION		☐ IP-42 (FOR INDOOR SERVICE) ☒ IP-55 (FOR OUTDOOR SERVICE) ☐ ANY OTHER		
	CONTROL HARDWARE		☐ RELAY BASED		
	FOUNDATION ARRANGEMENT		☐ FOUNDATION BOLTS ☐ ANCHOR FASTENERS		
	WEIGHT OF PANEL (Kg.)		(Vendor to specify)		
	PANEL TYPE		☐ PRESSURISED ☒ UNPRESSURISED As per Requirement		
	CABLE GLAND		☒ DOUBLE COMPRESSION		
	AMMETER (TYPE OF INPUT)		☐ 1 Amp CT ☐ 4-20 Ma NOT REQUIRED BELOW 30KW.		
	SCOPE OF SUPERVISION FOR ERECTION & COMMISSIONING		☐ APPLICABLE ☐ NA		
NAME DESIGNATION SIGNATURE DATE	PREPARED BY		CHECKED BY		APPROVED BY
					COMPANY SEAL NAME: SIGNATURE: DATE:



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DATA SHEET FOR LOCAL PANELS

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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)		
	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 MIMC THICKNESS OF MIMIC				
	PANEL COLOUR (INTERNAL)				
	FINISH (INTERNAL)				
	CLASS OF PROTECTION				
	CONTROL HARDWARE				
	FOUNDATION ARRANGEMENT				
	WEIGHT OF PANEL (Kg.)				

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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:

**QUALITY PLANS FOR
LOCAL CONTROL CUM STARTER PANEL**



STD QUALITY PLAN NO.: PE-QP-999-145-I056			
VOLUME	IIB		
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LEGEND: * CR - Critical characteristics \$ P - Agency Performing the Test. 1 - BHEL
MA - Major characteristics W - Agency Witnessing the Test. 2 - Vendor
MI - Minor characteristics V - Agency Verifying the Test. 3 - Sub-vendor

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



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LEGEND: * CR - Critical characteristics
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1 - BHEL
2 - Vendor
3 - Sub-vendor

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- 3 - Sub-vendor



PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.: PE-QP-999-145-I056	
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
		2. Surface defects	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
		3. IR / HV on Terminal Blocks	MA	Electrical	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
6.0	IN PROCESS Blanking / Bending / Forming	1. Dimensions	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
		2. Surface defects after bending	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	---	
7.0	Nibbling / Punching	1. Cutout Sizes	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
		2. Deburring	MA	Visual	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
8.0	ASSEMBLY Frame Assembly & Sheet fixing	1. Dimensions	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		2. Alignment	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		3. Welding Quality	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		4. Surface defects	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	

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STANDARD QUALITY PLAN FOR LOCAL CONTROL CUM STARTER PANEL

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

VOLUME IIB

SECTION D

REV. NO. **00** DATE: **28.03.2017**

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

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

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

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	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR COLTCS	
QUALITY ASSURANCE FOR INSTRUMENTS		



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

CHECK LIST FOR TRANSMITTER

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

Legend :

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

Note :

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



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

CHECK LIST FOR PRESSURE & DP GAUGE

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

Legend :

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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 %.
- 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 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	

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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.

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR COLTCS	
TYPE TEST REQUIREMENT		



VOLUME II
SUB-SECTION 4.22
C&I TESTING AND COMMISSIONING

1.0.0 ERECTION, FIELD TESTING AND COMMISSIONING

- 1.1.0 The Bidder shall select and adopt methods and procedures for equipment erection to suit the nature of equipment and erection, involved according to the best modern industrial practice and his own experience.
- 1.2.0 The Bidder shall arrange for the transportation and handling of cabinets and desks from stores to work site suitably without any damage. If any damage is observed before handling, this shall be brought to the notice of the OWNER
- 1.3.0 Before installation of cabinets and desks, the necessary openings and inserts required to be made on the floor by the Bidder shall be checked and then after proper alignment, the cabinets and desks shall be installed on the floor by the Bidder. All necessary civil work to be carried out for this shall be in Bidder's scope of supply. The cabinets and desks shall be cleaned by blowing air to remove dust or foreign particles.
- 1.4.0 Nameplates shall be installed for all the I&C equipments bearing the service description, instrument number and calibrated range.
- 1.5.0 The data base covering the instrument No. type, application, process parameters, range, set point, calibrated/feasible range & span, maximum admissible value, recommended periodicity of calibration, other information for all the instruments, final control elements etc., for the unit, BOP, etc., shall be given in soft form.
- 1.6.0 All cables shall be tested for insulation level. Cable ends shall be properly cleaned. The entry to and exit from pipes shall be smooth and free from burr where cables are run through pipes. Cable shall be pulled into the pipes in such a way that there shall be no damage to the cables. Flexible conduits shall be provided wherever necessary. Cable in hot areas shall have proper heat protection. A minimum distance of 300 mm shall be kept between instrument / signal cables and power cables. Each tray shall be filled with a maximum of two layers for instrument and control cables and one layer for power cables providing 20% spare space in the number of layers specified. Instrument Cable Trays, shall be erected vertically as far as possible to avoid dust accumulation. All the cables laid shall be tied individually to the Tray. Thermocouple cables shall be run completely independent of all other cables with minimum separation as per relevant standard and with cross over at right angles. The cabling accessories shall include terminal blocks, splicing materials, crimping tools, cable support grips, insulating tapes, GI flexible conduits, conduit fittings, GI perforated covered trays, supports, accessories, and cadmium plated trays & cable glands.
- 1.7.0 The Bidder shall get prior approval as per approved quality assurance plan of the Owner Representative before any installation work starts. If any work is carried out by the Bidder before prior approval from Owner Representative and modification is sought by Owner Representative later, then the work shall be redone by Bidder without any cost / material implications to the Owner Representative. Impulse / sample piping, air supply and pneumatic tubing, cable trays and equipment shall be supported rigid enough to prevent vibration and anchored sufficiently to prevent strains on equipment installed. Supporting clamps shall be provided at least at every one meter distance for better rigidity. Impulse / sampling piping shall be provided with adequate slope, (preferably 1:10). Hanger and supports shall be so installed as not to interfere with free expansion and contraction of the piping and tubing between anchors. Suitable vibration dampeners, etc., shall be provided wherever necessary. In addition, care shall be taken that the arrangement of impulse / sampling piping, air supply and pneumatic tubing from detrimental sagging, mechanical injury, abuse due to unusual



service conditions from sources other than those due to pressure, temperature and vibrations. All impulse lines of joints shall be welded type unless otherwise specified.

- 1.8.0 The Bidder shall set up his own instrument laboratory. The calibration equipment shall cover complete range and shall have the desired accuracy of less than 0.1% or better. The Bidder shall follow the standard procedures for calibration of various instruments and as set by the manufacturer of instruments and as instructed by the Owner including any requirements of field calibration. First, the calibrations shall be carried out independently by the Bidder and later in the presence of Owner who shall certify the same. Proper documentation in this regard shall be maintained and handed over to the Owner

- 1.9.0** All the instruments shall be calibrated for the entire range of the instrument for which it is designed. Calibration shall include test for repeatability. After first commissioning, the instruments shall be tested for calibration again to check whether the instrument maintains its zero and maximum of the range. All instruments and control equipment shall be calibrated to read correctly to the satisfaction of Owner. All switches shall be tested for the actuation of both normally open and normally closed contacts at the desired set points and also for the fixed / differential settings. All the float / displacer operated level switches shall be tested for the movement of the float and linkages to make to break the switch contacts by filling up with water before installation. For such tests, necessary testing set up required shall be arranged by the Bidder. Air leak tests shall be performed on all flue gas impulse / sample lines, air supply and pneumatic lines. Necessary equipment such as portable compressor, connecting pipes, materials, cables and test gauges shall be provided by the Bidder. All the welding shall be carried out as per the relevant codes with electrodes approved by the Engineer-in-Charge. Only qualified welders approved by the Engineer-in-charge shall carry out the welding. IBR grade of welder will be required wherever IBR grade welding is involved. After IBR welding, radiography as per the required standard to be done by qualified welder. All threaded joints shall be jointed using teflon tapes and no other pipe jointing compound shall be used except on higher temperature services where graphited sealing compounds shall be used. Brand of Teflon tape, insulation tape, graphite compound is to be approved by the engineer in charge. Tubing shall be bent with correct size tubing bender whenever possible to avoid the use of fittings. Tubing cutter shall always be used to cut tubing. The use of short length of tubing in long runs shall be avoided. All tubing shall be run in such a manner as to give the maximum protection against mechanical damage. Tubing runs shall be grouped together where possible. Tubing shall be arranged so that couplings can be tightened without disturbing lines. Pipes or tubes installed but not connected, shall have the ends closed in an approved fashion to prevent the entry of foreign material such as caps or plugs. All cables finally entering JB's / cabinets shall run through flexible PVC conduits for approximately 500mm. Field mounted instruments shall be mounted on brackets, subpanels, or placed on a suitable pedestal. They shall be easily accessible from grade, ladder or platform. All local indicators shall be readable from grade or operating level, and if used for manual control, shall be visible from the related valve. Wherever possible, local mounted instruments shall be mounted at approximately 1.35 meters (4' 6") above the platform or floor in an accessible position. When an instrument is located at a distance of 2.5 meters or more from its pressure connection, an additional block valve and a vent valve shall be provided adjacent to the instrument. Vent valves shall be arranged, if necessary, with drain lines to ensure that operation of these valves does not create a hazard. If the pressure piping is of such length that the isolating valve is inaccessible from the instrument location, a suitable valve shall also be fitted at the instrument itself. All pressure instruments shall be installed vertically. Those for steam must be tapped directly from above, for pressure transmitters and switches, there shall also be a condensing leg. The same applies to gas and vacuum measurements, but adequate provision should be made to ensure no condensation can take place along the line, i.e. the slope shall be adequate to drain any condensate back to the main lines (sloping upwards from the sensing point). Tapping points for liquids shall be made at an angle of 45° from the bottom of the main pipe and these are to be sloped downwards from the sensing point. An exception is made in the case of the tapping point for fuel oil or corrosive fluid in which the pressure instrument shall not have direct contact with the process fluid. Glycerine or other suitable liquid shall be used as a medium to separate the fuel oil from the pressure instrument. When the pressure impulse line



is liquid filled, the measuring unit shall be compensated for static head. The head correction shall be stated on the unit.

- 1.10.0 Pipes shall be bent using pipe benders and any hot bending will be totally rejected. Pipe shall be cut, using pipe-cutting devices. Hot cutting will not be allowed.
- 1.11.0 Hydro test shall be performed for all other impulse lines / sampling lines / sensors. Necessary equipment such as hydro test pumps and temporary piping to the required point, fill pump etc., materials such as temporary gaskets, miscellaneous fasteners, etc. tools and tackles including test pressure gauges, etc. are to be provided by the Bidder. For all electrical actuators of the valves, functioning, setting and performance of limit switches / torque switches of various positions shall be checked before and after installation of the actuators. The position transmitters for inching applications shall also be calibrated. Pneumatic actuators shall be calibrated at site. PG test points shall be provided on the process line at various location by the Bidder.
- 1.12.0 Chipping of foundations, alignment, as required for instrumentation installations.
- 1.13.0 Fabrication and erection of stanchions/supports for all local instruments, junction boxes, etc. Fabrication and erection of suitable supports for surface mounted instruments.
- 1.14.0 Fabrication and erection of structural steel plates, angles, pipes, required for supporting ducts, trays, local instruments, etc., complete with bolts and nuts. (GI bolts and nuts shall be used wherever applicable or directed).
- 1.15.0 Painting of all stanchion/structures meant for instrumentation work (ducts, trays, pipe/ angle, supports, etc. as per specification). Colour and codes shall be strictly followed as per guidelines/ specifications as per direction of the Engineer-in-charge.
- 1.16.0 Earthing of the Instrumentation panels on the separate earthing pits (by others).
- 1.17.0 Double compression cable glands, cable lug, ferrules, cable identification tags, trefoil clamps for single core cables, cable dressing materials etc.
- 1.18.0 Cable sealing compound to prevent water entry wherever cables enters from outdoor to indoor areas.
- 1.19.0 Supporting structures for cable trays, cable racks, etc. using mild steel sections like channels, angles, flats, chequered plates etc. shall be in bidder's scope
- 1.20.0 Excavation & refilling of soil for buried cable trench / earthing with necessary materials.
- 1.21.0 GI Cable tray with all accessories and its MS supports.
- 1.22.0 Minor civil works like drilling, chipping and punching holes and openings in concrete floors, slabs, brick walls, fabrication of supporting structures, drainage of water from cable trenches and cleaning of all debris due to instrumentation installation.
- 1.23.0 Primary impulse tubing, laying of all types of cables, glanding and wiring and all kinds of pipe/tube fittings.
- 1.24.0 Fabrication and installation of primary tubing for pressure and differential pressure instruments complete with manifolds as per standards.**
- 1.25.0 Erection & supply of the PVC instrument ducts(if required for the internal wiring of GCP cables), and perforated cable trays generally as per drawing including bends, tees, supports and opening wherever required, including provision of covers wherever required. No jumping of cables will be allowed.



- 1.26.0 Laying of multi-core / pair cables for all applications on perforated trays with proper tagging, dressing clamping, glanding and terminations (including proper termination of shields) at both the ends.
- 1.27.0 Laying of multi/single pair cables in trenches wherever required.
- 1.28.0 Interconnection wiring/tubing of various field mounted instruments, viz., transmitters, transducers, positioners etc.
- 1.29.0 Identification of each cable by proper tags at every 10 meters on the main tray as per cable schedule.
- 1.30.0 Fabrication of nipples from pipes and threading of the same wherever required.
- 1.31.0 Tapping/threading of coupling wherever required for special instruments.
- 1.32.0 Welding electrodes required for the complete of the job shall be in bidder's scope..
- 1.33.0 Completion/updating of Owner's drawings/documents as per the work done at site. This should be done before applying for completion certificate.
- 1.34.0 Pre-commissioning service and commissioning assistance during start-up of plant, wherever required.
- 1.35.0 Provision of copper wire, GI wires to panel earth bus, laying and grounding of the same to the system earth pits.
- 1.36.0 Fabrication and erection of canopy (single) for instruments, wherever required.
- 1.37.0 Minor modifications/repairs required to be done on the existing instruments namely, replacement of damaged signal tubes, tapping of damaged threads on couplings, tees and other fittings.
- 1.38.0 Identification of each cable by proper tag plate/ferrules at instrument ends, inside junction boxes and inside control room outside JB's by tagging the cables with SS tags as per the cable schedule.
- 1.39.0 Drilling holes on all Panels etc. for cables/ glands/ grommets, if required, after obtaining approval from the owner. Unused holes to be plugged after completion of job.
- 1.40.0 Grounding of shield for all shielded cables to respective instrument earth bus provided in the thermocouple head/junction boxes.
- 1.41.0 Sealing of switches with standard lead seals after final setting in the presence of Engineer-in-charge.
- 1.42.0 Painting of welded joints etc. as per the engineer in charge's instruction.
- 1.43.0 Excavating roads, laying cable road crossing sleeves and refilling and finishing wherever required.



2.0.0 LOOP TESTING

- 2.1.0 The action of the controller is set as prescribed. Controller settings for various modes of operation (Proportional band, reset and rate action) are at nominal value. For current signals, 4 – 20 mA shall be injected and checked the loop for 0%, 25%, 50%, 75% and 100% of full-scale inputs. For temperature loops with thermocouples, a known milli volt signal shall be injected and the output display shall be checked for input signals of 0%, 25%, 50%, 75% and 100%. For temperature loops with RTDs, a known resistance shall be injected in the control cable through decade resistance box and Output display shall be checked for 0%, 25%, 50%, 75% and 100%. For field mounted switches for alarms / interlocks, the action shall be simulated by disconnecting the wires / shorting the terminals and the function of the associated system shall be checked. Any equipment required by the Bidder for testing, calibration and commissioning shall be brought by the Bidder at site. The list of such equipment shall be furnished along with the offer
- 2.2.0 Prior to taking the instruments in service, all impulse lines, sampling lines and air supply lines shall be blown as required with the establishment of adequate line pressure and temperature conditions to keep the lines thoroughly clean. On-line i.e., without removing control valves from the pipe, calibration of the positioners and stroking of control valves / control dampers shall be carried out as required during control system tuning. Pre-commissioning checks, individuals loop checks, power initialisation, verification of system functioning, trouble shooting final solutions to application and / or instrument problems, etc., is Bidder's responsibility. All the required software and hardware changes shall be incorporated as required for successful commissioning to Owner satisfaction. Any other tests as may be directed by the Owner Representative. After delivery of the equipment, the Bidder shall locate all the equipment including electronic cards in its final position, check all the power wiring, grounding and interconnection cables, all in accordance with manufacturer's recommendations. The Bidder shall perform initialisation of system power, field loading of system configuration / software and data base, demonstration of system functionality to verify conformance with manufacturer's instructions and specifications, tuning of control loops, implementation of any configuration changes including hardware, software and additional tapping's / instruments, cabinets as required and providing general trouble shooting and final solutions to application and / or instrument problems.
- 2.3.0 The Bidder shall take care to complete all pre-commissioning activities and simulation tests after erection to suit the over all start up of respective plant equipment. The controllers shall be tuned as per the process requirement. The list of set points, alarms / Interlocks, settings for the controllers shall be furnished in the standard format and handed over to the Owner.. Control loops shall be put in auto mode as per the operational requirement of different phases. Processor, Bus Worst loading conditions calculation and other control system performance requirements shall be proved at the time of commissioning. Before taking over of the plant by the OWNER , all the system and auto control loops shall run satisfactorily for at least one month at varying loads without disturbing any adjustment. During this period, supervision and maintenance of the system shall be the scope and responsibility of the Bidder. The performance test shall be carried out for the system offered and certificates to these effects shall be approved by the OWNER .

3.0.0 INSPECTION, TESTING, GUARANTEE & SPECIAL TOOLS / TACKLES

- 3.1.0 After manufacturing all the I&C equipments / instruments shall be factory tested and calibrated. All the required test certificates, calibration certificates for the I & C equipments / instruments to be submitted to the Owner for approval before the dispatch of the same is allowed from the factory. As a minimum hydro-test, accuracy & repeatability test, over-range test, leak test, HV test, insulation test, functional tests, temperature rise test shall be conducted as applicable for the instruments and the control system. The electronic equipments shall be subjected to burn in test and tests as per IEC 68. The details of the test to be carried out for the I & C equipment shall be submitted for the Owner consent/approval



before proceeding with the test. Bidder shall submit a detailed quality assurance program for individual I & C equipments / instruments for Owners for approval.

3.2.0 Tests for DCS / SG control / STG control / PLC system will include the following:

3.2.1 Factory Acceptance Test (FAT):

To be carried out at BIDDER's / Sub-Vendor's works and witnessed by Owner/Engineer, successful completion of which will be the basis for 'Authorization for Shipment to Site'. FAT shall be a complete integrated test of the system and carried out at BIDDER's / Sub-Vendor's works on completion of manufacturing of the system. The test shall be performed with the completely assembled system and performing all the functions, it is expected to perform while in actual service. The BIDDER shall submit a detailed "Factory Acceptance Test Procedure" in line with the above specified guidelines for Owner approval. The FAT shall be conducted as an integrated test of plant I&C system integrating the control system supplied by Other Vendors.

FAT shall be preceded by a 'Pre- FAT Inspection/ Test' to be carried out by Bidder/Vendor. Pre-FAT inspection / test shall be carried out as per approved FAT procedure detailed above and shall submit 'Pre- FAT Inspection/ Test' report for Owners review and approval. Owner shall witness the actual FAT on the basis of successful completion of 'Pre- FAT Inspection/ Test'.

3.2.2 Site Test (SAT):

Involves tests for site commissioning, calibration of monitoring and control equipment, Integrated loop test wiring, Trial Operation of the system functioning. Site guarantee tests for system performance & availability to be conducted in the presence of Owner. The reliability run shall be conducted for one month period. During the reliability run if the I&C system fails to meet the specific requirements, then the Bidder shall take immediate remedial actions and the procedure shall be restarted again for the reliability run. After the completion of the reliability run with full satisfaction of the Owner, the system shall be deemed for take over and this shall mark the commencement of warranty period.

Special tools and equipment for the maintenance, inspection and repair of the individual main equipment and auxiliary equipment shall be supplied by the Bidders in sufficient quantity to equip the shift personnel, maintenance personnel and workshop craftsman.

The special tools and equipment for maintenance and repair shall be delivered by the bidder in lockable steel boxes and they shall be marked in an approved manner for identification purposes and a corresponding tool chart shall be supplied with the steel boxes

The I&C systems offered by the Bidder shall be provided with guarantee period which will start from the date of handing over to the owner and Bidder to indicate the same in his offer.

Latest version of hardware and software available at the time of system designing shall be provided. In case of future up-gradation of software, Bidder shall remain committed to upgrade the supplied system with the new version within the warranty period. Beyond the warranty period and during the remaining life of the plant, any up gradation in hardware and software shall be brought to the notice of Buyer. Bidder shall ensure that supplied controls & instruments should be supported by the supplier such that spare parts are guaranteed to be available for purchase for a period of 15 (Fifteen) years. Similarly the service shall also be guaranteed for a period of 15 (Fifteen) years.

CODES & STANDARDS



VOLUME – II
SUB-SECTION 4.4
CODES AND STANDARDS

1.0.0 CODES AND STANDARDS**1.1.0 Temperature Measurement**

- a) Instrument and apparatus for temperature measurement – ASME PTC 19.3
- b) Temperature Measurement Thermocouples – IEC 60584 – 3 / ANSI – MC 96.1 – 1982.
- c) Thermometer-element-Platinum resistance – IEC 751 / DIN 43760.

1.2.0 Pressure Measurement

- a) Instrument and apparatus for pressure measurement – ASME PTC 19.2.
- b) Instrument Accuracies - IS 3624 / ASME

1.3.0 Flow Measurement

- a) Instruments and apparatus for flow measurement (Flow nozzle assembly)- ASME PTC 19.5 (1972) Interim supplement, Part-II, BS 1042.
- b) Instruments and apparatus for flow measurement (Orifice plate)- ISO 5167 Part – 1 / BS 1042.

1.4.0 Electronic Measuring Instruments and Control Hardware

- a) Automatic null balancing electrical measuring instruments – ANSI C 39.4.
- b) Safety requirements for electrical and electronic measuring and controlling instrumentation – ANSI C 39.5 / 1974.
- c) Compatibility of analog signals for electronic industrial process instruments ISA-S 50.1: ANSI MC 12.1.
- d) Dynamic response testing of process control instrumentation – ISA –S26.
- e) Surge withstand capability (SWC) tests – ANSI C37.90.1-1989 / IEC-255-4.
- f) Electro-Magnetic Compatibility Tests – IEC 801
- g) Tests for electronic equipments – IEC 68
- h) RF compatibility standard-IEC 61000
- i) Safety Integrity level – IEC 61508
- j) Electronic Cards, Subassemblies and Components

- a) Unpackaged

- i) Vibration : IEC-68.2.6
 - ii) Shock : IEC-68.2.27
 - iii) Drop & Topple : IEC-68.2.31

- b) Packaged

Vibration, Drop & Static Compression - NSTA

- c) Electromagnetic Compatibility

- i) Electrical Fast Transient : IEC-801.4
 - ii) Surge Withstand : IEC-255.4
 - iii) Radiated Electromagnetic Field : IEC-801.3
 - iv) Electrostatic Discharge : IEC-801.2
 - v) Electromagnetic Emission : VDE 0871, Class B

**1.5.0 Enclosures**

- a) Classification of hazardous area – IEC 79
- b) Degree of protection for enclosures – IEC 60529.
- c) Electrical Instruments in Hazardous Area – ISA RP 12.11
- d) Purged and pressurized enclosure for electrical equipment in hazardous location – NFPA Article 496 Volume-4, 1978.
- e) Environmental conditions for process measurement and control systems – ISA S71.04
- f) Classification of hazardous area - NFPA Art. 500, Vol.70-1984.
- g) Electrical Instruments in hazardous dust locations - ISA-RP 12.11
- h) Intrinsically safe apparatus - NFPA Art.493 Vol.4.1978
- i) Purged and pressurized enclosure for electrical equipment in hazardous location - NFPA Art. 496 1982.

1.6.0 Sampling System

- a) ASME PTC 19.11 Steams and Water Sampling, Conditioning, and Analysis in the Power Cycle.
- b) Stainless steel material of tubing and valves for sampling system - ASTM A269-82 Gr TP316.
- c) Submerged helical coil heat exchangers for sample coolers ASTM D 11-98.
- d) Water and Steam in power cycle - ASME PTC 19.11(2008).
- e) Standard methods of sampling system - ASTM D 1066-69.

1.7.0 Interlocks, Protections, Symbols

- a) Turbine water damage prevention – ASME-TDP-1-1980.
- b) Boiler safety interlocks – Applicable NFPA 85 sections.
- c) Instrumentation Symbols and Identification– ISA – S5.1.
- d) Binary logic diagrams for process operations – ISA – S5.2.
- e) Graphic symbols for distributed control/shared display instrumentation – ISA – S5.3
- f) Relays and relay system associated with electric power apparatus - IEEE std.3.13.
- g) Surge withstand capability tests - ANSI C.37.90a - 1974 and IEEE Std. 472 - 1974.
- h) General requirements & tests for switching devices for control and auxiliary circuits including contactor relays - IS-6875 (Part-I) 1973.

1.8.0 Annunciations

- a) Specifications and guides for the use of general-purpose annunciations – ISA RP 18.1.

1.9.0 Control Valves

- a) Control Valve Sizing – ISA-75.01.
- b) Control Valve capacity test – ISA-75.02.
- c) Face to face dimensions of Control Valves – ANSI B16.10.
- d) Control valve seat leakage classification – ANSI / FCI 70.2
- e) Valves flanged threaded and welding end - ASME B 16.34

1.10.0 Cables

- a) Thermocouple extension wires / cables – ANSI MC96.1.
- b) Colour coding of Instrument cables – BS-5308, Part-2.
- c) Specification for PVC insulated cables – IS 5831 / 8130/ 1554/ 10810 / equivalent IEC standards.
- d) Guide for design and installation of cable system in power generating station (insulation, jacket materials) IEEE Standard 422 / NEMA VE-1, and NEC.
- e) FRLS tests - IEC 332 / IEC 754 / IEEE 383 / SS-4241475 / ASTM D2863/ 43



- f) Requirements of vertical tray flame test – IEEE 383.
- g) NFPA 70.
- h) IS 13882 : Optical Fibre Cable
- i) Oxygen index test as per ASTM D 6863
- j) Temperature index test as per ASTM D 6863
- k) Smoke generator test as per ASTM D 6843
- l) Drum for electrical cables .
- m) Acid gas generation test as per IEC754-1
- n) Swedish Test as per SEN 4241475

1.11.0 Instrument testing

Safety Requirement For Electrical and Electronic Measuring And Controlling Instruments as per ANSI C 39.5 – 1974

1.12.0 Process connection and tubing

Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service as per ASTM A 269

- a) Codes for pressure piping power piping ANSI B31.1
- b) Seamless carbon steel pipe ASTM A-106.
- c) Forged and Rolled Alloy steel pipe flanges, forged fittings, valves and parts - ASTM A-182.
- d) Material for socket welded fittings - ASTM A-105.
- e) Seamless ferrite alloy steel pipe - ASTM A-335.
- f) Pipe fittings of wrought carbon steel and alloy steel - ASTM A-234.
- g) Composition bronze or metal castings - ASTM B-62.
- h) Seamless copper tube, bright annealed ASTM B-168.
- i) Seamless copper tube - ASTM B-75.
- j) Dimensions of fittings - ANSI B-16.11
- k) Valves flanged and butt welding ends - ANSI B16.34.
- l) Nomenclature for Instrument tube fittings ISA-RP-42.1 - 1982.
- m) Seamless carbon steel pipe - ASTM - A106.
- n) Material for socket weld fittings - ASTM - A105.
- o) Dimensions of fittings - ANSI B16.11
- p) Code for pressure piping, welding, hydrostatic testing - ANSI B31.1.

1.13.0 Annunciations

Specifications and guides for the use of general-purpose annunciators - ISA RP 18.1.

1.14.0 DCS and other Control system

a. Interlocks, protections, symbols

- Instrumentation Symbols and Identification– ISA – S5.1.
- Binary logic diagrams for process operations – ISA – S5.2.
- Graphic symbols for distributed control/shared display instrumentation – ISA – S5.3
- Instrumentation Loop Diagram - ISA-S 5.4
- Graphic Symbols for Process Displays - ISA-S 5.5
- Functionally Safety – Safety Instrumented system of process section – IEC 61151
- Fossil fuel power plant steam turbine bypass system – ANSI/ISA – 77.13.01
- Human system interface design review guide lines – NUREG - 700

b. Communication system

- Logical link control - IEEE 802.2
- Local Area Network: CSMA/CD Access Method and physical layer - IEEE 802.3
- Local Area Network: Token Passing Bus Access Method - IEEE 802.4



- Information Processing System – Open System interconnection,
 - Basic Reference Model and connectionless Mode transmission - ISO 7498
 - Internal organization of network layers - ISO 8648
 - For power system monitoring, control and associated communications. - IEC 60870 - 5-101
- c. Hardware Testing of Digital Process computers - ISA RP-55.1- 1983**
- d. Standard Digital Interface For Programmable Instrumentation - IEEE - 488.2 - 1990**
- e. Electromagnetic compatibility Tests –**
- Voltage and current surge – IEC 1000-4-5, EN 61000-4-5,
 - Fast transient bursts – IEC 1000-4-4, EN 61000-4-4,
 - Damped oscillatory wave – IEC 1000-4-12, EN 61000-4-12,
 - Ring wave – IEC 1000-4-12, EN 61000-4-12.
- f. Electrostatic discharge Tests – IEC 1000-4-2, EN 61000-4-2**
- g. Magnetic and Electromagnetic fields –**
- Power frequency magnetic fields – IEC 1000-4-8, EN 61000-4-8,
 - Pulse magnetic fields – IEC 1000-4-9, EN 61000-4-9,
 - Damped oscillatory magnetic field – IEC 1000-4-10, EN 61000-4-10,
 - Ring wave – IEC 1000-4-12, EN 61000-4-12.
 - Radiated radio-frequency electromagnetic field – IEC 1000-4-3, EN 61000-4-3,
 - Immunity to conducted disturbances, induced by radio- frequency fields – IEC 1000-4-6, EN 61000-4-6,
- h. Emission test RF radiated fields – CISPR 11/EN 55011.**
- 1.15.0 Instrument switches & contacts – BS 6134**
- 1.16.0 Cable trays & conduits - IEEE 422 / NEMA VE-1 / NFPA-70**
- 1.17.0 Surge protection system**
- Surge Withstand capability Test as per ANSI C 37.90.1 (1989), R1994
- 1.18.0 Sample coolers for SWAS - ASTM D 11**
- 1.19.0 Others**
- Printed Circuit Boards – IEC 326 C
 - General requirements and tests for printed for wiring boards – IS 7405 (Part 1)
 - Edge socket connections – IEC 130 – 11
 - Dimensions of attachment plugs & receptacles ANSI C73/1973
 - Direct acting Electrical indicating Instruments IS 1248/1968
- 1.20.0 NFPA 72 – National fire alarm code (Latest edition)**
- In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India, as well as of the locality



where they will be installed, including the following:

- Indian electricity act
- Indian electricity rules
- Indian Explosives Act
- Indian Factories Act and State Factories Act
- Indian Boiler Regulations (IBR)
- Regulations of the Central Pollution Control Board, India
- Regulations of the Ministry of Environment & Forest (MoEF), Government of India
- Pollution Control Regulations of Department of Environment, Government of India
- State Pollution Control Board.
- Rules for Electrical installation by Tariff Advisory Committee (TAC).
- Building and other construction workers (Regulation of Employment and Conditions of services) Act, 1996
- Building and other construction workers (Regulation of Employment and Conditions of services) Central Rules, 1998
- Explosive Rules, 1983
- Petroleum Act, 1984
- Petroleum Rules, 1976
- Gas Cylinder Rules, 1981
- Static and Mobile Pressure Vessels (Unified) Rules, 1981
- Workmen's Compensation Act, 1923
- Workmen's Compensation Rules, 1924
- Any other statutory codes / standards / regulations, as may be applicable.

Unless covered otherwise in the specifications, the latest editions (as applicable as on date of bid opening), of the codes and standards given below shall also apply:

- Bureau of Indian Standards (BIS)
- Japanese Industrial Standards (JIS)
- American National Standards Institute (ANSI)
- American Society of Testing and Materials (ASTM)
- American Society of Mechanical Engineers (ASME)
- American Petroleum Institute (API)

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
	TECHNICAL SPECIFICATION (C&I) FOR COLTCS	
SUB VENDOR LIST		

SUB VENDOR LIST (AS ON 10/12/2018)

SI No	Package Name	Supplier Name	Supplier Communication Address
1	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in
2	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, Sarani, Kolkata Phone- +91 33 2548 7220 Pincode : 700074 Email : parthabosebpi@gmail.com; bosepanda@vsnl.net
3	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net
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9	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in
10	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
11	TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com,
12	TRANSMITTERS	ABB INDIA LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com
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16	TRANSMITTERS	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in
17	TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,
18	TRANSMITTERS	Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@miinet.com
19	TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,
20	TRANSMITTERS	Honeywell Automation India Limited	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com
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22	TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@delbby.rpgms.ems.vsnl.net.in
23	TRANSMITTERS	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com
24	TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com
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27	JUNCTION BOX	Shrenik & Company,	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com

28	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari Phone- 02637-265140,265003 Pincode : 396424 Email : flexpro@flexproltd.com
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30	INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
31	INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
32	INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
33	INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
34	INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
35	INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
36	INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
37	INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
38	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai Phone- 91-9324383121 Pincode : 400008 Email : shahanawaz.khan@perfectinstrumentation.com
39	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laximpura, Nandasan Phone- 02764-267036/37 Pincode : 382705 Email : marketing@com- fit.com
40	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com
41	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
42	INSTRUMENT FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
43	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai Phone- +91-250-2392246 Pincode : 401210 Email : arya@aryaengg.com
44	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com
45	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
46	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
47	INSTRUMENT FITTINGS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,

NOTE:

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



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-417/435-165-N002**

SECTION: **I**

SUB-SECTION: **ID**

REV. NO. **00** DATE **07.09.2018**

SHEET **1** OF **1**

SUB-SECTION – ID

DATASHEET-A



DATA SHEET - A

SPECIFICATION NO.: PE-TS- 417/435-165-N002

CONDENSER ON LINE TUBE CLEANING SYSTEM(COLTCS)

REV. NO.: 00. DATE : 07/09/2018

SECTION : I. SUB-SECTION : ID

SL NO	DESCRIPTION	UNITS	YADADRI TPS - 5X800 MW	UDANGUDI STPP STAGE- I - 2X660 MW
1.00	GENERAL			
1.1	Nos. of tube cleaning systems sets required for station	Nos.	Total Ten (10) nos. viz. Two (02) Nos. for One Unit. viz. One independent set common for each half of two condensers placed in series. There are 2 nos. condenser per Unit in Series,i.e. Balls from one Separator/ Collector has to pass through two nos. Condensers placed in Series.	Total 4 (four) nos. viz. Two (02) Nos. for 1 unit viz. One independent set common for each half of two condensers placed in series. There are 2 nos. condenser per Unit in Series, i.e. Balls from one Separator/Collector has to pass through two nos. Condensers placed in Series.
1.2	Liquid Handled		Clarified water (Refer enclosed water analysis at Annexure II)	Sea water (Refer enclosed water analysis at Annexure II)
1.3	Size of COLTCS	NB	2700	2600
1.4	Length of Ball Separator	mm	4200 Note: 1. Scope of Ball Separator counter flange is in Purchaser's scope. (Associated Gaskets, nuts and bolts are in Bidder's Scope) 2. Ball Separator shall be mounted directly on the existing Butterfly valve - Refer Annexure III. 3. Flap of butterfly valve shall be extended to approx 1300-1400 mm inside the Ball separator.	4200 Note: 1. Scope of Ball Separator counter flange is in Purchaser's scope. (Associated Gaskets, nuts and bolts are in Bidder's Scope) 2. Ball Separator shall be mounted directly on the existing Butterfly valve - Refer Annexure III. 3. Flap of butterfly valve shall be extended to approx 1300-1400 mm inside the Ball separator.
2	DESIGN DATA			
2.1	Operating pressure at Condenser inlet flange	kg/cm2 (g)	Approx 1.5 to 2.5	Approx 1.5 to 2.5
2.2	Design Pressure for ball separator	kg/cm2 (g)	5.5 kg/cm ² (g) & 0.1 Kg/cm2 (abs)	5.7 kg/cm ² (g) & 0.1 Kg/cm2 (abs)
2.3	Design Mechanical temperature	Deg. C	60	60
2.4	Condenser Details			
	a) Type of condenser		Single pass	Single Pass
	b) No. of Condenser sections	Nos.	Two (2)	Two (2)
	c) No. of passes per condenser section (viz. condenser half)	Nos.	One (1)	One (1)
	d) No. of tubes per condenser	Nos.	29755	24156
	• Condensing zone	Nos.	27673	-
	• Air Cooling zone	Nos.	2X2082	-
	e) Tube Dia. OD x Thickness			
	• Top two rows	mm x mm	25.4 x 0.889	28.575 x 0.889
	• Remaining	mm x mm	25.4 x 0.7112	28.575 x 0.7112
	f) Length of tubes between ends.	mm	14730	
	g) Tube material		Welded SS 304L	Welded Titanium (SB338 - Gr 2)
	h) Pressure drop across condenser - At Normal flow (between Inlet and Outlet flanges of condenser)	MWC	2X2.86 MWC (excl. interconnection pipes) (However the actual value can vary +/-10% of the design value)	2 X 2.0 MWC (EXCL. INTERCONNECTION PIPES BETWEEN TWO CONDENSERS) (However the actual value can vary +/-10% of the design value)
2.5	CW flow rate through each ball separator			
	- Normal	cu.m/hr	42105	40675
	- Maximum	cu.m/hr	50526	48810
2.6	Design differential pressure for ball separator strainer/screen	kg/cm2 (g)	0.3	0.3
2.7	Pressure drop across ball separator i.e. between inlet & outlet flanges in clean condition at normal flow.	MWC	0.2	0.2
2.8	Pressure drop across ball separator in choked condition when strainer backwashing starts	MWC	Not to exceed 0.30	Not to exceed 0.30
2.9	No. of balls required for COLTCS per condenser section		Minimum 10% of number of condenser tubes	Minimum 10% of number of condenser tubes
3	CONNECTING PIPE DETAILS			
3.1	Condenser inlet pipe			
	a) Material		Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589	Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589 Internally lined with Poly Urea/CorroCoat/Glass Flake Coating inside of 1500 Microns DFT
	b) O.D. X Thickness		2740 X 20	2640 X 20
3.2	Condenser outlet pipe			
	a) Material		Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589	Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589 Internally lined with Poly Urea/CorroCoat/Glass Flake Coating inside of 1500 Microns DFT
	b) O.D. X Thickness		2740 X 20	2640 X 20
3.3	Manhole		Yes, 600 NB size	Yes, 600 NB size
4	MATERIALS OF CONSTRUCTION			
4.1	BALL SEPARATOR			
	a) Body / housing		Carbon Steel to IS -2062 Gr.B. with epoxy painted inside (with minimum housing thickness same as connecting pipe thickness)	Carbon Steel to IS -2062 Gr.B. Rubber Lined(Min. 5mm thick) inside (with minimum housing thickness same as connecting pipe thickness)
	b) Screen / Strainer		SS-316	Duplex SS (UNS 32205/31803)
	c) Strainer shaft		SS-316	Duplex SS (UNS 32205/31803)
	e) Internal Hardware in contact with circulating water including nuts, bolts , etc.		SS-316	Duplex SS (UNS 32205/31803)
	f) Site Glass provision		YES	YES
4.2	BALL RECIRCULATING PUMP		Non clog Type	Non clog type
	a) Casing		SA 351 CF8M	Duplex SS (UNS 32205/31803)
	b) Impeller		SA 351 CF8M	Duplex SS (UNS 32205/31803)
	c) Shaft		SS-316	ASTM A276 UNS 31803
4.3	BALL COLLECTOR			
	a) Body / housing		Stainless steel, SS 304	Carbon Steel to IS -2062 Gr.B. Rubber Lined inside (Min. 5mm thick)
	b) Screen / Strainer/other internals		SS-316	Duplex SS (UNS 32205/31803)
	c) Site Glass Provision		YES	YES
4.4	Differential pressure measuring system		SS-316	Duplex SS
4.5	Injection nozzle		SS-316	Duplex SS (UNS 32205/31803)
4.6	Valves			
4.6.1	Check Valves (65 NB & Above)		For sizes 65 NB and above:- Swing check or dual plate type.	For sizes 65 NB and above:- Swing check or dual plate type.
	a) Body & Bonnet		SS316, Flanged Ends	A 439 Gr. D2- NI RESIST / Duplex SS



DATA SHEET - A

SPECIFICATION NO.: PE-TS- 417/435-165-N002

CONDENSER ON LINE TUBE CLEANING SYSTEM(COLTCS)

REV. NO.: 00. DATE : 07/09/2018

SECTION : I. SUB-SECTION : ID

SL NO	DESCRIPTION	UNITS	YADADRI TPS - 5X800 MW	UDANGUDI STPP STAGE- I - 2X660 MW
	b) Disc for Check Valve		SS316	A 439 Gr. D2- NI RESIST / Duplex SS
	c) Stem		ASTM A182 Gr F6a	Duplex SS
4.6.2	Check Valves (50 NB & Below)		For size 50 NB and below-Piston type	
	a) Body & Bonnet		SS-316, Socket welded Ends	A 439 Gr. D2- NI RESIST / Duplex SS
	b) Disc for Check Valve		SS316	A 439 Gr. D2- NI RESIST / Duplex SS
	c) Stem		ASTM A182 Gr F6a	Duplex SS
4.6.3	Gate/ Globe Valves 50 Nb & Below			
	Body & Bonnet		SS-316, Socket welded Ends	Duplex SS
4.6.4	Gate/Globe Valves (65NB & above)			
	Ø Body & Bonnet		SA 351 CF8M	A 439 Gr. D2- NI RESIST / Duplex SS
	Ø Disc		SA 351 CF8M	A 439 Gr. D2- NI RESIST / Duplex SS
	Ø Stem		ASTM A182 Gr F6a	Duplex SS
	Ø Companion Flange		SS316	Same as Connecting Pipe MOC
4.6.5	BFV Valves (65NB & above)		BFV (400 Nb & above)	BFV (Above 200 Nb)
	Ø Body & Disc		SA 351 CF8M	A 439 Gr. D2- NI RESIST / Duplex SS
	Ø Sealing, Retaining segment & Internals		18 – 8 -SS	Duplex SS
	Ø Bearing		Self lubricating type	Self lubricating type
	Ø Companion Flange		SS316	Same as Connecting Pipe MOC
4.6.6	Ball valves			
	i) Body		SA 351 CF8M	A 439 Gr. D2- NI RESIST / Duplex SS
	ii) Ball		SA 351 CF8M	Duplex SS
	iii) Stem		SS316	Duplex SS
4.7	Interconnecting Piping		By Bidder	By Purchaser
	Maretial		SS-316	a) PIPING UPTO 300Nb SHALL BE DUPLEX SS (AS PER SCH 40S FOR PIPE UPTO 50 NB & SCH 10S FOR PIPE SIZE ABOVE 50 NB) b) PIPING 350 NB AND ABOVE SHALL BE CARBON STEEL AS PER IS 3589 FABRICATED FROM IS 2062 PLATES INTERNALLY LINED WITH CORROCOAT OR POLYUREA OR GLASS FLAKE COATING INSIDE OF 1500 MICRONS DFT.
5	COUNTER FLANGES FOR BALL SEPERATOR			
5.1	MATERIAL			
	a) Flanges		Carbon Steel to IS 2062 Gr. B or eq for thickness, drilling etc refer Annexure II in section C1(In Bidder's Scope)	Carbon Steel to IS -2062 Gr.B. or eq(Internally Lined with CorroCoat or PolyUrea or Glass Flake) for thickness, drilling etc refer Annexure II in section C1 (In Purchaser's Scope)
	b) Fasteners		A 193 & A 194 (In Bidder's scope).	SS 316 L (In Bidder's scope).
	c) Gaskets		Min 4 mm thick rubber (In Bidder's scope).	Min 4 mm thick rubber (In Bidder's scope).
5.2	Drilling Standard			
6	OTHER COUNTER FLANGES		(for interconnecting piping, valves, bends, fittings, distributors, nozzles & support installation materials)	(for interconnecting piping, valves, bends, fittings, distributors, nozzles & support installation materials)
6.1	MATERIAL			
	a) Flanges		Carbon Steel to IS 2062 Gr. B or eq for thickness, drilling etc refer Annexure II in section C1(In Bidder's Scope)	Duplex SS



DATA SHEET - A				SPECIFICATION NO.: PE-TS- 417/435-165-N002
CONDENSER ON LINE TUBE CLEANING SYSTEM(COLTCS)				REV. NO.: 00. DATE : 07/09/2018
				SECTION : I. SUB-SECTION : ID
SL NO	DESCRIPTION	UNITS	YADADRI TPS - 5X800 MW	UDANGUDI STPP STAGE- I - 2X660 MW
	b) Fasteners		A 193 & A 194 (In Bidder's scope).	SS 316L (Non-Wetted)
	c) Gaskets		Min 4 mm thick rubber (In Bidder's scope).	Min 4 mm thick rubber
7	Material of Other components not specified above		1. All Non-wetted Fastners in Bidder's Scope shall be of SS316L material. 2. Suitable for intended duty and shall be subject to Purchasers approval during detailed engg. In the event of order.	1. All Non-wetter Fastners in Bidder's Scope shall be of SS316L material. 2. Suitable for intended duty and shall be subject to Purchasers approval during detailed engg. In the event of order.
8	PAINTING			
8.1	External Surface			
	a) Surface preparation		SA - 2.5 of Swedish Specn. SIS-05-59-00-1967	SA - 2.5 of Swedish Specn. SIS-05-59-00-1967 / By Sand Blasting
	b) Primer		Two coat of Red Lead primer	Two (2) coats of Epoxy primer coats with minimum thickness of 35 microns dft of each coat.
	c) Intermediate		-	Epoxy based TiO2 pigmented coat
	d) Final paint		Two (2) coats of High build Epoxy paint with minimum thickness of 35 microns dft of each coat.	Two (2) coats of High build Epoxy paint with minimum thickness of 35 microns dft of each coat.
8.2	Internal Surface			
	a) Surface preparation		SA - 2.5 of Swedish Specn. SIS-05-59-00-1967	SA - 2.5 of Swedish Specn. SIS-05-59-00-1967 / By Sand Blasting
	b) Primer		Two coat of Epoxy Resin based Red oxide primer	Two coat of Epoxy Resin based Zinc Phosphate epoxy primer
	c) Final paint		Adequate no. of coats (min. Two) of Synthetic Enamel paint to achieve total DFT of min. 200 microns. Colour- code shall be as per IS 9404	Adequate no. of coats of coal tar epoxy paint to achieve total dry film thickness of 200 to 250 microns
9	Adequate provision for future installation of cathodic protection		YES (Along with Sacrificial type anodic protection by purchaser)	YES (Along with Sacrificial type anodic protection by Bidder)
10	Flow straightener for streamlining the CW flow in ball collecting strainer		If required as per bidder's design – the same to be incorporated by bidder in its constructional feature.	If required as per bidder's design – the same to be incorporated by bidder in its constructional feature.
11	The tube cleaning system shall be designed for following operation modes			
	a) Automatic start up initiated by push button		YES	YES
	b) Automatic shut down with ball collection effected by : i. Push button ii. Adjustable timer iii. Ball monitoring system		YES	YES
	c) Automatic backwashing of ball separator with ball collection effected by : a. Push button b. Adjustable timer c. Diff. Pressure measuring system		YES	YES
	d) Automatic emergency backwashing of ball separator effected by diff. Pressure measuring system		YES	YES
	e) Automatic ball sorting initiated by push button		YES	YES
	f) Provision for manual operation of complete tube cleaning system in case of control system failure		YES	YES
	g) Whether the contacts for DPG, DPS and DPT are independent		YES	YES
	h) Timer for Backwashing		YES	YES
	i) Whether the ball monitoring system is designed to perform the following functions : i. Continuously counting the balls in circulation and giving an alarm calling for investigation of ball losses when the number of balls falls below a set value ii. Continuously measuring the size of the balls in circulation and initiating the shutdown of the tube cleaning system with alarm calling for replacement of balls when the no. of oversized balls falls below a set value		YES	YES
	j) Whether the electronic processor of the ball monitoring system is provided with the following : i. Indicators for required basic ball charge ii. Indicators for recirculating ball quantity iii. Indicators for oversized ball quantity iv. Time counters for total cleaning system operating hours v. Time counters for cleaning system operating hours with sufficient no. of oversized balls vi. Records for ball consumption		YES	YES
	k) Whether provision for self-testing and self-calibration are made		YES	YES
12	MANDATORY SPARES - to be supplied under this specification –		YES (As indicated in ANNEXURE-III)	YES (As indicated in ANNEXURE-III)

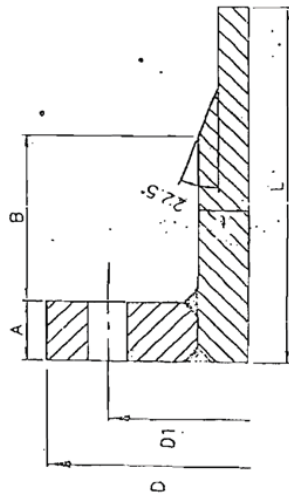
		MANDATORY SPARES		ANNEXURE- III	
PROJECT			5x800 MW Yadadri TPS	2x660 MW Udangudi TPS	
1	Valve Complete Assembly	LOT	2 LOTS (10% of each type and size of total population or minimum 1(one) No. whichever is higher= 1 LOT)	NOT APPLICABLE	
2	Field Instruments				
2.1	Transmitters/ Gauges/Switches etc. along with relevant accessories	LOT	2 LOTS (10% of total or at least two (whichever is higher) for each type along with accessories. = 1 LOT)	NOT APPLICABLE	
2.2	Temperature element/RTD	LOT	2 LOTS (10% of each type, range and immersion length. Or Minimum 5 nos.= 1 LOT)	NOT APPLICABLE	
2.3	Furnace Temperature Probe	LOT	2 LOTS (Thermocouple 1 no. = 1 LOT)	NOT APPLICABLE	
3	Control Panel/ Desk				
3.1	Back up panel mounted devices (selector switched/push buttons/indicators etc.)	LOT	2 LOTS (5% of installed capacity= 1 LOT)	NOT APPLICABLE	
3.2	Lamps/ LEDs	LOT	2 LOTS (100% of the total quantity =1 LOT)	NOT APPLICABLE	
3.3	Blank Tiles	LOT	2 LOTS (10% of installed capacity =1 LOT)	NOT APPLICABLE	
3.4	MCBs	LOT	2 LOTS (10% of each type & rating =1 LOT)	NOT APPLICABLE	
3.5	Fuses/ Fuse holder	LOT	2 LOTS (100% of each type & rating =1 LOT)	NOT APPLICABLE	
4	Annunciation System				
4.1	Each type of module	LOT	2 LOTS (1(one) No. each = 1 LOT)	NOT APPLICABLE	
4.2	Lamp Box with Facia & Lamps (LED type)	LOT	2 LOTS (5 (five) Nos. = 1 LOT)	NOT APPLICABLE	
4.3	Hooter	LOT	2 LOTS (1 (one) No.= 1 LOT)	NOT APPLICABLE	
5	415 Volt Motor (Upto 30KW Rating)				
5.1	Driving End & Non-Driving End Bearing	LOT	2 LOTS (3 Set for each type and rating of Motor = 1 LOT)	1 LOT (1 Set of each type=1 LOT)	
5.2	Cooling Fan	LOT	2 LOTS (2 No. for each type and rating of Motor = 1 LOT)	NOT APPLICABLE	
5.3	Motor Terminal Block	LOT	2 LOTS (5 No. for each type and rating of Motor = 1 LOT)	1 LOT (10 Nos. for each type and rating of Motor = 1 LOT)	
5.4	Complete Set of Coupling	LOT	2 LOTS (1 Set for each Application = 1 LOT)	NOT APPLICABLE	
5.5	Motors of each type & rating	LOT	NOT APPLICABLE	1 LOT (1 No. = 1 LOT)	
5.6	Ball circulating Pump (Complete)	LOT	NOT APPLICABLE	1 LOT (1 Set = 1 LOT)	
5.7	Local Indicators like temperature gauges, pressure gauges, differential pressure gauges, flow gauges, flow meters etc.,	LOT	NOT APPLICABLE	2 LOTS (10% or 2 no. of each make, model and type whichever is more.= 1 LOT)	
6	INSTRUMENTATION CABLE, INTERNAL WIRING AND ELECTRICAL FIELD				
6.1	Pre fabricated cable of each type	LOT	NOT APPLICABLE	2 LOTS (10% of installed quantity= 1 LOT)	
6.2	Pre fabricated cable connector	LOT	NOT APPLICABLE	2 LOTS (10% or 1 no.of each type and model, whichever is more. = 1 LOT)	
6.3	Other cables	LOT	NOT APPLICABLE	2 LOTS (5% of each type, pair and size of actual installed quantity = 1 LOT)	
6.4	Electrical actuator, complete assembly, of each rating	LOT	NOT APPLICABLE	1 LOT (2 Nos. = 1 LOT)	
Notes for Mandatory Spares:					
1	Spares not applicable for the Package to be specifically quoted as "NOT APPLICABLE".				
2	In case if such items of spares indicated as "not applicable" by bidder in its offer, are found applicable at a later date during execution of the project, such items of spares are to be supplied within the ordered cost of the mandatory spares.				
3	Wherever % is indicated for the mandatory spares, the quantity shall be calculated for % of supply for one unit, unless otherwise specified. The quantity to be reckoned for % indicated shall be rounded off to the next higher whole number. For example if the % arrived is 0.2 the quantity to be supplied shall be 1 and if the % arrived is 5.1 the quantity to be supplied shall be 6.				
4	In respect of quantity mentioned as 'Set' means the total quantity of all the components/items used in particular equipment unless otherwise specified.				

ANNEXURE-I

ALL DIMENSIONS ARE IN MM

FIRST ANGLE PROJECTION

7101-141-666-00-3d 3d DWG



NOTES:-

Flange thicknesses listed are for Design pressure=5Kg/cm²(g) and Flange dimensions as given in the table. Final thickness of the flange is to be checked for actual OD/Bolting PCD/Neck dimensions.

— TENTATIVE

DRAWING FOR BAL' SEPARATOR COUNTER FLANGE

PIPE SIZE	PIPE THK.	FLANGE OD 'D'	BOL PCD 'D1'	FLANGE THK. 'A'	NECK THK. 'A'	WELD NECK THK. 'A'	NECK LENGTH 'L'	APPR. TOTAL LENGTH 'L'	SLIP-ON FLANGE THICKNESS
1200	10-12	1465	1380	40	24	70	200	90	90
1400	14	1675	1590	50	24	70	200	100	100
1600	14	1915	1920	60	32	80	220	110	110
1800	14-16	2115	2020	70	32	90	250	120	120
2200	18	2550	2420	80	36	100	300	140	140
2300	20			90	38	110	325	150	150
2500	20			90	38	110	325	150	150
2700	20			90	38	110	325	150	150

REV.		DATE	ALT	QTY	APPR	JOB NO.	999
STATUS		DISTRIBUTION					
BIHARAT HEAVY ELECTRICALS LTD PROJECTS ENGINEERING MANAGEMENT PPEL, NOIDA DRIVING NO. PC-999-141-M017 SHEET 01 OF 01							



NOTE:—
1. SCHEMATIC SHOWN IS TYPICAL FOR
ONE HALF OF CONDENSER, SHALL BE
IDENTICAL FOR THE CONDENSER
SECOND HALF.

a) BALL RECIRCULATING SKID COMPLETE WITH BALLS COLLECTOR, BOM, BRM, VALVES, INSTRUMENTS ETC.

- b) COUNTERFLANGES FOR BALL SEPARATORS.
- c) INJECTION NOZZLES WITH FLANGES/
COUNTER FLANGES.
- d) ALL VALVES IN CODES (*) INCLUDING
COUNTER FLANGES.

e) COUNTERFLANGES WITH NUTS, BOLTS & GASKETS FOR ALL TERMINAL POINTS.

f) SIGHT FLOW INDICATORS (*) OR ANY

COMING ON COTCS PIPEWORK.
SCOPE OF SUPPLY

PURCHASER'S	BIDDER'S

TYPICAL FLOW DIAGRAM FOR
ON LOAD TUBE CLEANING SYSTEM

DESIGN CLARIFIED WATER ANALYSIS (MAKE UP WATER)

S.No.	CONSTITUENTS	As	CONTENT
1.	Calcium	CaCO ₃	76.9 ppm
2.	Magnesium	CaCO ₃	59.5 ppm
3.	Sodium	CaCO ₃	148.2 ppm
4.	Potassium	CaCO ₃	2.5 ppm
5.	Iron in Soln.	Fe	0.7 ppm
6.	Hydrogen (FMA)	CaCO ₃	0.0 ppm
7.	Strontium (Sr)	CaCO ₃	0.0 ppm
8.	Barium	CaCO ₃	4.6 ppm
9.	Ammonia (NH ₄)	NH ₄	0.0 ppm
	TOTAL CATIONS (Except Fe)	CaCO₃	291.7 ppm
10.	Bicarbonate	CaCO ₃	116 ppm
11.	Sulphate	CaCO ₃	82.9 ppm
12.	Chloride	CaCO ₃	82.6 ppm
13.	Nitrate	CaCO ₃	7 ppm
14.	Phosphate	CaCO ₃	0.6 ppm
15.	Fluoride	CaCO ₃	2.6 ppm
	TOTAL ANIONS	CaCO₃	291.7 ppm
16.	Boron	B	0.52 ppm
17.	Reactive Silica	SiO ₂	14 ppm
18.	Colloidal Silica	SiO ₂	2.9 ppm
19.	Total Silica	SiO ₂	16.9 ppm
20.	Nitrites	NO ₂	1.8 ppm
21.	Total Hardness	CaCO ₃	109.7 ppm
22.	Total Suspended Solid		15 ppm
23.	Total Dissolved Solids		411 ppm
24.	Conductivity at 25°C		610 µS/cm
25.	pH value at 25°C	-	8.3
26.	Turbidity		15 NTU
27.	TOC		8.9 ppm
28.	BOD ₃ at 27°C		12 ppm
29.	COD		40 ppm
30.	Dissolved Oxygen		6.3 ppm
31.	Oil & Grease		<1 ppm

NOTE:

- 1. THE CYCLE OF CONCENTRATION (COC) SHALL BE CONSIDERED AS 6.5**
for sets of cooling water systems.
- 2. DATA FOR COOLING TOWER:**

SAMPLE IDENTIFIED AS : SEA WATER

SAMPLING METHOD N.A.
 SAMPLE DESCRIPTION SEA WATER
 SAMPLE QTY. 20L
 SAMPLE CODE N.08+24,001,E-78+04,088/09.09.06
 MARK TOP LAYER
 COLLECTED ON 09/09/2006
 TEST START DATE 13/09/2006
 TEST END DATE 27/09/2006

S.NO	Parameter	Protocol	Result
1	pH	ASTM D1292-99	7.98
2	Conductivity	ASTM D1125-99	53700 μ S/cm
3	Temperature	ASTM method	34°C
4	Turbidity	ASTM D1889-00	12.5 NTU
5	Salinity	ASTM method	35.5
6	Total Suspended Solids	ASTM D1888	6 mg/l
7	Total Organic Carbon	ASTM D4129-98	Less than 5 mg/l
8	Calcium as Ca	ASTM D511-98	400 mg/l
9	Magnesium as Mg	ASTM D511-98	1274 mg/l
10	Sodium as Na	ASTM D1428	12600 mg/l
11	Potassium as K	ASTM D1428	380 mg/l
12	Ammonia as NH ₃	ASTM D1426-98	BDL (DL : 0.01 mg/l)
13	Strontium as Sr	ASTM D5673-02	1.57 mg/l
14	Barium as Ba	ASTM D5673-02	BDL (DL : 0.41 mg/l)
15	Total Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
16	Dissolved Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
17	Total Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
18	Dissolved Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
19	Total iron as Fe	ASTM D1068-03	0.30 mg/l
20	Dissolved iron as Fe	ASTM D1068-03	0.16 mg/l
21	Chloride as Cl	ASTM D512-99	21088 mg/l
22	Sulfate as SO ₄	ASTM D516-02	3189 mg/l
23	Nitrate as NO ₃	ASTM 3867-99	0.87 mg/l
24	Nitrite as NO ₂	ASTM D3867-99	0.008 mg/l
25	Bicarbonate as HCO ₃	ASTM D1067-02	140 mg/l
26	Carbonates as CO ₃	ASTM D1067-02	NIL

27	Fluoride as F	ASTM D1179-99	1.4 mg/l
28	Boron as B	ASTM D3082-03	1.29 mg/l
29	Phosphate as PO ₄	ASTM D515-97	0.08 mg/l
30	Sulfide as H ₂ S	ASTM D4658-03	BDL (DL : 0.01 mg/l)
31	Total Silica as SiO ₂	ASTM D859-00	0.31 mg/l
32	Dissolved Silica as SiO ₂	ASTM D859-00	0.18 mg/l
33	Dissolved Oxygen	ASTM D888-96	5.5 mg/l
34	BOD @ 27°C for 3 days.	ASTM method	10 mg/l
35	Phenols	ASTM D1783-01	BDL (DL : 0.001 mg/l)
36	COD	ASTM D1252-00	62 mg/l
37	Oil & Grease	ASTM D4281-01	Less than 1 mg/l
38	Zinc as Zn	ASTM D5673-02	BDL (DL : 0.003 mg/l)
39	Copper as Cu	ASTM D5673-02	BDL (DL : 0.006 mg/l)
40	Nickel as Ni	ASTM D5673-02	BDL (DL : 0.008 mg/l)
41	Cadmium as Cd	ASTM D5673-02	BDL (DL : 0.003 mg/l)
42	Lead as Pb	ASTM D5673-02	BDL (DL : 0.01 mg/l)
43	Mercury as Hg	ASTM D5673-02	BDL (DL : 0.001 mg/l)

NOTE: BDL: Below Detection Limit.

DL : Detection Limit



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-417/435-165-N002**

SECTION: **II**

SUB-SECTION: **IIA**

REV. NO. **0** DATE **07.09.2018**

SHEET **1** OF **1**

SUB-SECTION - IIA

STANDARD TECHNICAL SPECIFICATION (MECHANICAL)

STANDARD TECHNICAL SPECIFICATION FOR COLTCS

STANDARD QUALITY PLANS



TITLE :

SPECIFICATION NO. PE-TS-999-165-N002

**STANDARD TECHNICAL SPECIFICATION
CONDENSER ON - LOAD TUBE CLEANING
SYSTEM (Sponge Rubber Ball Type)**

SECTION : II

SUB-SECTION : IIA

REV. NO. 01

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1.00.00 GENERAL

This specification covers the design, performance and operational requirements, configuration and constructional features, manufacture, assembly, inspection and testing at the manufacturer's and/or his sub-contractor's works and painting for delivery of condenser on-load tube cleaning system (sponge rubber balls type) complete with all accessories as specified hereinafter. Each half of the condenser shall be provided with an independent tube cleaning system.

2.00.00 CODES AND STANDARDS

2.01.00 The design, materials, manufacture, inspection and testing of the condenser on-load tube cleaning system complete with all accessories, shall comply with the requirements of the latest versions of the following appropriate codes and standards.

2.01.01 IS/BS/DIN/US Standards regarding pressure vessels, pumps, piping, flanges and others as necessary.

2.01.02 IS/BS/DIN/ASTM Standards for materials specification and testing procedures.

2.01.03 IS/BS/DIN/AWWA Standards for valves and the testing.

2.02.00 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 the matter, the interpretation of the specification by the Engineer shall be final and binding.

3.00.00 DESIGN AND CONSTRUCTION

3.01.00 General Requirements

3.01.01 Unless otherwise necessary, manufacturer's standard and proven models of the tube cleaning system shall be supplied.

3.01.02 The tube cleaning system shall be capable of safe, continuous and trouble-free operation for removal of fouling and scaling materials from condenser tubes. Vibration, noise, mechanical stresses shall be kept within allowable limits specified by relevant codes/standards. In design, due attention shall be given to ease of maintenance, repair and cleaning.

3.01.03 Suitable Corrosion allowance shall be provided whenever necessary. Adequate provision for future installation of cathodic protection shall be provided.

3.01.04 The tube cleaning system shall consist of ball separator at condenser outlet, recirculating pump, ball collector, differential pressure measuring system for ball separator, ball monitoring system, cleaning balls, piping valves, distributors, injection nozzles, instrumentations, control panel, interconnecting cables and others as necessary. The configuration of the tube cleaning system shall be as described in section C and / or as per the scheme enclosed.

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3.02.00	DELETED		
3.03.00	<u>Operational Requirements.</u> The tube cleaning system and other accessories shall be designed for the following operation modes :		
3.03.01	Complete automatic start-up of tube cleaning system initiated by pressing the push button (manual command).		
3.03.02	Complete automatic shut-down of tube cleaning system with ball collection, effected by the following : ◆ Push button (manual command). ◆ Adjustable timer (after a defined cleaning period). ◆ Ball monitoring system (when the number of oversized balls falls below a set value).		
3.03.02	Complete automatic backwashing of ball separator with ball collection, effected by the following : ◆ Differential pressure measuring system at a pre-determined differential across the ball separating strainer/ screen. ◆ Adjustable timer ◆ Push button		
3.03.04	Complete automatic emergency backwashing of ball separator with alarm, indication, effected by differential pressure measuring system.		
3.03.05	Manual operation for start-up, shut-down with ball collection backwashing of ball separator, flushing of differential pressure measuring system etc., in case of failure of control system.		
3..04.00	<u>Ball Separator</u>		
3.04.01	Ball separator body shall be of rigid construction and shall be designed and manufactured as per the applicable codes for pressure vessels. It shall house the ball separating screen / strainer and shall have flanged inlet, outlet, ball extraction opening and pressure measuring tappings etc. Body shall be designed and manufactured as per the applicable codes for pressure vessels and to take care of forces and moments as enclosed in the specification. However in no case thickness of housing/body shall be less than the connecting pipe thickness as specified in data sheet A		
3.04.02	The ball separator shall be provided with manhole with bolted cover and sight glass to observe its internals.		
3.04.03	If specified in Data Sheet -A, ball separator body shall be Epoxy lined.		



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- 3.04.04 The ball separating screen / strainer shall be designed for the maximum differential pressure across the separator and shall be securely mounted in the body. Screen / strainer shaft shall be sized adequately considering the overloading of screens / strainer due to debris accumulation.
- 3.04.05 The ball separating strainers / screens shall have electric actuators for swivelling to allow for their backwashing. Also suitable hand wheels shall be provided to enable manual swivelling of strainers / screens.
- 3.05.00 **Ball Recirculating Pump**
- 3.05.01 The ball recirculating pump shall be horizontal centrifugal type. The casing shall be designed to withstand 1.5 times the shut-off pressure or twice the operating pressure, whichever is higher.
- 3.05.02 The impeller shall be non-clog type and shall be contoured suitably to avoid damage to the cleaning balls. The impeller shall be secured suitably to the shaft and shall be retained against circumferential movement by keys, pins or lock rings. Loctite compound shall be applied after tightening of locknuts to prevent dislocation of impeller.
- 3.05.03 Replaceable type wearing ring shall be provided to prevent damage to the casing and impeller.
- 3.05.04 Pumps shall be provided with mechanical seals to the extent feasible. If Gland packing is provided it should be of good quality to be provided to prevent leakage of water from pump glands.
- 3.05.05 Shaft size selected shall take into Consideration the critical speed which shall be away from the operating speed as recommended in applicable codes / standards. Renewable type fine finished shaft sleeves shall be integral with water thrower plates at the end and the length must extend beyond the outer faces of gland packing so as to distinguish between the leakage between shaft and the shaft sleeve and that past the seals / glands.
- 3.05.06 Bearings of adequate design shall be provided for taking the entire pump load arising from all probable conditions of continuous operation through its range of operation. The bearings shall be designed on the basis of 20,000 working hours minimum for the load corresponding to the duty point. Proper lubricating element does not contaminate the liquid being pumped. Bearings shall be easily accessible without disturbing the pump assembly
- 3.05.07 Stuffing box of suitable design to permit replacement of packing without removing any part other than the gland shall be provided. The stuffing boxes shall be sealed / cooled by the fluid being pumped.
- 3.05.08 Pumps shall be of self-lubricated, self - sealed and self-cooled type. All pipework, fitters etc., for sealing, cooling and lubricating purpose shall be supplied and no external cooling/lubricating/sealing water will be supplied. Pump capacity shall take into account



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the cooling/lubricating/sealing water requirement.

3.05.09 All rotating components shall be statically and dynamically balanced.

3.05.10 The pump shall be designed such that pump impellers and other accessories of the pump, are not damaged due to flow reversal.

3.05.11 The pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the head Vs. flow characteristic curve over a range or 40% of rated flow to 120 -130 % of rated flow.

3.05.12 The pump shall preferably be non-overloading type. The total head Vs. capacity curve shall be continuously rising from the maximum flow point towards shut-off without any zone of instability.

3.05.13 The pump shall run smoothly without undue noise and vibration. Peak to peak vibration limits and noise level shall be within the acceptable values of applicable codes/standards.

3.05.14 The pump and motor shafts shall be connected through a pin and rubber bush flexible type of couplings. Suitable coupling guards shall be provided for the couplings.

3.05.15 The pump shall be capable of being started with discharge valve fully opened. Motor rating shall be adequate for this condition. The output KW rating of the pump drive motor shall not be less than the larger of the following :

- a) Maximum power input to the pump over the entire range for maximum flow to shut-off condition.
- b) 125% of power input to the pump at duty point corresponding to 103% of the rated speed.

3.06.00 **Ball Collector**

3.06.01 The body of the ball collector shall be designed to withstand 2.0 times the operating pressure or 1.5 times the recirculating pump shut-off pressure, whichever is higher. The ball collector shall be designed and manufactured as per the applicable codes for pressure vessels.

3.06.02 Ball collector shall be provided with an inspection window/sight glass for visual inspection of the cleaning balls.

3.06.03 Ball collector shall be provided with suitable ports with covers for ball feeding and removal.

3.06.04 The ball collector shall be provided with vent and drain connections with isolating valves.

3.06.05 Provision shall be made in the ball collector for separating the undersized balls and ball collector shall have a separate chamber for collecting the undersized balls.



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3.06.06 If specified in Data Sheet -A, ball collector body shall be lined with suitable resilient material.

3.06.07 The differential pressure measuring system shall be provided with D.P. transmitter ,DPS & DPGof remote seal arrangement.

3.07.00 **Differential Pressure Measuring System.**

3.07.01 The ball separator shall be provided with a measuring system for differential pressure across the ball separating strainer/screen, to check debris accumulation and to initiate ball catching and backwashing operations. This shall consist of a differential pressure switch/transmitter for automatic backwashing operation, a differential pressure guage for manual observation with adequate number of tappings with isolating valves.

3.07.02 The contacts for differential pressure switch/transmitter and for differential pressure guage shall be independent so that in the event of failure of one, the other is available.

3.07.03 The differential pressure measuring system shall be with remote seal arrangement .

3.08.00 **Ball Monitoring System**

3.08.01 Ball monitoring system shall be provided for continuously monitoring the quantity and size of the cleaning balls in circulation. The monitoring system shall perform the following functions :

- a) Continuously counting the oversize balls in circulation and giving an alarm calling for investigation of ball losses, when the number of oversize circulating balls falls below a set valve.
- b) Continuously measuring the size of the balls in circulation and initiating the shut-down of the tube cleaning system with alarm calling-for replacement of balls when the number of oversized balls falls below a set valve.
- c) Bidder's if not manufacturing ball oversized monitor, can supply automatic ball sorter in lieu of same for automatic sorting of the undersized balls.

3.08.02 The monitoring system shall be of proven and reliable design and shall be complete with necessary transducers, amplifiers, transmission lines, power cables and electronic processor etc.

3.08.03 The electronic processor of the ball monitoring system shall be housed in the control panel and shall consist the following : -

- a) Indicators for
 - ◆ required basic ball charge.
 - ◆ recirculating ball quantity.
 - ◆ oversized ball quantity.



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- b) Time counters for
- ◆ total cleaning system operating hours.
 - ◆ cleaning system operating hours with sufficient number of oversized balls.
- c) Recorder for ball consumption.

3.08.04 The ball monitoring system shall have provisions for self-testing and self-calibration.

3.09.00 **Cleaning Balls**

3.09.01 The sponge rubber cleaning balls shall be slightly oversized to the internal diameter of condenser tubes and should be able to remove all fouling and scaling deposits in the condenser tubes.

3.09.02 The specific gravity of the cleaning balls shall be such that good distribution of balls across the tube sheet and cleaning of all tubes are ensured.

3.09.03 The composition of the cleaning balls shall be based on natural rubber and shall be suitable for temperature upto 100°C. Hardness of the cleaning balls shall be compatible to tube material and corrosion/fouling behaviour. If cleaning balls consist of abrasive coated balls, the abrasive material shall also be compatible for use with the tube material.

3.09.04 Calculations and basis for selection of cleaning balls circulation quantity, type, size, hardness, cleaning frequency etc., shall be furnished during contract stage.

3.10.00 **Piping, Valves, Distributors and Injection Nozzles.**

3.10.01 Interconnecting piping, valves, injection nozzles and other fittings shall be designed to withstand 2.0 times the operating pressure or 1.5 times the pump shut-off pressure whichever is higher.

3.10.02 Interconnecting piping shall be sized and routed optimally. Velocity in the pipe work shall be less than 1.5 m/s for pump suction and less than 2.2 m/s in other pipe work.

3.10.03 Necessary isolation valves, vent and drain valves for various equipments shall be provided. Valves shall conform to appropriate standards. Valves provided in ball transport piping shall be ball type. Gland packing of all valve shall be of superior quality to avoid leakage. All valves upto 150 Nb shall be ball valves. For higher sizes, gate / globe / B.F. valves shall be provided. All instrument valves shall be needle valves.

3.10.04 Adequate number of ball injection nozzles shall be provided for proper distribution of cleaning balls in condenser inlet. Ball injection nozzles shall be flanged type and shall have two sets of flanges, one for connecting to ball transport pipe and other for connecting to the stub on condenser inlet pipe for ease of removal during repairs or checking.

3.10.05 Distributors (if applicable) with sight glass shall be provided wherever ball transport



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pipings branching out or joining together for proper guidance of cleaning balls.

3.10.6 Type of valves shall be ball valves, no diaphragm type valve shall be used.

3.11.00 **Actuators**

3.11.00 Tube cleaning system shall be provided with actuators wherever necessary for various automatic operations. The actuators shall be electric motor operated and shall meet the requirements of the enclosed specification. The actuator shall be provided with auxiliary handwheel for manual operation in the event of control system failure.

3.12.00 **Electric Motors**

The drive motors for recirculating pump and differential pressure measuring system flushing pump shall conform to the requirements of the enclosed specification.

3.13.00 **Instrumentation and Control System.**

3.13.01 Complete instrumentation and control system for automatic operation of tube cleaning system, protection, interlocking, indication / annunciation of differential pressure and other malfunctions etc., shall be provided. This shall consist of adequate operational hardware, local control panel (As applicable) and interconnecting control and power cabling between the control panel and various equipments in the tube cleaning system.

3.13.02 The control panel shall house all necessary instruments, indicating / annunciation lamps, alarms, differential pressure indicator, timer, function selection switches, ball monitoring system processor, relays, protection and interlocking systems, start / stop push button etc., and shall be complete with internal wiring. The control panel shall meet the requirements of the enclosed specification.

3.13.03 Pressure gauges shall be provided at recirculating pump suction and discharge. All instrumentation shall be of reputed make and shall meet the requirements of the enclosed specifications.

3.14.00 **Other Accessories.**

3.14.01 Counter flanges, complete with gaskets, bolts and nuts etc., shall be supplied for ball separator inlet, outlet connections and all other terminal points. Fabrication, dimensions and drilling of the flanges shall conform to the codes/standards specified in Data Sheet-A / Section -C.

3.14.02 Ball recirculating pump, ball collector with interconnecting piping and valves, shall be mounted on a frame. For fixing the frame, necessary foundation plates, bolts, nuts etc. shall be provided.

3.14.03 Suitable lifting arrangement shall be provided for various equipments of the tube cleaning system, for handling during erection and maintenance.

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4.00.00	DELETED
5.00.00	<u>SHOP INSPECTION AND TESTS</u>
5.01.01	<u>General</u>
5.01.01	Manufacturer shall conduct all tests and stage inspections as per the approved quality plan to ensure that the various equipments and other accessories of the tube cleaning system shall conform to the requirements of this specification and of the applicable codes / standards.
5.01.02	All materials used for manufacture /fabrication of the various equipments of the tube cleaning system shall be of tested quality. Relevant test certificates for chemical analysis, mechanical tests and heat treatment shall be made available before the final shop inspection. In case the relevant test certificates are not available, the manufacturer shall arrange to carry out the necessary tests as per the approved quality plan and applicable codes at his cost for which samples shall be identified by BHEL's representative.
5.01.03	All shop tests shall be conducted as per approved quality plan and test certificates / reports for the same shall be furnished to BHEL for approval.
5.01.04	Qualification of welding procedures and welders shall be as per ASME B&PV code, Section - IX / applicable codes.
5.2.00	<u>Ball Separator</u>
5.02.01	Chemical analysis, mechanical tests shall be carried out on materials used for body, strainer / screen, strainer / screen shaft and other appurtenances as per the applicable material specification standards.
5.02.02	All butt welded joints shall be subjected to radiographic/ ultrasonic testing as per applicable codes. However, all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.
5.02.03	Strainer / screen shaft shall be subjected to ultrasonic test as per ASTM-A388 for subsurface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1.
5.03.00	<u>Ball Recirculating Pump</u>
5.03.01	Chemical analysis, mechanical tests shall be carried out on materials used for casing, impeller, shaft, sleeves, wear rings etc., as per the applicable material specification standards.
5.03.02	The casting used for pump casing and impeller shall be sound, clean and free from porosity, blow holes, hard spots, cold shuts, distortion and other harmful defects. All accessible surfaces of the impeller shall be subjected to penetrant test as per ASTM-

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5.03.03	E165 for surface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1. No welding or repairs shall be carried out without prior permission of BHEL. Pump shaft and sleeves shall be subjected to ultrasonic test as per ASTM - A388 for sub-surface defects and penetrant test after finish machining as per ASTM-E165 for surface defects.		
5.03.04	Wear rings shall be subjected to penetrant test as per ASTM-E165.		
5.03.05	Pump impellers and rotor assembly shall be statically and dynamically balanced as per ISO-1940		
5.04.00	<u>Ball Collector</u>		
5.04.01	Chemical analysis, mechanical tests shall be carried out on materials used for body and other appurtenances / accessories as per the applicable material specification standards.		
5.04.02	All but welded joints shall be subjected to radiographic / ultrasonic testing as per applicable codes. However, all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.		
5.05.00	<u>Piping, Valves, Distributors, and Injection Nozzles.</u>		
5.05.01	Chemical analysis, mechanical tests shall be carried out for materials used for piping, fittings, valves, distributors and injection nozzles.		
5.05.02	All welded joints of distributors & injection nozzles shall be subjected to penetrant test as per ASTM-E165 for surface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1.		
5.05.03	Inspection and testing of valves including leakage test shall be carried out as per the requirements of the applicable standards. Valve stem and ball shall be subjected to penetrant test as per ASTM-E165.		
5.05.04	All materials for various nozzles, stubs, gaskets, nuts, bolts etc. shall be of tested quality and correlating test certificates for chemical and mechanical properties shall be furnished.		
5.06.00	<u>Rubber Lining (as applicable)</u>		
	Rubber lining shall be subjected to surface crack test, 100% spark and hardness tests and shall be checked for layer thickness, defects etc.		
5.07.00	<u>Flanges</u>		
5.07.01	Chemical and mechanical test certificates shall be furnished for flange materials.		
5.07.02	In case of fabricated flanges, all the welds shall be subjected to 100% radiography as		



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per ASME B&PV code, Section VIII, Division 1.

5.07.03 In case of forged flanges, ultrasonic testing shall be carried out as per ASTM-A 388.

5.07.04 If the thickness of the plate used for flanges is 40mm or more, the same shall be checked ultrasonically as per ASTM-A435 to demonstrate the absence of lamination and lack of fusion etc.

5.07.05 Flanges shall be checked for edge preparation, fit up and satisfactory working with matching parts.

5.08.00 **Dimensional Checks.**

Dimensional checks for various equipments/components of the tube cleaning system shall be carried out as per assembly drawing approved by BHEL. Alignment and fit up of movable parts shall be checked.

5.09.00 **Hydrostatic Test**

Hydrostatic test shall be conducted on various assemblies / equipments / components of the tube cleaning system at a pressure of 1.5 times and design pressure. The duration of the test shall be minimum 30 minutes.

5.10.00 **Leakage Test**

Leakage test shall be conducted at the design pressure on all assemblies of the tube cleaning system to demonstrate that the assemblies are leak tight and no water seepage shall take place at various nozzles and valve connections.

5.11.00 **Performance Test on Recirculating Pump**

Performance test on recirculating pump with drive motor shall be conducted as per BS-599 / ASME PTC 8.0. Performance curves i.e., discharge flow Vs head, discharge flow Vs power consumption and discharge flow Vs efficiency shall be plotted and acceptance norms shall be as per BS-599 / ASME PTC 8.0. Vibration and noise shall be measure and acceptance norms shall be as per Hydraulic Institute (USA) standard.

5.12.00 **Functional Tests**

Various assemblies / equipments / components of the tube cleaning system shall be subjected to functional tests and the following shall be checked.

5.12.01 Smooth and free operation of all movable parts.

5.12.02 Interlock and sequential operation.

5.12.03 Satisfactory operations of ball monitoring system.



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5.12.04 Satisfactory operations of actuators torque switches, limit switches etc.

6.00.00 **TESTING AT SITE**

After completion of installation at site, the tube cleaning system will be tested to check that the tube cleaning system performance meets the requirements of this specification. Rectification of all defects shall have to be done by the supplier at no extra cost to the owner / purchaser. However, the owner / purchaser reserves the right to reject the equipments / parts not meeting the requirement if the deficiency still persists.

7.00.00 **QUALITY ASSURANCE & QUALITY PLAN**

7.01.00 The tube cleaning system and other accessories to be supplied, shall have assured quality and workmanship.

7.02.00 Typical quality plans are enclosed herewith this specification for bidder's guidance. The bidder shall furnish his own quality plan based on materials, equipments and components of the tube cleaning system being offered.

8.00.00 **NAME PLATE AND TAG NUMBERS**

8.01.00 Ball separator, recirculating pump, ball collector shall be provided with a permanently attached brass or stainless steel plate indicating the following details :-

- a) Design and maximum flow rates.
- b) Design and test pressures.
- d) Design temperature.
- e) Empty and operating weights.

8.02.00 Each valve in the tube cleaning system shall be provided with a name plate indicating the following :-

- a) Service.
- b) Design and test pressures.
- c) Maximum flow and flow direction.
- d) Size.
- e) Tag Number.

Tag Numbers will be indicated on the drawings submitted for approval during contract stage.

8.03.00 Each motor shall be provided with a name plate indicating the following details:

- a) Supply conditions.
- b) KW Rating.
- c) Make.



	TITLE : DATA SHEET - C CONDENSER ON - LOAD TUBE CLEANING SYSTEM (Sponge Rubber Ball Type)	SPECIFICATION NO. PE-TS-999-165-N001	
		VOLUME : II B	
		SECTION : D	
		REV. NO. 01	DATE :20.06.16
		SHEET 1 OF 2	

1.00.00 DRAWING, DATA & INFORMATION TO BE SUBMITTED AFTER THE AWARD OF CONTRACT.

After the award of contract, the following drawings, data and information is to be submitted for review / approval of BHEL.

1.01.00 The drawings to be submitted by bidder in event of award of contract shall be as per cl. 10.0 (b), sub-section-1A.

1.01.01 Data sheet (s) - B.

1.01.02 Final versions of the following drawings to enable BHEL to finalise the layout and to design foundations and structures:-

- General arrangement / installation drawings of ball separator, ball recirculating unit, control panel each complete with all accessories, incorporating the principal dimensions and weights of equipment offered, size and location of various nozzle connection, supporting arrangement (wherever applicable) and scope of supply etc.
- Foundation arrangement drawings (wherever applicable) showing load data on supports, size and location of anchor bolts etc.
- General arrangement drawing indicating the layout of the equipments and interconnecting piping with pipe supports.

1.01.03 Bar chart and inspection schedule.

1.02.00 Within the stipulated time period as per Vendor's drawing /document list, the following shall be submitted.

1.02.01 Cross Sectional/ detailed drawing of ball separator, recirculating pump, ball collector, differential pressure measuring system, ball monitoring system distributors, injection nozzles actuators, motors, control panel etc, indicating bill of quantities and materials of construction.

1.02.02 Final versions of calculations and basis for selection of cleaning balls circulation quantity, type, size, hardness, cleaning frequency etc.

12.2.03 Flow and control logic diagrams for various operations of the tube cleaning system.

1.02.04 Detailed schedule of valves indicating Tag numbers, type, make size, pressure and temperature ratings, materials etc.

1.02.05 Detailed schedule of instruments indicating tag numbers, type, make, materials , of construction, range and accuracy etc.

1.2.6 Detailed schedule of piping and fittings indicating sizes, materials, maximum working pressure and temperatures etc.



	TITLE : DATA SHEET - C CONDENSER ON - LOAD TUBE CLEANING SYSTEM (Sponge Rubber Ball Type)	SPECIFICATION NO. PE-TS-999-165-N001	
		VOLUME : II B	
		SECTION : D	
		REV. NO. 01	DATE :20.06.16
		SHEET 2	OF 2

- 1.02.07 Control panel layout and list of instruments provided on control panel.
- 1.02.08 List of annunciators, protections and interlocks provided.
- 1.02.09 Detailed drawings of flanges.
- 1.02.10 Ball recirculating pump performance characteristic curves.
- 1.02.11 Write-up and instruction manuals for erection, operation and maintenance.
- 1.02.12 Storage instructions.
- 1.02.13 Vendor to send 3 sets of final documents (O&M manual, GA drg, P&ID) direct to site under intimation to PEM.

1 of 15

		Manufacturer's Name & Address		STANDARD QUALITY PLAN				BHEL Doc No.: PE-QP-999-165-N008			
		P.O. No.		Item : Ball Separator		Vendor Q.P. NO:		PROJECT:			
				PACKAGE : COLTCS		CUSTOMER:					
				Date :		PURCHASER:					
				Page 02 of 15		CONSULTANT:					
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency	Remarks	
1	2	3	4	5	6	7	8	9	D* ** M C O	11	
1.0.0	Ball Separator										
1.1.0	Raw Material										
[a]	Housing Shell, Nozzle flanges	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample/cast heat / batch	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Mill Test Certificate / Lab test report/Raw material flow sheet	*	P V V	
		Surface defects	Minor	Visual	100%	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Inspection report/ Raw material Flow sheet	-	P V V	
		Sub Surface Defects	Major	Ultrasonic test	100%	ASME SA 435	ASME SA 435	Inspection report	*	P V V	Plates > 20mm Thk only (UT - Full Volume)
[b]	Nozzle Pipes	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample/heat	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Mill Test Certificate / Lab test report/Raw material flow sheet	*	P V V	
		Surface defects	Minor	Visual	100%	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Inspection report/ Raw material Flow sheet	-	P V V	
		Leak Tightness	Major	Hydrostatic test	100%	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Mill Test Certificate	*	P V V	
[c]	Main Flange	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample/cast heat / batch	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Manufacturer's Test Certificate	*	P V V	
		Heat treatment (Normalising)	Major	Verification	HT Chart	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Manufacturer's Certificate	*	P V V	if casting
		Surface defects	Critical	Magnetic particle test	100%	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Inspection report	*	P V V	if casting
		Sub-surface defects	Critical	Ultrasonic test	100%	ASME SA609 / SA 435	ASME SA609 Level II / SA 435 / SA 388	Inspection report	*	P V V	
[d]	Screen Shaft	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample/heat	Approved sheet drg/Data sheet	Approved sheet drg/Data sheet	Mill Test Certificate / Lab test report/Raw material flow sheet	*	P V V	
		LEGEND									
				* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.							
				** M : Manufacturer / Manufacturer's Sub-contractor							
				C : Contractor O : Owner							
Manufacturer / Sub-Contractor Signature		Contractor		Indicate : "P" - Perform, "W" - Witness and "V" - Verification				Reviewed By		Name & Sign. Of approving authority & Seal	

		Manufacturer's Name & Address		STANDARD QUALITY PLAN				BHEL Doc No.: PE-QP-999-165-N008		
P.O. No.		Item : Ball Separator		Vendor Q.P. NO:		PROJECT:				
				PACKAGE : COLTCS		CUSTOMER:				
				Date :		PURCHASER:				
				Page 03 of 15		CONSULTANT:				
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency	Remarks
1	2	3	4	5	6	7	8	9	D* **	10
		Surface defects on machined area	Critical	Penetrant test	100%	ASME Sec.VIII Div.1 Appendix 8	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P V V
		Sub-surface defects	Critical	Ultrasonic test	100%	ASME SA745	ASME SA745	Inspection report	*	P V V
[e]	Screen ribs	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample / heat	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / Lab test report/Raw material flow sheet	*	P V V
		Corrosion Resistance	Major	IGC	One/Heat	ASTM A 923	ASTM A 923	Test Report/Lab test report	*	P V V
		Surface Defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Inspection report/ Raw material Flow sheet	-	P V V
[f]	Ball Extraction Nozzle Pipe [Duplex Stainless Steel]	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample / cast/heat/ batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / Lab test report/Raw material flow sheet	*	P V V
		Surface Defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Inspection report/ Raw material Flow sheet	-	P V V
		Leak Tightness	Major	Hydrostatic Test	100%	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's Test Certificate	*	P V V
1.2.0	Inprocess Quality Control									
1.2.1	Welding procedure specification	Correctness	Critical	Scrutiny	100%	ASME Sec.IX	ASME Sec.IX	QW 482 of ASME Sec.IX	*	P V V
1.2.2	Welding procedure qualification	Weld soundness	Critical	Physical test	100%	ASME Sec.IX	ASME Sec.IX	QW 483 of ASME Sec.IX	*	P V V
1.2.3	Welder performance qualification	Weld soundness	Critical	Radiography	100%	ASME Sec.IX	ASME Sec.IX	QW 484 of ASME Sec.IX	*	P V V
1.2.4	Fit-up of butt weld	Alignment, and dimensions	Major	Template, visual	100%	Manufacturing Drawing	ASME Sec VIII Div.1	Log book		P W/V -- BHEL to witness > 20mm thick butt joint
1.2.5	Fit-up of shell flange and nozzle assembly to shell	Orientation, alignment and dimensions	Major	Template, visual	100%	Manufacturing Drawing	ASME Sec VIII Div.1	Log book		P -- --
LEGEND										
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C : Contractor O : Owner										
Manufacturer / Sub-Contractor Contractor Indicate : "P" - Perform, "W" - Witness and "V" - Verification										
Signature										
Reviewed By										
Name & Sign. Of approving authority & Seal										

		Manufacturer's Name & Address				STANDARD QUALITY PLAN				BHEL Doc No.: PE-QP-999-165-N008				
		P.O. No.				Vendor Q.P. NO:				PROJECT:				
						Item : Ball Separator				PACKAGE : COLTCS		CUSTOMER:		
						Date :				PURCHASER:		CONSULTANT:		
				Page 04 of 15										
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency				Remarks	
1	2	3	4	5	6	7	8	9	D*	M	C	O	10	11
1.2.6	Weld quality for Pressure Parts													
	[a] Root run	Surface defects	Major	Penetrant test / Visual	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Operation Process Sheet	-	P	V	V		
1.2.7	[a] Completed butt welds	1.Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P	V	V		
		2.Sub-surface defects	Critical	Radiography test	10% of total weld length & 100% T Joints	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 4 / UW 52	Radiographs & inspection report	*	P	V	V		RT films will be reviewed by BHEL
	[b] Completed fillet welds	Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P	V	V		
1.2.8	Fabricated Shell (Prior to sand blasting)	1.Dimensions, Orientation	Major	Measurement by visual	100%	Manufacturing Drawing	Manufacturing Drawing	Inspection report	*	P	V	V		
		2. Hydro test	Critical	Hydrostatic Pr. @ 1.5 times design pr. (positive) Duration 30 minutes	100%	ASME Sec.VIII Div.1	No Leakage	Inspection report	*	P	W	V		
1.2.9	Pickling and Passivation	Protection Layer	Major	Visual	100%	IS : 10117	IS : 10117	Log Book	-	P	--	--		
1.2.10	Final tests (completed equipments) - After assembly	1.Dimensions, orientation, workmanship & finish	Major	Measurement by visual	100%	G.A.drawing	G.A.drawing	Inspection report	*	P	W	W		
		2.Leak tightness for assembly	Critical	Leak Tightness @ design pr. (positive) Duration 30 minutes	100%	ASME Sec.VIII Div.1	No Leakage	Inspection report	*	P	W	W		
		3.Dry function test for Ball Separator	Critical	Operational test	100%	Approved procedure	Approved procedure	Inspection report	*	P	W	W		
LEGEND														
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** M : Manufacturer / Manufacturer's Sub-contractor														
C : Contractor O : Owner														
Indicate : "P" - Perform, "W" - Witness and "V" - Verification														
Manufacturer / Sub-Contractor										Contractor				
Signature										Reviewed By				
										Name & Sign. Of approving authority & Seal				

		Manufacturer's Name & Address				STANDARD QUALITY PLAN			BHEL Doc No.: PE-QP-999-165-N008			
		P.O. No.				Item : Ball Separator		Vendor Q.P. NO:		PROJECT:		
								PACKAGE : COLTCS		CUSTOMER:		
		Date :		Date :		PURCHASER:		CONSULTANT:				
Page 05 of 15												
Sl. No.	Component / Operation	Characteristics	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency			Remarks
1	2	3	4	5	6	7	8	9	D*	**	10	11
1.3.0	Rubber Lining for ball Separator Shell, V-Piece & skid IC Pipe.											
1.3.1	Rubber formulation	Tensile elongation and hardness	Major	Physical test	One per lot	Manufacturer's procedure	BS 6374/Equivalent	Manufacturer's test certificate	P	V	V	
		Polymer Identification	Major	Flame test	One per lot	For Semi Ebonite	For Semi Ebonite	Inspection report	*	P	V	V
						Ebonite Polymer catches fire; catches fire and On removal from fire it continues to burn	Ebonite Polymer catches fire; catches fire and On removal from fire it continues to burn					
		% Change in weight after 24 hrs immersion in sea water at 70 degrees	Major	Immersion test (bleeding test)	One per lot	ASTM D 471	+/- 1 %	Inspection report	*	P	V	V
1.3.2	Surface preparation of items to be lined	Free from rust scale, dust and grease	Major	Visual	100%	SA 2.5	SA 2.5	Manufacturer's Internal inspection	P	-		
1.3.3	Vulcanising	Temperature, Pressure and time	Major	Process monitoring	100%	Manufacturer's procedure	Manufacturer's procedure	Process Procedure	P	-	-	
1.3.4	Vulcanised rubber lined items	a) Chip test	Major	Chip test	One per lot	Approved drawing and BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V
		b) Adhesion, Visual defects, thickness and hardness	Major	Measurement, visual inspection	100% visual, Thickness 0 hardness at random	Approved drawing and BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V
		c) Spark test for Pin holes at 5 kv/mm	Major	Spark test for Pin holes	100%	Approved drawing and BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V
LEGEND * Records identified with "STAR" shall be essentially included by contractor in QA Documentation. ** M : Manufacturer / Manufacturer's Sub-contractor C : Contractor O : Owner												
Manufacturer / Sub-Contractor Signature		Contractor		Indicate : "P" - Perform, "W" - Witness and "V" - Verification				Reviewed By		Name & Sign. Of approving authority & Seal		

		Manufacturer's Name & Address				STANDARD QUALITY PLAN				BHEL Doc No.: PE-QP-999-165-N008			
		P.O. No.				Item : WORM GEAR & ACTUATORS		Vendor Q.P. NO:		PROJECT:			
								PACKAGE : COLTCS		CUSTOMER:			
								Date :		PURCHASER:			
						Page 06 of 15		CONSULTANT:					
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency				Remarks
1	2	3	4	5	6	7	8	9	D*	M**	C	O	11
1.4.0	Complete Unit of Worm gear	Reduction Ratio	Critical	Functional Test	100%	Approved Sheet	Data Approved Data Sheet						
		Angle of Rotation						Manufacturer test certificate	*	P	V	V	
		Input Torque											
		Output Torque											
		Degree of protection	Critical	Water & Dust ingress tests	Type test	Approved Data Sheet	Approved Data Sheet	Type test certificate	*	V	V	V	
1.5.0	Actuators	Routine Test	Major	Electrical test	100%	Supplier catalogue	Supplier ADS	Manufacturer TC	*	V	V	V	Review of TCs
		Make, Range, Model	Major	Visual	100%								
		Assembly check alongwith ball valves	Major	Visual	100%	Supplier catalogue	Supplier catalogue / ADS	Inspection Report	-	P	--	--	
		Functional check alongwith settings/auxiliary contacts	Major	Visual	100%								
Note: ADS - APPROVED DATA SHEET													
LEGEND													
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C : Contractor O : Owner													
Indicate : "P" - Perform, "W" - Witness and "V" - Verification													
Manufacturer / Sub-Contractor				Contractor				Reviewed By				Name & Sign. Of approving authority & Seal	
Signature													

		Manufacturer's Name & Address					STANDARD QUALITY PLAN			BHEL Doc No.:		PE-QP-999-165-N008	
		P.O. No.					Vendor Q.P. NO:			PROJECT:			
							Item : Ball Recirculation Skid & Ball Vessel			PACKAGE : COLTCS		CUSTOMER:	
							Date :			PURCHASER:			
					Page 07 of 15			CONSULTANT:					
Sl. No.	Component / Operation	Characteristics	Class	Type of	Quantum of	Reference	Acceptance	Format of	Agency			Remarks	
		Checked		Check	Check	Documents	Norms	Record	M	C	O		
1	2	3	4	5	6	7	8	9	D*	**	10	11	
2.0.0	Complete Skid												
	Recirculating Skid with ball vessel and ball oversize monitor	Completeness, Correctness, Orientation, Dimensions	Major	Visual & Measurement	100%	Approved Drawing	Approved Drawing	Inspection report	*	P	V	V	
	Ball Vessel												
2.1.0	Raw Material												
[a]	Housing Shell, Nozzle flanges and dished end	Chemical properties & Physical properties	Major	Chemical Analysis & Mechanical test	One sample/heat	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / Lab test report / raw material flow sheet	*	P	V	V	
		Surface defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill TC/Inspection report	*	P	V	V	
		Sub-surface defects	Major	Ultrasonic test	100%	ASME SA 435	ASME SA 435	Inspection report	-	P	V	V	
2.2.0	Inprocess Quality Control												
2.2.1	Welding procedure specification	Correctness	Critical	Scrutiny	100%	ASME Sec.IX	ASME Sec.IX	QW 482 of ASME Sec.IX	*	P	V	V	
2.2.2	Welding procedure qualification	Weld soundness	Critical	Physical test	100%	ASME Sec.IX	ASME Sec.IX	QW 483 of ASME Sec.IX	*	P	V	V	
2.2.3	Welder performance qualification	Weld soundness	Critical	Radiography	100%	ASME Sec.IX	ASME Sec.IX	QW 484 of ASME Sec.IX	*	P	V	V	
2.2.4	Dished end for ball vessel	Dimensions	Major	Template	100%	Manufacturing Drawing	ASME Sec VIII Div.1	Inspection report	-	P	V	V	
		Surface defects	Critical	Penetrant test	100%	ASME Sec VIII Div.1	ASME Sec VIII Div.1 Appendix 8	Inspection report	-	P	V	V	
			LEGEND										
			* Records indentified with "STAR" shall be essentially included by contractor in QA Documentation.										
			** M : Manufacturer / Manufacturer's Sub-contractor										
			C : Contractor										
			O : Owner										
Manufacturer / Sub-Contractor			Contractor		Indicate : "P" - Perform, "W" - Witness and "V" - Verification								
Signature							Reviewed By				Name & Sign. Of approving authority & Seal		

		Manufacturer's Name & Address		STANDARD QUALITY PLAN					BHEL Doc No.: PE-QP-999-165-N008					
		P.O. No.		Item : RECIRCULATING PUMP		Vendor Q.P. NO:		PROJECT:						
						PACKAGE : COLTCS		CUSTOMER:						
						Date :		PURCHASER:						
						Page 9 of 15		CONSULTANT:						
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency				Remarks	
1	2	3	4	5	6	7	8	9	D*	M	C	O	11	
2.3.0	Raw material control													
2.3.1	Casing	Chemical, Physical properties	Major	Chemical & Physical analysis	One Sample/Cast / Heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's Certificate	Test	*	P	V	V	
		Surface defects	Minor	Visual	100%	Approved drg/ Data sheet	Approved drg/ Data sheet	MTC / Inspection report		-	P	V	V	
2.3.2	Impeller, Sleeve	Physical, and Chemical properties	Major	Physical and Chemical analysis	One Sample/Cast / Heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's Certificate	Test	*	P	V	V	
2.3.3	Shaft	Physical, and Chemical properties	Major	Physical and Chemical analysis	One Sample/Cast / Heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's Certificate	Test	*	P	V	V	
		Sub-Surface defects	Major	Ultrasonic Test	100%	ASME SA 745	ASME SA 745	MTC / Inspection report		*	P	V	V	Only for shaft >= 50mm
2.3.4	In-process control													
2.3.5	Casing	Leak tightness	Critical	Hydro, test @ 1.5 times design pr. (positive) (Duration 30 minutes)	100%	Manufacturing Standard	No Leakage	Inspection report		*	P	V	V	
2.3.6	Shaft	Surface defects	Critical	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report		*	P	V	V	
2.3.7	Impeller	Residual, static, dynamic unbalance	Major	Static, dynamic balancing	100%	ISO:1940	ISO:1940, Gr 6,3	Inspection report		*	P	V	V	
2.3.8	All components	Workmanship, finish and dimensions	Major	Measurement, visual examination	100%	Manufacturing drawing	Manufacturing drawing	Log book / job card		-	P	--	-	
2.3.9	Assembly, control, final inspection / test													
	Performance Test	a) Q Vs. Head, Q Vs. Pumps efficiency / overall efficiency, Q Vs. Power, Vibration and Noise	Critical	Performance test	100%	Approved curve, data sheet, IS:5120	Approved data sheet	Inspection report, plotted curves	*	P	V	V		
		b) Dimensions, workmanship and finish	Major	Measurement, visual	100%	Data sheet	Data sheet							
		c) Noise level	Major	-	-	-	85 db at 1 meter distance							
2.3.10	Complete pump	Completeness, correctness, cleanliness	Major	Visual examination	100%	Approved data sheet / Mfg. Drg.	Approved data sheet / Mfg. Drg.	Check list / inspection report	*	P	V	V		
		LEGEND												
				* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.										
				** M : Manufacturer / Manufacturer's Sub-contractor										
				C : Contractor		O : Owner								
Manufacturer / Sub-Contractor		Contractor		Indicate : "P" - Perform, "W" - Witness and "V" - Verification										
Signature								Reviewed By				Name & Sign. Of approving authority & Seal		

		Manufacturer's Name & Address		STANDARD QUALITY PLAN					BHEL Doc No.:		PE-QP-999-165-N008		
		P.O. No.		Item : BALL VALVES		Vendor Q.P. NO:		PROJECT:					
						PACKAGE : COLTCS		CUSTOMER:					
						Date :		PURCHASER:					
						Page 10 of 15		CONSULTANT:					
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency			Remarks	
1	2	3	4	5	6	7	8	9	D*	M	C	O	10
2.4.0	Ball valves												
2.4.1	Materials												
	Body and Tail end pieces	Chemical, Physical properties	Major	Chemical & Physical analysis	One Sample/Cast / heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's T.C.	*	P	V	V	
2.4.2	Ball	Chemical, Physical properties	Major	Chemical & Physical analysis	One Sample/Cast / heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's T.C.	*	P	V	V	
2.4.3	Stem	Chemical, Physical properties	Major	Chemical & Physical analysis	One Sample/Cast / heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's T.C.	*	P	V	V	
2.4.4	In-process inspection												
2.4.5	Machining of body, end, pieces, ball	Dimension	Major	Measurement	100%	Approved drg/Data sheet	Approved drg/Data sheet	Log book	-	P	V	V	
2.4.6	Ball	a) Surface defects	Critical	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P	V	V	
		b) Hardness	Major	Hardness testing	Random	Approved drg/Data sheet	Approved drg/Data sheet	Inspection report	*	P	V	V	
2.4.7	Assembly	a) Dimensions	Major	Measurement	100%	EN ISO 17292	EN ISO 17292	Manufacturer's T.C.	*	P	V	V	
		b) Opening / Closing	Major	Operation	100%	--	As per approved data sheet	-	-	P	V	V	Test at works for opening / closing time of actuator operated valves.
2.4.8	Testing												
	[a] Body	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2/API 598/Appd data sheet	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[b] Seat test	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2/API 598/Appd data sheet	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[c] Seat	Leakage	Critical	Air test	100%	EN 12266-1&2/API 598/Appd data sheet	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
			LEGEND										
			* Records indentified with "STAR" shall be essentially included by contractor in QA Documentation.										
			** M : Manufacturer / Manufacturer's Sub-contractor										
			C : Contractor O : Owner										
Manufacturer / Sub-Contractor			Contractor		Indicate : "P" - Perform, "W" - Witness and "V" - Verification		Reviewed By				Name & Sign. Of approving authority & Seal		
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					Manufacturer's Name & Address			STANDARD QUALITY PLAN				BHEL Doc No.:		PE-QP-999-165-N008	
								Vendor Q.P. NO:		PROJECT:					
					Item : Pressure Gauge, DP Gauge, DP Switch, DP Transmitter			PACKAGE : COLTCS		CUSTOMER:					
					P.O. No.			Date :		PURCHASER:					
										CONSULTANT:					
					Cleaning Balls										
					All components & Equipments			Page 13 of 15		PACKAGE : COLTCS					
Sl. No.	Component / Operation	Characteristics	Class	Type of	Quantum of	Reference	Acceptance	Format of		Agency			Remarks		
		Checked		Check	Check	Documents	Norms	Record		M	C	O			
1	2	3	4	5	6	7	8	9	D*	**	10		11		
5.0.0	In process quality control	Make, Range and Model	Critical	Visual	100%	Approved Sheet	Data	Approved Data Sheet	Manufacturer test certificate	*	P	V	V		
		Calibration	Critical	Calibration test	100%	Approved Sheet	Data	Approved Data Sheet	Manufacturer test certificate	*	V	V	V		
		Degree of Protection	Critical	-	Type,Test Certificate	Approved Sheet	Data	Approved Data Sheet	Manufacturer test certificate	*	V	V	V	For Pressure guage, DP Guage, DP Switch	
6.0.0	Cleaning Balls														
	- Normal balls - Abrasive balls	Dimensions	Critical	Measurement	Random	Approved Data Sheet		Approved Data Sheet	Manufacturer's test certificate	*	P	V	V	Quantity and type of balls to be checked with datasheets	
		Type Size				Sheet									
7.0.0	All Components / Equipments	Painting Dry film thickness and visual	Major	Measurement	Random	Painting schedule		Painting schedule	Inspection report	*	P	V	V		
		Packing	Major	Measurement	100%	MFG. Procedure		MFG. Procedure	Inspection report	*	P	V	-		

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										Manufacturer's Name & Address				STANDARD QUALITY PLAN				BHEL Doc No.: PE-QP-999-165-N008	
P.O. No.										Item : FASTENERS				Vendor Q.P. NO:		PROJECT:			
										PACKAGE : COLTCS				CUSTOMER:					
										Date :				PURCHASER:					
										Page 15 of 15				CONSULTANT:					
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency			Remarks						
1	2	3	4	5	6	7	8	9	D*	M	C	O	11						
9.1.0	Internal Fasteners (Duplex Steel)	Chemical & Physical properties	Major	Chemical Mechanical analysis	1 Per heat/HT Batch	Approved sheet	drg/Data sheet	Approved sheet	drg/Data	Mfr TC / Lab report	*	P	V	V					
		Visual workmanship finish	Major	Visual	Sample	Approved sheet	drg/Data sheet	Approved sheet	drg/Data		—	P	V	V					
		Dimensions	Major	Measurement	Sample	Approved sheet	drg/Data sheet	Approved sheet	drg/Data		—	P	V	V					
9.2.0	Main Fasteners	Visual	Major	Visual	Sample	Approved sheet	drg/Data sheet	Approved sheet	drg/Data	Inspection report / Mfr TC	*	P	V	V					
		Dimensions	Major	Measurement	Sample	Approved sheet	drg/Data sheet	Approved sheet	drg/Data	Inspection report / Mfr TC	*	P	V	V					
		Chemical & Physical properties	—	Chemical & Physical test	1 sample per heat	Approved sheet	drg/Data sheet	Approved sheet	drg/Data	Mfr TC/Lab report	*	P	V	V					
				a) Tensile															
				b) Yield															
				c) Elongation															
				d) Proof load															
LEGEND																			
* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.																			
** M : Manufacturer / Manufacturer's Sub-contractor																			
C : Contractor O : Owner																			
Manufacturer / Sub-Contractor Signature		Contractor		Indicate : "P" - Perform, "W" - Witness and "V" - Verification						Reviewed By		Name & Sign. Of approving authority & Seal							



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-417/435-165-N002**

SECTION: **II**

SUB-SECTION: **IIB**

REV. NO. **0** DATE 07.09.2018

SHEET **1** OF **1**

SUB-SECTION - IIB

STANDARD TECHNICAL SPECIFICATION (ELECTRICAL)



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO. PE-SS-999-506-E101
VOLUME NO. : II-B
SECTION : D
REV NO. : 00 DATE : 29/08/2005
SHEET : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

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

1.0

INTENT OF SPECIFIATION

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

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

2.0

CODES AND STANDARDS

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

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

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

3.0

DESIGN REQUIREMENTS

3.1

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

3.2

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

3.3

Starting Requirements

3.3.1

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

3.3.2

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

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 2 OF 4
The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.		
3.3.3 The following frequency of starts shall apply		
i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.		
ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)		
iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor		
3.4 Running Requirements		
3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.		
3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.		
3.5 Stress During bus Transfer		
3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.		
3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.		
3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.		
3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.		
4.0 CONSTRUCTIONAL FEATURES		
4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy		
4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.		
Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled		
4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.		

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
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		SHEET : 3 OF 4
4.4.	Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.	
4.5	Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.	
4.6	In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation. In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.	
4.7	Terminals and Terminal Boxes	
4.7.1	Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A. Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".	
4.7.2	unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.	
4.7.3	Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.	
4.7.4	Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.	
4.7.5	Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.	
4.7.6	Degree of protection for terminal boxes shall be IP 55 as per IS 4691.	
4.7.7	Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.	
4.7.8.	Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.	
4.7.9	Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.	
4.8	Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.	
4.9	General	

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
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		REV NO. : 00 DATE : 29/08/2005
		SHEET : 4 OF 4
4.9.1 Motors provided for similar drives shall be interchangeable. 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors. 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above. 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956. 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz. 4.9.6 Name plate with all particulars as per IS: 325 shall be provided 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions. 5.0 INSPECTION AND TESTING 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied. 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser. 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan. 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A. 6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT a) OGA drawing showing the position of terminal boxes, earthing connections etc. b) Arrangement drawing of terminal boxes. c) Characteristic curves: (To be given for motor above 55 kW unless otherwise specified in Data Sheet). i) Current vs. time at rated voltage and minimum starting voltage. ii) Speed vs. time at rated voltage and minimum starting voltage. iii) Torque vs. speed at rated voltage and minimum voltage. For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling. iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.		

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

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION : TITLE :			
		SHEET 2 OF 2		SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	
NOTES: 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON 2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. 3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
BHEL			PARTICULARS		BIDDER/VENDOR				BIDDER'S/VENDORS COMPANY SEAL			
			NAME									
			SIGNATURE									
			DATE									



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-417/435-165-N002**

SECTION: **II**

SUB-SECTION: **IIC**

REV. NO. **0** DATE 07.09.2018

SHEET **1** OF **1**

SUB-SECTION - IIC

STANDARD TECHNICAL SPECIFICATION (C &I)

QUALITY PLANS FOR

- 1. LOCAL CONTROL CUM STARTER PANEL**
- 2. INSTRUMENTS**



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STANDARD QUALITY PLAN FOR LOCAL CONTROL CUM STARTER PANEL

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

VOLUME IIB

SECTION D

REV. NO. **00** DATE: **28.03.2017**

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 ^{\$}			Remarks
									P	W	V	
1.0	INCOMING Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	3	---	2	
		2. Bend Test	CR	Mech. test	Sample	IS:1079 IS:513	IS:1079 IS:513	Log Book	2	---	---	
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---	
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---	---	
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---	---	
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	1	
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	IS:2062	IS:2062	Log Book	2	---	---	
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---	
		3. Straightness	MA	Measurement	100%	Factory Std.	Factory Std.	Log Book	2	---	---	
		4. Mill marking	MA	Visual	100%	IS:2062	IS:2062	Log Book	2	---	1	
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---	
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---	

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

^{\$} P - Agency Performing the Test.
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V - Agency Verifying the Test.

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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 ^{\$}			Remarks
									P	W	V	
		3. Conductor a) Resistance b) Size c) Sheet colour	MA MA MA	Electrical Measurement Visual	100% 100% 100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---	
		4. Type / Routine Test Certificates	MA	Verification	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	3	---	2	
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc.	1. Verification at make and Type 2. Verification of Test Certificates 3. Operation / Functional check 4. I.R. 5. H.V. 6. Calibration 7. Pick up / Drop off Voltage	CR CR CR MA MA MA MA	Visual Scrutiny of Type / Routine T.Cs. Electrical Electrical Electrical Electrical	Sample 100% Sample+ 100% 100% 100% 100% 100%	BHEL Spec. and BOM Relevant IS Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue	BHEL Spec. and BOM Relevant IS Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue	Log Book Log Book Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2 2 2	--- --- --- --- --- --- ---	--- --- --- --- --- 1 ---	+ for relay & contactors only @ for all components except relays & contactors.

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SHEET 3 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^s			Remarks
									P	W	V	
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
		2. Surface defects	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
		3. IR / HV on Terminal Blocks	MA	Electrical	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
6.0	IN PROCESS Blanking / Bending / Forming	1. Dimensions	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
		2. Surface defects after bending	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	---	
7.0	Nibbling / Punching	1. Cutout Sizes	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
		2. Deburring	MA	Visual	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
8.0	ASSEMBLY Frame Assembly & Sheet fixing	1. Dimensions	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		2. Alignment	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		3. Welding Quality	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		4. Surface defects	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	

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

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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 ^{\$}			Remarks
									P	W	V	
10.	Panel Wiring	1. Wiring Layout	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		2. Wiring Termination (Crimped Lugs)	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		3. Ferrule numbers	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		4. Colour of wiring	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
		5. Size of Conductor	MA	Measurement	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
11.	Component Mounting	1. Correct components	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
		2. Fixing	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
12.	FINAL Final Inspection	1. Workmanship	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.
		2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		3. Components identification Marking / Name plates	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	

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

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SHEET 7 OF 7

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

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

CHECK LIST FOR TRANSMITTER

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

Legend :

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

Note :

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



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-417/435-165-N002**

SECTION: **III**

SUB-SECTION:

REV. NO. **0** DATE 07.09.2018

SHEET **1** OF **1**

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER



**TITLE : SCHEDULE OF PERFORMANCE GUARANTEES
FOR
CONDENSER ON LOAD TUBE CLEANING SYSTEM (COLTCS)**

SPEC. NO. PE-TS- 417/435-165-N002

SECTION: III

Sheet 1 of 1 Date- 23.09.2018

S.NO.	DESCRIPTION	UNITS	YADADRI TPS – 5X800 MW
1.	Pressure drop across the ball collecting Strainers (i.e. between inlet & outlet nozzle) under clean condition and Normal flow condition	MWC	
2	Percentage of ball recovery	%	
3	Life of sponge rubber balls	Weeks	

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



**TITLE : SCHEDULE OF PERFORMANCE GUARANTEES
FOR
CONDENSER ON LOAD TUBE CLEANING SYSTEM (COLTCS)**

SPEC. NO. PE-TS- 417/435-165-N002

SECTION: III

Sheet 1 of 1 Date- 23.09.2018

S.NO.	DESCRIPTION	UNITS	UDANGUDI STPP – 2X660 MW
1.	Pressure drop across the ball collecting Strainers (i.e. between inlet & outlet nozzle) under clean condition and Normal flow condition	MWC	
2	Percentage of ball recovery	%	
3	Life of sponge rubber balls	Weeks	

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

	COMPLIANCE CERTIFICATE FOR COLTCS	SPEC. NO.	PE-TS- 417/435-165-N002
		DATE:	29.09.2018
		SHEET	1 OF 2

COMPLIANCE CERTIFICATE

The bidders shall confirm compliance with following by signing/ stamping this compliance certificate 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 with regard to same.
- b) There are no other deviations w.r.t. specification 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/Customer's Consultant approval and 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. Charges for 3rd party inspection (TUV/ equivalent) for imported components wherever required shall be included by bidder in the base price itself.
- d) Any drawing/ document/ data-sheet/ calculation/ Quality plan/ Instrumentation etc. submitted along with the offers shall be considered for reference only, same shall be subject to BHEL/ Customer/Customer's Consultant approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification. 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 including balls shall be supplied on 'As Required Basis' and to be supplied at the time of commissioning of COLTCS system & prices for same included in the base price itself.
Prices for special tools & tackles, if any, shall also be included in the base price.
Recommended spares for 3 years shall be quoted separately with price indicated separately.
- g) Charges for Installation Checks, Commissioning of equipments, Trial runs and Performance Testing at site shall be included by bidder as per the price format.
- h) The main flanges for Ball separator shall be suitable for the forces and moments as per the specification.
- j) Injection nozzles – 2/4 numbers of stubs of 100 NB or size as informed by bidder shall be provided by BHEL. The injection nozzles, counter flanges for the stubs along with nuts, bolts and gaskets shall be supplied by the bidder.
- k) Number of balls (Normal as well as abrasive) for COLTCS shall be as specified i.e Number of balls per charge shall be @ 10% of no. of tubes per condenser section.
- l) The hydrostatic test pressure shall be 1.5 times the design pressure.
- m) All sub - vendors shall be subject to BHEL/ Customer/Customer's Consultant approval in the event of order.
- n) The Performance guarantees of equipments shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Customer/Customer's Consultant.
- o) The orientation of piping around COLTCS shall be finalised during detailed Engg.
- p) Electrical/ C&I :

	COMPLIANCE CERTIFICATE FOR COLTCS	SPEC. NO.	PE-TS- 417/435-165-N002
		DATE:	29.09.2018
		SHEET	2 OF 2

- All selected motor ratings have minimum 15 % margin over maximum continuous demand of the driven equipment including voltage and frequency variations, temperature rise and other factors.
- Supply of electrical viz. LT power cables, instrumentation and control cables, cable glands, lugs, cable trays etc. shall be as per specification. Their erection shall be done by BHEL
- The junction boxes for termination of DPT/ DPS/ Actuator LS / solenoid valves/ Ball oversize monitor/ Ball recirculating monitor are included in bidder's scope. The instrumentation cable and cabling from instruments/ actuators to junction boxes is also included in bidder's scope.
- Valve actuators and controls shall be provided as specified in Data Sheet-A and Project specific requirements as specified in Sub-Section IB & Section IC.
- Alarms/ annunciations/ instruments shall be finalised during detailed engineering in the event of order which shall be subject to BHEL/ Customer/Customer's Consultant approval and shall be without any commercial implications to BHEL.



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME III PART A
SHEET I OF 13

INSTRUCTION TO BIDDER 1. This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
1.0	General :	
1.1	Number of Tube Cleaning System sets being supplied.	Nos.
1.2	Type	
1.3	Liquid handled	
1.4	Manufacturer	
1.5	Country of origin	
2.0	Design :	
2.1	Design Pressure	Bar (g)
	a) Ball Separator	
	b) Ball Recirculating Pump	
	c) Ball Collector	
	d) Piping	
	e) Valves	
	f) Distributors	
	g) Injection Nozzles	
2.2	Design Temperature	°C
2.3	Operating pressure at condenser inlet	Bar (g)
2.4	Design differential pressure	Bar (g)
2.5	Flow rate through ball separator	M ³ /hr
	a) Normal	
	b) Maximum allowable	
2.6	Flow rate through ball collector	M ³ /hr
	a) Normal	
	b) Maximum allowable	

Name of
Bidder/ Vendor

Revision Number

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Signature of Bidder/ Vendor

Authorised Representative

Date



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME	III	PART	A
SHEET	2	OF	13

INSTRUCTION TO BIDDER 1. This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
3.0	Guaranteed Performance	
3.1	Whether condenser back pressure/overall heat transfer coefficient is guaranteed that it will be permanently maintained as long as the tube cleaning system is in operation.	YES/NO
3.2	Pressure drop across the ball separator (i.e., between inlet and outlet connections) :	
	a) Normal flow condition	
	b) Maximum allowable flow condition	
3.3	Power consumption by ball recirculating pump during :	KW
	a) Normal operation	
	b) Ball collection operation	
	c) Ball sorting operation	
3.4	Quantity of cleaning balls required per set for an operating period of one year	Nos.
4.0	Operation :	
	Whether tube cleaning system is designed for the following operation modes :	
4.1	Automatic start-up initiated by push button.	YES/NO
4.2	Automatic shut-down with ball collection effected by :	
	a) Push button	YES/NO
	b) Adjustable timer	YES/NO
	Ball monitoring system	YES/NO

Name of Bidder/ Vendor					
Revision Number	0	1	2	3	4
Signature of Bidder/ Vendor Authorised Representative					



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME III PART A
SHEET 3 OF 13

INSTRUCTION
TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PES-179-01.
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
4.3	Automatic backwashing of ball separator with ball collection effected by :	
	a) Differential pressure measuring system	YES/ NO
	b) Adjustable timer	YES/ NO
	c) Push button	YES/ NO
4.4	Automatic emergency backwashing of ball separator effected by differential pressure measuring system.	YES/ NO
4.5	Automatic flushing of differential pressure measuring system.	YES/NO
4.6	Automatic ball sorting initiated by push button.	YES/NO
4.7	Whether provision for manual operation of the complete tube cleaning system is made in case of control system failure.	YES/NO
5.0	Ball Separator :	
5.1	Make	
5.2	Nos. provided per set	Nos.
5.3	Code/ Standard	
5.4	Body outer diameter	mm
5.5	Body thickness	mm
5.6	Manhole type & size	mm
5.7	Whether sight glass is provided	
5.8	No. of screens/ strainers provided per each ball separator	Nos.
5.9	Type of arrangement provided to prevent lodging of the debris at the entrance of ball extraction pipes.	

Name of
Bidder/ Vendor

Revision Number

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Signature of Bidder/ Vendor
Authorised Representative

Date



Title

DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.

PE-TS-999-165-N001

VOLUME

III

PART A

SHEET

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OF

13

INSTRUCTION
TO BIDDER

1

This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.

PARTICULARS

ITEM

UNIT

5.10

Clearance between screen/ strainer
bars.

mm

5.11

Materials :

a) Body/ Housing

b) screen/ Strainer section

c) Screen/ Strainer shaft

d) Hardware for fixing the screen/
Strainer

e) Other internal hardware

f) External hardware

5.12.

Lining material (if applicable)

6.0

Ball Recirculating Pump :

6.1

Make

6.2

Nos. provided per set

Nos.

6.2

Design discharge flow

M³/hr

6.4

Design discharge pressure

Bar

6.5

Design pump Speed

RPM

6.6

Design pump efficiency

%

6.7

Seal for the pump

6.8

Materials :

a) Casing

b) Impeller

c) Shaft

7.0

Ball Collector :

7.1

Nos. provided per set

Nos.

Name of
Bidder/ Vendor

Revision Number

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Signature of Bidder/ Vendor

Authorised Representative



Title **DATA SHEET - B**
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO. **PE-TS-999-165-N001**

VOLUME III PART A
SHEET 5 OF 13

INSTRUCTION TO BIDDER 1. This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	PARTICULARS	ITEM	UNIT
7.2	Code/ Standard		
7.3	Whether inspection window/ sight glass is provided.		YES/ NO
7.4	Materials : a) Shell/ Body b) Internals		
7.5	Lining material (if applicable)		
7.6	Whether provision for separating and collecting the undersized balls, is made		YES/ NO.
8.0	Differential Pressure Measuring System:		
8.1	Differential Pressure Switch/ Transmitter a) Type b) Make and Model c) Range d) Accuracy e) Material of sensing element f) No. of contacts g) Contact rating h) Enclosure i) Mounting	Nos.	
8.2	Whether differential Pressure gauge is provided for manual observation.		
8.3	Differential Pressure Gauge : a) Type b) Make and Model c) Range		

Name of Bidder/ Vendor

Revision Number

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Signature of Bidder/ Vendor
Authorised Representative



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME III **PART** A
SHEET 6 **OF** 13

INSTRUCTION TO BIDDER 1. This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
d) Accuracy		
e) Material of sensing element		
f) No. of contacts	Nos.	
g) Dial size	mm	
h) Enclosure		
i) Mounting		
8.4	Whether the contacts for differential pressure gauge and switch/ transmitter are independent.	YES/ NO
9.0	Timer for Backwashing	
9.1	Timer make	
9.2	Range of duration setting	
9.3	Range of frequency	
10.0	Ball Monitoring System :	
10.1	Type	
10.2	Maake & Model	
10.3	Whether ball monitoring system is designed to perform the following functions :	
	a) Continuously counting the balls in circulation and giving an alarm calling for investigation of ball losses, when the number of circulating balls falls below a set value	YES/ NO
	b) Continuously measuring the size of the balls in circulation and initiating the shut-down of the tube cleaning system with alarm calling for replacement of balls, when the number of oversized balls falls below a set value.	

Name of Bidder/ Vendor

Revision Number

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Signature of Bidder/ Vendor
Authorised Representative

Date



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001
VOLUME III PART A
SHEET 7 OF 13

INSTRUCTION TO BIDDER
1. This data sheet shall be read in conjunction with Specification No. PES-179-01 Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
10.4	Whether electronic processor of the ball monitoring system is provided with the following a) Indicators for ♦ Required basic ball charge ♦ Recirculating Ball quantity ♦ Oversized ball quantity b) Time counters for ♦ Total cleaning system operating hours ♦ Cleaning system operating hours with sufficient number of oversized balls c) Recorder for ball consumption	YES/ NO YES/ NO YES/ NO YES/ NO. YES/NO YES/NO
10.5	Whether provision for Self-testing and Self Calibration are made	YES/NO
11.0	Cleaning Balls :	
11.1	Type	
11.2	Size	mm
11.3	Specific gravity	
11.4	Material	
11.5	Hardness	
11.6	Total Ball recirculation quantity per set	Nos.
11.7	abrasive coated ball recirculation quantity per set - (if any)	No.s
12.0	Piping :	
12.1	Ball Extraction Piping	

Name of Bidder/ Vendor					
Revision Number	0	1	2	3	4
Signature of Bidder/ Vendor					
Authorised Representative					

	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)	SPECIFICATION NO. PE-TS-990-165-N001			
		VOLUME III		PART A	
		SHEET 8 OF 13			

INSTRUCTION TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PES-179-01 Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	PARTICULARS	ITEM	UNIT
12.2	Ball Transport Piping	a) OD x thicknes b) Material c) Length of piping being supplied	mm x mm M
12.3	Differential pressure measuring system flushing piping.	a) OD x thicknes b) Material c) Length of piping being supplied	mm x mm M
2.4	Any other		
3.0	Valves (Indicate Type of Valves)		
3.1	Sizes		: mm
3.2	Nos. provided per set		Nos.
3.3	Materials		
	a) Body b) Disc/ Trim c) Shaft		
4.0	Distributors		
4.1	Nos. provided per set		Nos.
4.2	Materials :		
	a) Body b) Sight glass c) Sight glass flanges d) Internal parts		

Name of Bidder/ Vendor					
Division Number	0	1	2	3	4
Signature of Bidder/ Vendor					
Authorised Representative					
Date :					



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME III PART A
SHEET 9 OF 13

INSTRUCTION TO BIDDER
1. This data sheet shall be read in conjunction with Specification No. PES-179-01
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO. PARTICULARS	ITEM	UNIT
14.3	Lining material (if applicable)	
15.0	Injection Nozzles :	
15.1	Nos. provided per each CW inlet pipe	Nos.
15.2	Size of the stubs to be provided in CW inlet pipe for installing the injection nozzles.	mm
15.3	Material	
15.4	Lining material (if applicable)	
16.0	Actuators :	
16.1	Actuators for ball separator :	
	a) Nos. provided per ball separator	No.s
	b) Type & make	
	c) Motor rating	KW
16.2	Actuators for ball collector	
	a) Nos. provided per ball collector.	No.s
	b) Type & make	
	c) Motor rating	KW
16.3	Actuators for Valves:	
	a) Nos. provided per set	No.s
	b) Type & motor	
	c) Motor rating	KW
16.4	Any other	

Name of
Bidder/ Vendor

Revision Number

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Signature of Bidder/ Vendor
Authorised Representative

Date



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME III **PART** A
SHEET 10 **OF** 13

INSTRUCTION TO BIDDER 1. This data sheet shall be read in conjunction with Specification No. PES-179-0:
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
17.0	Electric Drive Motors	
17.1	Drive motor for recirculating pump :	
	a) Type and make	
	b) Rating	KW
17.2	Drive motor for differential pressure measuring system flushing pump (if applicable)	
	a) Type and make	
	b) Rating	KW
17.3	Any other.	
18.0	Control Panel	
18.1	Type	
18.2	Model & Manufacturer	
18.3	Operating Voltage/ frequency	V/ Hz
18.4	Control Voltage/ frequency	V/ Hz
18.5	Materials of housing and door	
18.6	Protections/ interlocks provided for :	
18.7	Class of Protection	
18.8	Control Hardware	
18.8	Alarms/ Annunciations provided for :	
18.9	Indicators provided for :	
18.10	Whether interconnecting control and power cabling between the control panel and various drive is included in the offer.	
19.0	Pressure gauges :	
19.1	Manufacturer & Type, Model	

Name of Bidder/ Vendor

Revision Number

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Signature of Bidder/ Vendor

Authorised Representative

Date



Title **DATA SHEET - B**
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO. **PE-TS-999-165-N001**

VOLUME III PART A
SHEET 11 OF 13

INSTRUCTION
TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PES-179-01 /
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
19.2	Nos. provided per set	Nos.
19.3	Location	
19.4	Dial size	mm
19.5	Range & Accuracy	
19.6	Materials of construction : a) Sensing element b) Movement c) Casing	
19.7	Enclosure	
19.8	Mounting	
20.0	Counter Flanges :	
20.1	Whether counter flanges complete with gaskets, bolts and nuts etc. for all terminal points are included in the offer.	YES/ NO
20.2	Type	
20.3	Rating	
20.4	Materials a) Flanges b) Bolts and Nuts c) Gaskets	
20.5	Code/ Standard	
21.0	Whether lifting arrangement is provided for various equipments.	YES/ NO.
22.0	Whether ball recirculating pump, ball collector with interconnecting piping and valves are mounted on a single frame.	YES/ NO
23.0	Whether supports (wherever necessary) complete with foundation plates, bolts, nuts, inserts etc. are included in the offer.	YES/ NO

Name of
Bidder/ Vendor

Revision Number

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Signature of Bidder/ Vendor
Authorised Representative

Date :



Title
DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.
PE-TS-999-165-N001

VOLUME III **PART** A
SHEET 12 **OF** 13

INSTRUCTION
TO BIDDER

1. This data sheet shall be read in conjunction with Specification No PES-179-01
Section - D, Volume - IIB.
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	PARTICULARS	ITEM	UNIT
24.0	Shop Inspection and Tests		
24.1	Whether all the tests and inspections as detailed in the specification/ quality plan are carried out.		YES/NO
24.2	Hydrostatic Test :		
	a) Test Pressure	Bar (g)	
	♦ Ball Separator		
	♦ Recirculating Pump		
	♦ Ball Collector		
	♦ Distributors		
	♦ Injection nozzles		
	♦ Piping & Valves		
	a) Test duration	Minutes	
24.3	Lekage Test :		
	a) Test Pressure	Bar (g)	
	b) Test duration	Minutes	
25.0	Painting :		
25.1	External Surfaces :		
	a) Surface Preparation		
	b) Primer		
	a) Finish		
25.2	Internal Surfaces :		
	a) Surface Preparation		
	b) Primer		
	a) Finish		
26.0	Weights :		
26.1	Empty Weight	Kg.	
	a) Ball Separator		

Name of
Bidder/ Vendor

Revision Number

0

1

2

3

4

Signature of Bidder/ Vendor
Authorised Representative

Date

-31-



Title

DATA SHEET - B
CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.

PE-TS-999-165-N001

VOLUME	III	PART	A
SHEET	13	OF	13

INSTRUCTION
TO BIDDER

1. This data sheet shall be read in conjunction with Specification No. PES-179-01

Section - D, Volume - IIB.

2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT
PARTICULARS		
b) Recirculating pump c) Ball collector d) recirculating unit		
26.2 Operating weight	kg	
a) Ball Separator b) Recirculating pump c) Ball collector d) recirculating unit		
26.3 Weight of the heaviest equipment/ assembly to be handled.	kg.	
27.0 Overall Dimensions		
27.1 Ball Separator		
27.2 Recirculating Unit		
28.0 Other information (if any)		
G:\MSEVASH\DS-COTCS.RTF		

Name of

Bidder/ Vendor

Revision Number

0

1

2

3

4

Signature of Bidder/ Vendor

Authorised Representative

	TITLE MOTORS DATA SHEET – C (TO BE FILLED FOR EACH TYPE)	TECHNICAL SPECIFICATION NO:
		PE-TS-RC-165-N002
		SECTION III
		REV NO. 00 DATE 05.04.17
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 MOTORS DATA SHEET – C (TO BE FILLED FOR EACH TYPE)	TECHNICAL SPECIFICATION NO: PE-TS-RC-165-N002
		SECTION III
		REV NO. 00 DATE 05.04.17
		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 $\geq 55KW$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-417/435-165-N002**

SECTION: **II**

SUB-SECTION: **IIA**

REV. NO. **0** DATE 07.09.2018

SHEET **1** OF **1**

SUB-SECTION - IIA

STANDARD TECHNICAL SPECIFICATION (MECHANICAL)

STANDARD TECHNICAL SPECIFICATION FOR COLTCS

STANDARD QUALITY PLANS



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-417/435-165-N002**

SECTION: **II**

SUB-SECTION: **IIB**

REV. NO. **0** DATE **07.09.2018**

SHEET **1** OF **1**

SUB-SECTION - IIB

STANDARD TECHNICAL SPECIFICATION (ELECTRICAL)