

TECHNICAL SPECIFICATION
FOR RATE CONTRACT
CONDENSER ON LOAD TUBE CLANING SYSTEM
(COLTCS)

TECHNICAL SPECIFICATION
FOR CONDENSER ON LOAD TUBE CLEANING
SYSTEMS (COLTCS).

Specification No. : PE-TS- RC-165-N002 (REV. 00)



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



TITLE:
**TECHNICAL SPECIFICATION
COLTCS FOR RATE CONTRACT**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-RC-165-N002**

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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 specification is intended for finalization of rate contract between BHEL PEM and Bidder. Standard technical detail as indicated in the specification shall be agreed upon between BHEL PEM and Bidder. Project specific technical detail shall be made available to the bidder along with project enquiry.

1.2 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.

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.

NOTE: - The specification is made with the intent of entering Rate Contract for the supply Commissioning, Trail run and PG test of COLTCS for various projects time to time.

List of COLTCS for Sea water Application:

I.	TYPE-I	Flow= 29850 CubM/hr	Size= 2200 NB
II.	TYPE-II	Flow= 38320 CubM/hr	Size= 2500 NB
III.	TYPE-III	Flow= 45000 CubM/hr	Size= 2700 NB

Bidder to note that flow of COLTCS for various sizes may vary during detail engineering up to (+/-) 5%. Same shall be informed during project specific order. However maximum possible design parameter are indicated in the respective datasheet of each type in Section- ID of this specification. No commercial implication shall be applicable for the same.

1.3 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.

1.4 The bids shall be evaluated as per NIT. Ordering shall be done separately for each type.

1.5 Bidder to quote for items as per price schedule attached in NIT. The quantity as mentioned in the BOQ is only for evaluation purpose. However actual ordered quantity may vary from project to project throughout the year.



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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.
- e) Differential pressure measuring system for ball separator. 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 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:



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2 Sets of COLTCS shall have one Common Starter Panel (Switch Gear Panel) for DCS based control system.

OR

2 Sets of COLTCS shall have one Common Switch Gear Panel for DCS based control system. However, separate Local Control Panel (Starter Panel) shall be provided near to each COLTCS for its operation.

Switch Gear Panel should have suitable arrangement like Bus Coupler for providing redundancy to incoming supply feeder (1 Working + 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 COLTCS system.
- o) Set of mandatory spares as indicated in Data Sheet A. Spare balls (if applicable) to be supplied at the time of commissioning of COLTCS system.
- p) 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.
- q) Finish paints for touch up painting of equipment after erection at site, in sealed containers.
- r) Set of special tools and tackles if required for maintenance and erection of the equipment supplied.
- s) 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.
- t) 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.



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- **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.

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

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 Type - II & III).

Adequate provision for future installation of Cathodic Protection for COLTCS (Sacrificial type) shall be kept by the bidder in the equipment. (Applicable for Type - I).



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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)
- 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.

For demonstrating the parameters at sl no. (i) & (ii) above, the COLTCS system shall be operated 24 hours per day for two weeks.

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.



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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.

PACKAGE	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 Days) from LOI/PO & subsequent revisions within 10 days of comments received from BHEL.
	PE-V2-XXX-165-N002	TECHNICAL DATA SHEET-COLTCS	
	PE-V2-XXX-165-N003	INSTALLATION PLAN-COLTCS	
	PE-V2-XXX-165-N004	GENERAL ARRANGEMENT OF BALL SEPARATOR	
	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 PHILOSOPHY 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 :



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- 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.

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



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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 [Kgs.]	Board Thickness	Batton / Rafter 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.



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SUB-SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
COLTCS**

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION : **C**

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**TECHNICAL SPECIFICATION FOR
COLTCS
(ELECTRICAL PORTION)**



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
COLTCS**

SPECIFICATION NO.

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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.



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- 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.

SL.NO.	PARAMETERS	SPECFIIC TECHNICAL REQUIREMENTS OF ELECTRICAL MOTOR (SPEC NO- PE-TS- RC-165-N004)		
		TYPE-I	TYPE-II	TYPE-III
1	CODE ANS STANDARDS	IS-325, IS-12615, IEC-60034, IS-4691, IS-4728	IS-325, IS-12615, IEC-60034	IS : 325, IS : 900, IS : 996, IS : 1231, IS : 1271, IS : 2223, IS : 2254, IS : 3043, IS : 3177, IS : 4029, IS : 4691, IS : 4722, IS : 4728, IS : 4889, IS : 5571, IS : 6362, IS : 8223, IS : 8789, IS : 12065, IS : 12075, IS : 12615, IS : 12802, IS : 12824, IS : 12824, IS : 14222, IEC: 60034-1, ISO : 1940-1, NEMA, MG-1, DIN/IEC/IS, BS 5308 part II
2	SERVICE CONDITIONS	Hot, Humid and Tropical Atmosphere highly polluted.	Hot, Humid and Tropical Atmosphere	Hot, Humid and Tropical Atmosphere highly polluted.
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 more than 10% margin over the input power requirement of the HT driven equipment and 15% for LT driven equipments at rated duty point.	General purpose, Constant speed, Squirrel cage, Three/Single phase, Induction type, Continuous duty, motor name-plate rating at 50°C shall have at least 10% margin	General purpose, Constant speed, Squirrel cage, Three/Single phase, Induction type, Continuous duty, motor name-plate rating at 50°C, relative humidity of 95% (at 50°C) and shall have at least 15% margin. All LV motors above 10 kW with S1 duty.
4	EFFICIENCY CLASS	IE3	IE3	IE3
5	RUNNING REQUIREMENT	(a) The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals. (b) Motor shall not stall if the supply voltage drops to 70% of the rated voltage two (2) second duration. (c) The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.	(a) Motors shall run satisfactorily at a supply voltage of 80% of rated voltage for 5 minutes with full load without injurious heating to the motor. (b) Motor shall run continuously at rated output over the entire range of voltage and frequency variations as required for the driven equipment	(a) 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. (b) 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. (c) All motors shall be designed to withstand hundred twenty (120) percent of rated speed without any mechanical damage for two (2) minutes.
6	STARTING CURRENT	(a) Starting current shall not exceed 6 times full load current for all auxiliaries. No further tolerances are applicable on starting current specified above for HT motors. (b) For LT motors, the applicable starting current shall be limited to 7.2 times of full load current including all tolerance. (b) The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage. (c) Motor with rigid coupling shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminals. (d) Minimum starting requirement for fluid coupling shall be 75% rated voltage at motor terminals. (i) Motor shall be capable of three equally spread starts per hour, two starts in quick succession from cold condition and one restart from hot condition. (ii) Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction. (c) The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage.	(a) For LT motors (except energy efficient motors) locked rotor current shall not exceed 700% of full load current inclusive of tolerance as per IS: 325. For LT energy efficient motors above 10kW with S1 duty, locked rotor current shall be as per IS: 12615-2011. (b) The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage. (c) Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature. (d) Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125% rated speed in reverse direction (e) The following frequency of starts shall apply i) Three equally spaced starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. ii) The motor shall be capable of two starts in succession with coasting to rest between starts and the motor initially at rated operating temperature. iii) Two hot starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.	(a) Locked rotor current shall not exceed 600% of full load current inclusive of IS tolerance. (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) Pump motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with shaft rotating at 125% rated speed in reverse direction. (f)Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. (g). Pull out torque at rated voltage shall not be less than 205% of full load torque. It (h). Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met. (i)Motors shall be capable of restarting under full load after a momentary loss of voltage with the possibility of 150 % nominal voltage during fast bus transfer.
7	LOCKED ROTOR WITHSTAND TIME	(a) The locked rotor withstand time under hot condition at 110% rated voltage shall be more than motor starting time by at least 2.5 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time and upto 45 secs starting time. (b)For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.	Locked rotor withstand time of motors under hot condition at highest voltage limit shall be as follows: a) For motors with starting time up to 20 sec. - At least 2.5 sec. more than starting time. b) For motor with starting time above 20 secs and up to 45 secs. - At least 5.0 sec. more than starting time. c) For motors with starting time above 45 secs. - At least 10% more than starting time. The starting time of the motor referred above is at minimum permissible voltage. For motors and in cases where the above requirements are not complied with, speed switches of approved make & type shall be provided to bypass the locked rotor protection for a pre-selected time during starting of motors. The speed switches shall have one NO & one NC contacts having maximum interrupting capacity of 5 Amps at 240V AC and 0.25 amps at 220 V DC	i. For motors with starting time less than 20 secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs more than starting time. ii. For motors with starting time more than 20 secs and up to 45 secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs more than starting time. iii. For motors with starting time more than 45 secs at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.

SL.NO.	PARAMETERS	SPECFIIC TECHNICAL REQUIREMENTS OF ELECTRICAL MOTOR (SPEC NO- PE-TS- RC-165-N004)		
		TYPE-I	TYPE-II	TYPE-III
8	ENCLOSURE	All motor enclosures shall conform to the degree of protection IPW-55 unless otherwise specified. Motor for outdoor or semi-outdoor service shall be of weather-proof construction with canopy.	Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction rain canopy (Rain canopy provided for the outdoor HT motors shall be removable type) shall be provided for outdoor motors.	All motor enclosures for outdoor, semi-outdoor & indoor application shall conform to the degree of protection IP-55 (For Outdoor) and IP-54 (For Indoor) unless otherwise specified. Motor for outdoor or semi-outdoor service shall be of weather-proof construction with canopy.
9	COOLING	(TEFC) or closed air circuit air- cooled (CACA). For large capacity motors, totally enclosed tube ventilation (TETV) cooling system shall be considered.	Motors shall generally have totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) enclosures or Closed Air circuit Air (CACA), the method of cooling conforming to IC-0141 or IC-0151 or IC-0161 of IS: 6362 up to 3000 kW motor	The motors shall be either totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. Motors with CACA heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate the following: a) Hot and cold air temperatures of the closed air circuit for CACA motors.
10	WINDING AND INSULATION	(a) All insulated winding shall be of copper. (b) All motors shall have class F insulation but limited to class B temperature rise. © Windings shall be impregnated to make them non-hygroscopic and oil resistant.	LT motors shall have class F insulation. The temperature rise of all motors shall be limited to the limits applicable to Class 'B' insulation. In case of continuous operation at extreme voltage limits, 10deg C rise above the temperature limits specified in IS: 325 shall be permissible.	(a) Class F insulation but limited to class B temperature rise. (b) Windings shall be impregnated to make them non-hygroscopic and oil and flame resistant.
11	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 900 Deg. for HT/LT motors . (C) The terminal box shall be capable of withstanding maximum system fault current for a duration of 0.25 sec. (D) For 11000V and 3300V motor, the terminal box shall be phase-segregated type. The neutral leads shall be brought out in a separate terminal box (not necessarily phase segregated type) with shorting links for star connection.	(a) phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end. (b) Separate terminal boxes shall be provided for space heaters and temp. Indicators. Detachable gland plates with double compression tinned brass glands shall be provided in terminal boxes. (c) Terminal box shall be capable of being turned 360 Deg. in steps of 90 Deg. However, in the case of rectangular type, Terminal Box shall be rotatable in steps of 180 Deg.	(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 180 Deg. for HT motors and 90 Deg. for LT motors unless otherwise approved. (c) The motor terminal box shall be suitable for withstanding the maximum system fault current (50 KA) for a duration of at least 0.25 seconds. (d) Terminal boxes shall be weatherproof and water-tight confirming to minimum IP-55 degree of protection with removable front cover for making connections.
12	MINIMUM PHASE TO PHASE & PHASE TO EARTH CLEARANCE FOR 415V	25 mm		Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:- Motor MCR in KW Clearance (i) UP to 110 KW - 10mm (ii) Above 110 KW and upto 150 KW - 12.5mm (ii) Above 150 KW - 19mm
13	GROUNDING	The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer.		The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer.
14	GROUNDING CONDUCTORS			1) Above 100 KW upto200 KW -- 75x10 mm GI Flat 2) Above 55 KW upto 100 KW -- 40x6 mm GI Flat 3) Above 22 KW upto 55 KW -- 40x6 mm GI Flat 4) Above 5.5 KW upto 22 KW -- 25 x 6 mm GI Flat 5) Upto 5.5 KW -- 4 SWG GI Wire

SL.NO.	PARAMETERS	SPECFIIC TECHNICAL REQUIREMENTS OF ELECTRICAL MOTOR (SPEC NO- PE-TS- RC-165-N004)		
		TYPE-I	TYPE-II	TYPE-III
15	TESTS	Routine and Type Tests are to be conducted in presence of customer's representative as per IS:325 and in addition,any special test called for in the driven equipment specification shall be performed and required copies of test certificates are to be furnished for approval. In addition, following Type tests shall have to be carried out in presence of Owner representative on all 3.3kV/11kV motors. a) Impulse test by 1.2 / 50 micro sec. On sample coil of Stator winding insulation as type test as per IEC-671/IS-14422 : 1995 test voltages as under : Voltage rating of motor Impulse Test Voltage 3.3 kV 18 kV peak 11 kV 49 kV peak b) Tan delta, charging current and dielectric loss measurements on each phase of motor stator winding as routine test. c) Polarization Index Test as per IS:7816 as routine test d) Test for suitability of IPW– 55(Weather proof) as per IS 4691 as type test. Type test certificate for first numeral shall be acceptable in lieu to test, provided the test motor is identical to motor being supplied. e) Fault Withstand Test for main terminal box as type test. Type test certificate shall be acceptable, if the test has been conducted on exactly identical terminal box. f) Test for noise level as routine test. g) Test for vibration as routine test. h) Tan delta measurement on coils. i) Surge withstand test for inter turn insulation. j) Test to diagnose rotor bar failure during manufacture. Tests indicated at (h), (i), (j) shall be carried out during manufacture of the coils and shall be furnished for verification.	<u>Type Tests</u> type test reports for type tests as per IS: 325/ IS: 12615 conducted on equipment similar to those proposed to be supplied and carried out within last five years shall be submitted. However, if such reports are not available, one motor of each type shall be subjected to type tests for free of cost. <u>Routine Tests</u> All motors shall be subjected to routine tests as per IS: 325/ IS: 12615 in the presence of customer or customer representative.	Routine and Type Tests are to be conducted in presence of customer's representative as per IS:325 and in addition,any special test called for in the driven equipment specification shall be performed and required copies of test certificates are to be furnished for approval.
16	MINIMUM STARTING VOLTAGE FOR MOTOR		85% for motor ratings upto 1000kW	
17	SHORT TIME RATING FOR TERMINAL BOXEX	The terminal box shall be capable of withstanding maximum system fault current for a duration of 0.25 sec.	90 kW and above (Breaker : 50 KA for 0.25 sec. Controlled) Below 90 kW (Contactor : 50 KA protected by HRC fuse Controlled)	
18	SPACE HEATER			Suitable single phase space heaters shall be provided on motors rated 30 kW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided.



TITLE:
**TECHNICAL SPECIFICATION
COLTCS FOR RATE CONTRACT**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-RC-165-N002**

SECTION: **I**

SUB-SECTION: **IC**

REV. NO. **00** DATE **05.04.2017**

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

SUB-SECTION – IC

SPECIFIC TECHNICAL REQUIREMENTS (C &I)

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 by Bidder. 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 and starter panel for the package are 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 The Minimum requirement for sea water or saline water media is given 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. Wherever transmitters & switches are provided, in addition Local gauges shall also be provided by bidder for local field monitoring.

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR COLTCS

- 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 Following minimum wire size shall be utilized for internal wiring in the panel and shall be finalized during detailed engg.:
- a. Current (4-20 mA): 0.75 sq.mm Low voltage signals: (AI/AO & DI signals)
 - b. DO signals, Ammeter/: 1.5 sq.mm voltmeter circuit, control switches, indicator, recorder
 - c. Internal Illumination: 2.5 sq.mm
 - d. Size of Power supply cables shall be as below: -
 - i. 1 to 16 Amp. - 2.5 sq. mm
 - ii. 17 to 20 Amp. – 4 sq. mm
 - iii. 21 to 32 Amp. - 6 sq. mm
 - iv. 33 to 40 Amp. - 10 sq. mm.
 - v. 41 to 60 Amp. - 16 sq. mm
 - vi. Power earth - 4 sq. mm
- 1.23 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.
- 1.24 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.
- 1.25 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.
- 1.26 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.

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR COLTCS

- 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.
- 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

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR COLTCS

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	TYPE-I	TYPE-II	TYPE-III
1	SYSTEM APPLICABLE: CONDENSER ONLOAD TUBE CLEANING SYSTEM (COLTCS)	Y	Y	Y
2	SYSTEM CONFIGURATION: UNITISED OR COMMON OR AS APPLICABLE			
3	CONTROL SYSTEM			
4	LOCATION OF CONTROL SYSTEM			
5	CONTROL SYSTEM SCOPE (BIDDER /BHEL/ CUSTOMER)			
6	CONTROL FROM PUSH BUTTONS ON STARTER PANEL			
7	ANNUNCIATION ON STARTER PANEL (Y/N) -- IF Y, MIN NO. OF HARDWIRED ALARMS / INDICATIONS			
8	MIMIC ON STARTER PANEL (Y/N)			
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 engg.	240 V AC UPS	
10	PROTECTION CLASS FOR STARTER PANEL			
11	ACTUATOR WITH INTEGRAL STARTER (Y/N)	Y	Y	Y
12	DPG/ DPT PER COLTCS SYSTEM *			
13	SEA WATER APPLICATION	Y	Y	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 starter panels for the package are in bidder's scope of supply.			
2	For Type-II & Type-III, for each Unit, each side of COLTCS system- Left & Right, shall be supplied with its Local control panel and its MIMIC and annunciator for its operation. Extent of MIMICs and annunciators shall be decided during detailed engg.			
3	For Type-I, for each Unit, each side of COLTCS system- Left & Right shall be supplied with a common Local control 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 starter panel. Remote and local indication, indicating lamps / LED cluster for instruments/drives/equipments status and critical alarms shall be provided on the starter panel. Nos. shall be decided during detailed engineering.			
5	No. of facia on Starter panel shall be decided during detailed engineering.			
6	Colored MIMICS on the panel is to be provided as per system flow diagram.			

7	The ball collecting strainer shall have differential pressure transmitter with back- washing system.
8	415 V, 3 phase AC power supply shall be provided by BHEL at a single point for the 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. 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. Complete cable schedule (in BHEL excel format provided in electrical portion of the specification) and cable interconnection details from field to Starter panel and Starter panel to DDCMIS shall be provided by bidder.
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 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 15m 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.
20	No deviations with respect to technical specification shall be acceptable.

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE FOR COLTCS		SPECIFICATION NO.: PE-TS-XXX-145-I100	
			VOLUME	
			SECTION	
			REV. NO. 00	DATE: 03.04.2017
			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	☐ 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		

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE FOR COLTCS			SPECIFICATION NO.: PE-TS-XXX-145-I100	
				VOLUME	
				SECTION	
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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 FOR COLTCS

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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



DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER FOR COLTCS

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

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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	☐ $\pm 0.04\%$ OF SPAN OR BETTER	
	LINEARITY, HYSTERESIS, DEAD BAND AND REPEATABILITY	☐ $\pm 0.05\%$ OF SPAN OR BETTER	
	STABILITY	☐ $\pm 0.1\%$ OF URL FOR 10 YEARS	
	SENSITIVITY	☐ $\pm 0.05\%$ OF SPAN OR BETTER	
	<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

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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	☒ ATLEAST 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 600 OHMS 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) NAME PLATE / METAL TAG	SS	
b) PRESSURE MEASUREMENT	☒ 2 WAY ☒ MATERIAL: 316 SS	
c) 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. UNION, NUT, PIPE-U CLAMPS, BOLTS & TAIL PIECE AND OTHER INSTALLATION ACCESSORIES AS REQUIRED.		

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



DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER FOR COLTCS

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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 FOR COLTCS	SPECIFICATION NO.: PE-TS-XXX-145-I100	
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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>			
d) PRESSURE MEASUREMENT			
B) DIFFERENTIAL PRESSURE MEASUREMENT			
CABLE ENTRY DETAIL			

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



SPECIFICATION FOR MOTORISED VALVE ACTUATOR FOR COLTCS

SPECIFICATION NO.: PE-DG-XXX-145-I902

VOLUME II B

SECTION D

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Data Sheet A & B

DATA SHEET-A
(TO BE FILLED BY PURCHASER)

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

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			



SPECIFICATION FOR MOTORISED VALVE ACTUATOR FOR COLTCS

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Data Sheet A & B

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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 ☐ 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 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	☐ 1 No ☒ 2 Nos.	2 Nos. (ADJ.)	☐ 1 No. ☒ 2Nos.	
	CONTACT TYPE	2 NO + 2 NC			
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC			



SPECIFICATION FOR MOTORISED VALVE ACTUATOR FOR COLTCS

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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 ☐ 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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Data Sheet A & B

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

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

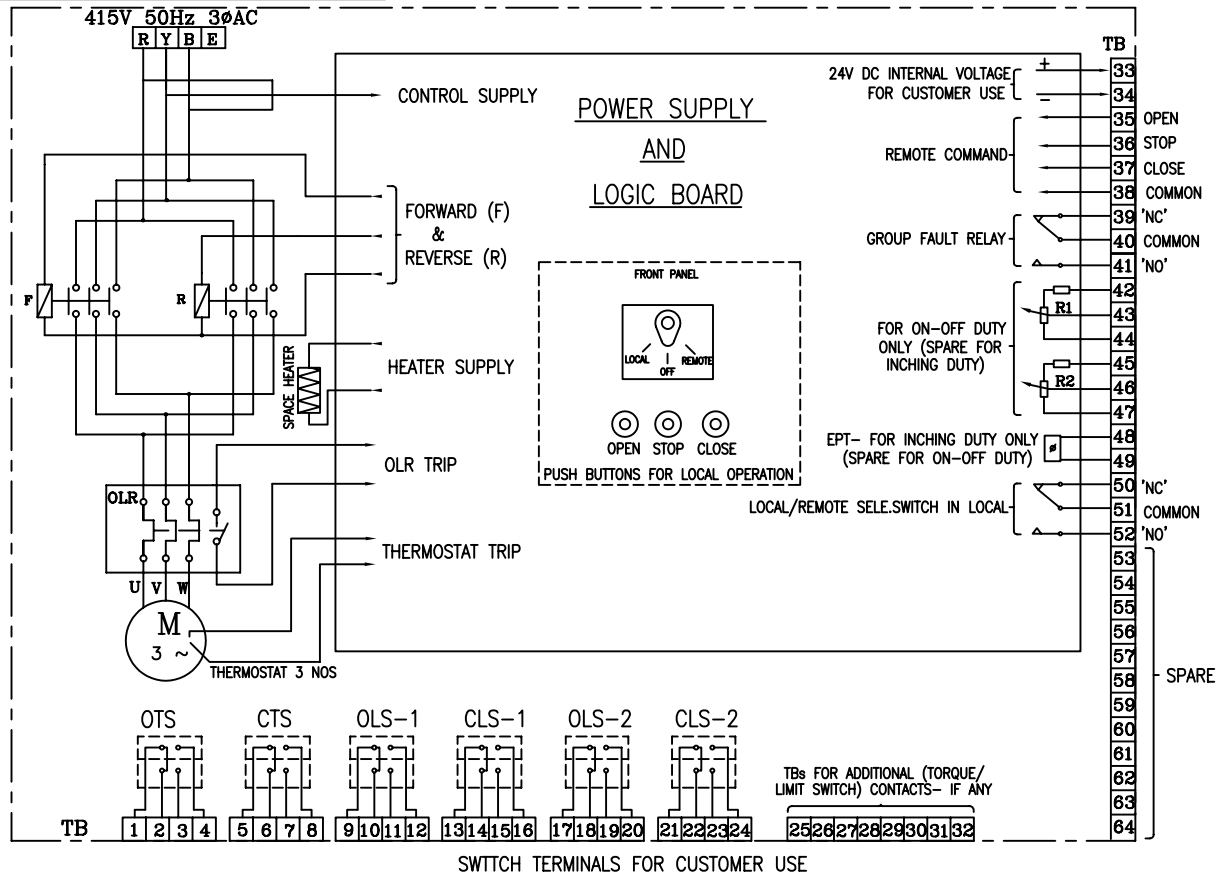
\$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.

EPOXY PAINT OR BETTER IS RECOMMENDED FOR COASTAL AREAS/ SEA WATER APPLICATIONS.

	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 3Φ 415V 50 Hz AC SUPPLY

REV	DATE	ALTERED
		CHD & APPD

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

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT		ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS (DRAWN FOR INTERMEDIATE POSITION OF VALVES)					
 BHARAT HEAVY ELECTRICALS LTD., UNIT: HIGH PRESSURE BOILER PLANT. TIRUCHIRAPALLI-620014. 365-121		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 INFORMATIONS			NO. OF ITEMS
CODE							
TITLE WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER			CARD CODE U 01	DRAWING NO. 3-V-MISC-24227			REV 0



DATA SHEET FOR LOCAL CONTROL CUM STARTER PANELS FOR COLTCS

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

VOLUME

SECTION

REV. NO. 00 DATE: 04.04.2017

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 20 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 CONTROL CUM STARTER PANELS FOR COLTCS

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

VOLUME

SECTION

REV. NO. 00

DATE: 04.04.2017

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-66 (FOR OUTDOOR LOCATIONS)☒ IP-55 (FOR INDOOR LOCATIONS)

THE PANEL SHALL BE NEMA 4X WITH A SUITABLE CANOPY AT THE TOP.

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 CONTROL CUM STARTER PANELS FOR COLTCS

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

VOLUME

SECTION

REV. NO.

00

DATE: 04.04.2017

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.)				
	PANEL TYPE				
	CABLE GLAND				

	DATA SHEET FOR LOCAL CONTROL CUM STARTER PANELS FOR COLTCS		SPECIFICATION NO.: PE-SS-999-145-054A	
			VOLUME	
			SECTION	
			REV. NO. 00	DATE: 04.04.2017
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)				
	AMMETER (TYPE OF INPUT)			
	SCOPE OF SUPERVISION			
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL NAME: SIGNATURE: DATE:



TITLE:

**TECHNICAL SPECIFICATION
COLTCS FOR RATE CONTRACT**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-RC-165-N002**

SECTION: **I**

SUB-SECTION: **ID**

REV. NO. **00** DATE **05.04.2017**

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

SUB-SECTION – ID

DATASHEET-A

DATA SHEET - A					SPECIFICATION NO.: PE-TS-405-100-N001
CONDENSER ON LINE TUBE CLEANING SYSTEM(COLTCS)					REV. NO.: 00. DATE : 05/04/2017
FOR SEA WATER APLICATION					SECTION : I. SUB-SECTION : ID
SL NO	DESCRIPTION	UNITS	TYPE - I	TYPE - II	TYPE - III
1.00	GENERAL				
1.1	Nos. of tube cleaning systems sets required for station	Nos.	Two (02) Nos. for station viz. One independent set for each half of condenser	Four (04) Nos. for 2 units viz. One independent set for each half of condenser	Six (06) Nos. for three Units. 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		Sea water (Refer enclosed water analysis at Annexure II)	Sea water (Refer enclosed water analysis at Annexure II)	Sea water (Refer enclosed water analysis at Annexure II)
1.3	Size of COLTCS	NB	2200	2500	2700
1.4	Length of Ball Separator	mm	3900 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 1200 mm inside the Ball separator.	4000 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 1200-1300 mm inside the Ball separator.	4350 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 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	Approx 1.5 to 2.5
2.2	Design Pressure for ball separator	kg/cm2 (g)	5.0 kg/cm² (g)	5.5 kg/cm² (g)	5.0 kg/cm² (g)
2.3	Design Mechanical temperature	Deg. C	60	60	60
2.4	Condenser Details				
	a) Type of condenser		Double Pass	Single pass	Single pass
	b) No. of Condenser sections	Nos.	Two (2)	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.	24398	33180	2 X 24156
	• Condensing zone	Nos.	22688	32804	2 X 23744
	• Air Cooling zone	Nos.	1710	376	2 X 412
	e) Tube Dia. OD x Thickness				
	• Top two rows	mm x mm	31.75 x 0.889	24.0 x 0.889	28.575 x 0.889
	• Remaining	mm x mm	31.75 x 0.7112	24.0 x 0.7112	28.575 x 0.7112
	f) Length of tubes between ends.	mm		14730	14742
	g) Tube material		Welded Titanium (SB338 - Gr 2)	Ti Gr 2 (Seamless)	Welded Ti (SB338 - Gr 2)
	h) Pressure drop across condenser - At Normal flow (between Inlet and Outlet flanges of condenser)	MWC	4.0 MWC (However the actual value can vary +/-20% of the design value)	2.62 MWC (However the actual value can vary +/-20% of the design value)	2 X 2.5 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	29850	38310	45000
	- Maximum	cu.m/hr	35820	45972	54000
2.6	Design differential pressure for ball separator strainer/screen	kg/cm2 (g)	0.3	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	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	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	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 Internally lined with Polyurethane (PU) as per AWWA C-222	Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589 Internally lined with Poly Urea/CorroCoat Coating inside of 1500 Microns DFT	Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589 Internally lined with Poly Urea/CorroCoat Coating inside of 2000 Microns DFT
	b) O.D. X Thickness		2235 X 18	2540 X 20	2740 X 20
3.2	Condenser outlet pipe				
	a) Material		Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589 Internally lined with Polyurethane (PU) as per AWWA C-222	Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589 Internally lined with Poly Urea/CorroCoat Coating inside of 1500 Microns DFT	Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589 Internally lined with Poly Urea/CorroCoat Coating inside of 2000 Microns DFT
	b) O.D. X Thickness		2235 X 18	2540 X 20	2740 X 20
3.3	Manhole		Yes, 600 NB size	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. Rubber Lined 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)	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		Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)
	c) Strainer shaft		Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)
	e) Internal Hardware in contact with circulating water including nuts, bolts , etc.		Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)
	f) Site Glass provision		YES	YES	YES
4.2	BALL RECIRCULATING PUMP			Non clog type	Non clog type
	a) Casing		Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)

	b) Impeller		Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)
	c) Shaft		Duplex SS	ASTM A276 UNS 31803	ASTM A276 UNS 31803
4.3	BALL COLLECTOR				
	a) Body / housing		Carbon Steel to IS -2062 Gr.B. Rubber Lined inside (Min. 5mm thick)	Carbon Steel to IS -2062 Gr.B. Rubber Lined (Min. 5mm thick) inside	Carbon Steel to IS -2062 Gr.B. Rubber Lined(Min. 5mm thick) inside
	b) Screen / Strainer/other internals		Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS (UNS 32205/31803)
	c) Site Glass Provision		YES	YES	YES
4.4	Differential pressure measuring system		Duplex SS	Super Duplex SS	Duplex SS
4.5	Injection nozzle		Duplex SS	Duplex SS (UNS 32205/31803)	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		DI to ASTM-A-439 Grade D2 or Duplex SS	Duplex SS (UNS 32205/31803), Flanged Ends	Duplex SS, Flanged Ends
	b) Disc for Check Valve		DI to ASTM-A-439 Grade D2 or Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS
	c) Stem		DI to ASTM-A-439 Grade D2 or Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS
4.6.2	Check Valves (50 NB & Below)			For size 50 NB and below-Piston type	For size 50 NB and below-Piston type
	a) Body & Bonnet		DI to ASTM-A-439 Grade D2 or Duplex SS	Duplex SS (UNS 32205/31803), Screwed Ends	Duplex SS, Screwed Ends
	b) Disc for Check Valve		DI to ASTM-A-439 Grade D2 or Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS
	c) Stem		DI to ASTM-A-439 Grade D2 or Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS
4.6.3	Gate/ Globe Valves 50 Nb & Below				
	Body & Bonnet		DI to ASTM-A-439 Grade D2 or Duplex SS	Duplex SS (UNS 32205/31803), Screwed Ends	Duplex SS, Screwed Ends
4.6.4	Gate/Globe Valves (65NB & above)			Gate Valves (upto 200 Nb)	
	➤ Body & Bonnet		DI to ASTM-A-439 Grade D2 or Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS
	➤ Disc		DI to ASTM-A-439 Grade D2 or Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS
	➤ Stem		DI to ASTM-A-439 Grade D2 or Duplex SS	Duplex SS	Duplex SS
	➤ Companinon Flange		Carbon steel as per IS 2062 internally lined/coated in line with connecting pipe material lining/coating	Same as Connecting Pipe MOC	Same as Connecting Pipe MOC
4.6.5	BFV Valves (65NB & above)		BFV (Above 200 Nb)	BFV (Above 200 Nb)	
	➤ Body & Disc		18% Ni Ductile Iron To ASTM A439 Gr. D2	Duplex SS (UNS 32205/31803)	Duplex SS
	➤ Sealing, Retaining segment & internals		Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS
	➤ Bearing		Self lubricating type	Self lubricating / Seal Lubricated	Self lubricating / Seal Lubricated
	➤ Companinon Flange		Carbon steel as per IS 2062 internally lined/coated in line with connecting pipe material lining/coating	Same as Connecting Pipe MOC	Same as Connecting Pipe MOC
4.6.6	Ball valves				
	i) Body		Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS
	ii) Ball		Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS
	iii) Stem		Duplex SS	Duplex SS (UNS 32205/31803)	Duplex SS
4.7	Interconnecting Piping		By Purchaser	By Purchaser	By Purchaser
	Maretial		a) PIPING UPTO 300Nb SHALL BE SS 316L/EQUIVALENT OR SUPERIOR b) PIPING 300 NB AND ABOVE SHALL BE CARBON STEEL AS PER IS 3589 FABRICATED FROM IS 2062 PLATES INTERNALLY LINED WITH POLYURETHANE INSIDE	a) PIPING UPTO 150Nb SHALL BE DUPLEX SS (AS PER SCH 40S FOR PIPE UPTO 50 NB & SCH 10S FOR PIPE SIZE ABOVE 50 NB) b) PIPING 200 NB AND ABOVE SHALL BE CARBON STEEL AS PER IS 3589 FABRICATED FROM IS 2062 PLATES INTERNALLY LINED WITH CORROCOAT OR POLYUREA COATING INSIDE OF 1500 MICRONS DFT.	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 COATING INSIDE OF 2000 MICRONS DFT.
5	COUNTER FLANGES FOR BALL SEPERATOR				
5.1	MATERIAL				
	a) Flanges		Carbon Steel to IS -2062 Gr.B. or eq (Internally Lined with PolyUrethane), for thickness, drilling etc refer Annexure II in section C1 (In Purchaser's Scope)	Carbon Steel to IS -2062 Gr.B. or eq(Internally Lined with CorroCoat or PolyUrea) or Duplex SS, for thickness, drilling etc refer Annexure II in section C1 (In Purchaser's Scope)	Carbon Steel to IS -2062 Gr.B. or eq(Internally Lined with CorroCoat or PolyUrea) or Duplex SS, for thickness, drilling etc refer Annexure II in section C1 (In Purchaser's Scope)
	b) Fasteners		SS 316 L (In Bidder's scope).	SS 316 L (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).	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)	(for interconnecting piping, valves, bends, fittings, distributors, nozzles & support installation materials)
6.1	MATERIAL				
	a) Flanges		Duplex SS	Duplex SS	Duplex SS
	b) Fasteners		SS 316L	SS 316L	SS 316L (Non-Wetted)
	c) Gaskets		Min 4 mm thick rubber	Min 4 mm thick rubber	Min 4 mm thick rubber
7	Material of Other components not specified above		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.	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.	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 / By Sand Blasting	SA - 2.5 of Swedish Specn. SIS-05-59-00-1967 / By Sand Blasting	SA - 2.5 of Swedish Specn. SIS-05-59-00-1967 / By Sand Blasting
	b) Primer		Two (2) coats of Epoxy primer coats with minimum thickness of 35 microns dft of each coat.	Two (2) coats of Epoxy primer coats with minimum thickness of 35 microns dft of each coat.	Two (2) coats of Epoxy primer coats with minimum thickness of 35 microns dft of each coat.
	c) Intermediate		Epoxy based TiO2 pigmented coat	Epoxy based TiO2 pigmented coat	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.	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 / By Sand Blasting	SA - 2.5 of Swedish Specn. SIS-05-59-00-1967 / By Sand Blasting	SA - 2.5 of Swedish Specn. SIS-05-59-00-1967 / By Sand Blasting
	b) Primer		Two coat of Epoxy Resin based Zinc Phosphate epoxy primer	Two coat of Epoxy Resin based Zinc Phosphate epoxy primer	Two coat of Epoxy Resin based Zinc Phosphate epoxy primer
	c) Final paint		Adequate no. of coats of coal tar epoxy paint to achieve total dry film thickness of 200 to 250 microns	Adequate no. of coats of coal tar epoxy paint to achieve total dry film thickness of 200 to 250 microns	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 Bidder)	YES (Along with Sacrificial type anodic protection by Bidder)	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.	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	YES
	b) Automatic shut down with ball collection effected by : i. Push button ii. Adjustable timer iii. Ball monitoring system		YES	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	YES
	d) Automatic emergency backwashing of ball separator effected by diff. Pressure measuring system		YES	YES	YES
	e) Automatic ball sorting initiated by push button		YES	YES	YES
	f) Provision for manual operation of complete tube cleaning system in case of control system failure		YES	YES	YES
	g) Whether the contacts for DPG, DPS and DPT are independent		YES	YES	YES
	h) Timer for Backwashing		YES	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	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. Recorders for ball consumption		YES	YES	YES
	k) Whether provision for self-testing and self-calibration are made		YES	YES	YES
12	MANDATORY SPARES - to be supplied under this specification –		NA	YES (As indicated in ANNEXURE-III)	YES (As indicated in ANNEXURE-III)

ANNEXURE-I TYPE-I

SEA WATER ANALYSIS

SI. No	PARAMETERS	UNIT	RESULT
1.	pH	-	7.9
2.	Conductivity	μ mhos/cm	53700
3.	Temperature	$^{\circ}$ C	33
4.	Turbidity	NTU	14.8
5.	Salinity		35.4
6.	Total Suspended Solids	mg/l	8
7.	Total Organic Carbon	mg/l	Less than 5
8.	Calcium as Ca	mg/l	400
9.	Magnesium as Mg	mg/l	1270
10.	Sodium as Na	mg/l	12500
11.	Potassium as K	mg/l	376
12.	Ammonia as NH ₃	mg/l	BDL (DL: 0.01)
13.	Strontium as Sr	mg/l	1.76
14.	Barium as Ba	mg/l	BDL (DL: 0.41)
15.	Total Aluminium as Al	mg/l	BDL (DL: 0.03)
16.	Dissolved Aluminium as Al	mg/l	BDL (DL: 0.03)
17.	Total Manganese as Mn	mg/l	BDL (DL: 0.02)
18.	Dissolved Manganese as Mn	mg/l	BDL (DL: 0.02)
19.	Total iron as Fe	mg/l	0.33
20.	Dissolved iron as Fe	mg/l	0.17
21.	Chloride as Cl	mg/l	20987
22.	Sulfate as SO ₄	mg/l	3000
23.	Nitrate as NO ₃	mg/l	1.21
24.	Nitrate as NO ₂	mg/l	0.008
25.	Bicarbonate as HCO ₃	mg/l	137
26.	Carbonates as CO ₃	-	Nil
27.	Fluoride as F	mg/l	1.2
28.	Boron as B	mg/l	1.36
29.	Phosphate as PO ₄	mg/l	0.08
30.	Sulfide as H ₂ S	mg/l	BDL (DL: 0.01)
31.	Total silica s SiO ₂	mg/l	0.4
32.	Dissolved Silica as SiO ₂	mg/l	0.2
33.	Dissolved Oxygen	mg/l	5.4
34.	BOD @ 27°C for 3 days	mg/l	9
35.	Phenols	mg/l	BDL (DL: 0.001)
36.	COD	mg/l	53
37.	Oil & Grease	mg/l	Less than 1
38.	Zinc as Zn	mg/l	0.1
39.	Copper as Cu	mg/l	BDL (DL: 0.006)
40.	Nickel as Ni	mg/l	BDL (DL: 0.008)
41.	Cadmium as Cd	mg/l	BDL (DL: 0.003)
42.	Lead as Pb	mg/l	BDL (DL: 0.01)
43.	Mercury as Hg	mg/l	BDL (DL: 0.001)

ANNEXURE-I TYPE-II

SEA WATER ANALYSIS

S.No.	Parameter	Unit	Value (Range)
1	General		
a	pH		7.94-8
b	Conductivity	millisiemens/cm	43.8-44.1
c	Temperature	Deg C	25-32
d	Turbidity	NTU	20-40
e	Total Organic carbon (total/ dissolved)	PPM of C	2.4-2.84
f	CO ₂	Mg/l	<2
g	TDS	Mg/l	39600-39740
h	BOD	Mg/l	10-12
i	COD	Mg/l	88-96
j	Oil & Grease	Mg/l	<10
k	Phenols	Mg/l	0.08-0.09
l	Free Residual Chlorine	Mg/l	<0.2
2	Cations		
a	Calcium	Mg/l	459-478
b	Magnesium	Mg/l	1510-1516
c	Sodium	Mg/l	10100-12000
d	Potassium	Mg/l	358-450
e	Ammonia	Mg/l	4.43-5.42
f	Strontium	Mg/l	12.9-12.4
g	Barium	Mg/l	1.55-1.58
h	Aluminum Total	Mg/l	1-1.8
i	Aluminum Dissolved	Mg/l	0.8-1.0
j	Manganese Total	Micro g/l	0.2-0.6
k	Manganese Dissolved	Micro g/l	0.1-0.2
l	Iron total	Micro g/l	220-260
m	Iron Dissolved	Micro g/l	Below detectable limit (detectable Limit : 10)
3	Anions		
a	Chloride	Mg/l	18994-19194
b	Sulphate	Mg/l	3710-3949
c	Nitrate	Mg/l	136-152
d	Nitrite	Mg/l	0.46-0.62
e	Bicarbonate	Mg/l	144-148
f	Carbonate	Mg/l	Nil
g	Fluoride	Mg/l	2.64-2.8
h	Boron	Mg/l	0.14-0.17
i	Phosphate	Micro g/l	240-380
j	Sulphide	Micro g/l	Below detectable limit (detectable Limit : 100)
k	Silica Dissolved	Micro g/l as SiO ₂	200-250
4	Heavy Metals		
A	Arsenic	Micro g/l	Below detectable limit (detectable Limit : 2)
B	Mercury	Micro g/l	Below detectable limit (detectable Limit : 1)
C	Cadmium	Micro g/l	120-130
D	Copper	Micro g/l	200-220
E	Nickel	Micro g/l	470-490
F	Molybdenum	Micro g/l	Below detectable limit (detectable Limit : 100)

ANNEXURE-I TYPE-II

SEA WATER ANALYSIS

5	Suspended Particle Size Range		
A	10 micron & above	Mg/l	Below detectable limit (detectable Limit : 10)
B	5 micron to 10 micron	Mg/l	Below detectable limit (detectable Limit : 10)
C	1 micron to 5 micron	Mg/l	Below detectable limit (detectable Limit : 10)
D	0.1 micron to 1 micron	Mg/l	20-26
6	Colloidal Particle Size Range		
A	SDI (10 Minutes)	-	10-20
B	SDI (5 Minutes)	-	20-40
7	Density of sea water	Kg/ cum	1030

COC of Circulating Water : 1.3

ANNEXURE-I TYPE- III

SEA WATER ANALYSIS

S.No.	Parameters	Value (ppm)
1.	Total Solids	35,000
2.	Dissolved solids	21,620
3.	Suspended Solids	580
4.	Ignited residue	17,500
5.	Volatiles Solids	4,700
6.	Acid Insolubles	112
7.	Chlorides (as Cl)	20,232
8.	Sulphates (as SO ₄)	1,457
9.	Iron (as Fe)	70
10.	Total alkalinity (as CaCO ₃)	525
11.	Alkalinity due to Normal Carbonates (as CaCO ₃)	Nil
12.	Alkalinity due to bi-Carbonates (as CaCO ₃)	525

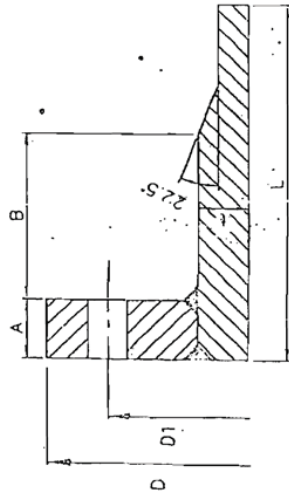
13.	Total hardness (as CaCO ₃)	8,155
14.	Permanent hardness (as CaCO ₃)	6,200
15.	Temporary hardness (as CaCO ₃)	1,955
16.	Calcium hardness (as CaCO ₃)	1,255
17.	Magnesium hardness (as CaCO ₃)	6,900
18.	P _H	8.2

ANNEXURE-II

ALL DIMENSIONS ARE IN MM

FIRST ANGLE PROJECTION

710M-141-666-DG-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.

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

— TENTATIVE

DRAWING FOR BAL' SEPARATOR COUNTER FLANGE

REV.		DATE	ALT	QTY	APPR	JOB NO.	999
STATUS		DISTRIBUTION					
BHARAT HEAVY ELECTRICALS LTD. PROJECTS ENGINEERING MANAGEMENT PPEL, NOIDA							
TITLE		COUNTER FLANGE DETAILS					
DRAWING NO.		PC-DG-999-141-M017					
SHEET 01 OF 01		REV 00					

MANDATORY SPARES -COLTCS ANNEXURE-III						
Sl. No	DESCRIPTION OF EQUIPMENT / ITEM Spares to be supplied under this specification.	DESCRIPTION OF UNIT OF MEASUREMENT	UOM	TYPE - I	TYPE - II	TYPE - III
1.0	Mechanical Spares			3	4	5
1.1	Sponge rubber balls for condenser on-load tube cleaning system	1000 Nos balls = 1 Lot	Lot	1	1	50
1.2	Abrasive balls for condenser on-load tube cleaning system	1000 Nos balls = 1 Lot	Lot	1	1	20
1.3	Worm gear assembly for Ball separator screen	Set	Set	1	1	1
1.4	Ball separator screen	Set	Set	1	1	1
1.5	Ball Circulating Pump (Complete)	Set	Set	1	1	1
2.0	Electrical Spares					
2.1	415 V Motor					
2.1.1	Terminal plates	Nos. each for small motors upto 30 kW	Nos	1	10	10
2.1.2	Heaters	set	Set	1	2	2
2.1.3	Greasing arrangements	sets each type of motor	Set	1	4	4
2.1.4	Motor of each type and rating	10% qty installed of each COLTCS = 1 Lot	Lot	1	1	2
2.1.5	Bearings (DE and NDE) for each type and rating of motor	Sets	Set	1	4	4
3.0	C&I Spares					
3.1	Each type of lamps, PBs, ILPBs, fuse, MCB, MCCB used in the equipment/system.	(20%) installed for each type in each COLTCS.= 1 LOT)	Lot	1	4	6
3.2	Measuring Instruments - Indicators, Recorders, Electrical Metering and Skid Mounted Instruments					
3.2.1	Indicators, recorders and meters offered from each model for the project. These instruments shall be supplied with three sets of blank scales.	(10% of total number of Instruments / transducers offered for each model and type for each COLTCS = 1 LOT)	Lot	1	4	6
3.2.2	Skid mounted instruments (if any)	(10% of total no. of instruments for each COLTCS.= 1 Lot)	Lot	1	4	6
3.3	Temperature, Transmitters and Electronic Transmitters (For Pressure, DP, Temp, Flow, Level), Temperature, Pressure, Flow & Level Switch, safety switches, Gauges, meters, Transducer or any other instrument etc.	(10% of total number of Instruments / transducers offered for each model and type for each COLTCS= 1 Lot)	Lot	1	4	6
3.4	Hooters, Buzzers, Cooling fans of each type.	10 % percent of each type for each COLTCS = 1 Lot	Lot	1	4	1
3.5	Interface cables	sets of each type / model for each COLTCS	Sets	1	4	1
3.6	Power supply modules (AC to DC Convertors)	10% of each type/model for each COLTCS = 1 Lot	Lot	1	4	1
3.7	Relay based Control Panels					
3.7.1	LEDs for indicating lights	10% of installed of each current rating for each COLTCS.= 1 Lot	Lot	1	4	42
3.7.2	Control circuit fuses	300% of installed of each current rating for each COLTCS.= 1 Lot	Lot	1	4	6
3.7.3	MCB/MCCB of each current rating	10% of installed of each current rating for each COLTCS.= 1 Lot	Lot	1	120	64
3.7.4	Relays modules & contactors.	20% of installed of each current rating for each COLTCS.= 1 Lot	Lot	1	4	6
3.7.5	Cooling Fans of each type, model and rating.	20% of each type and rating for each COLTCS = 1 Lot	Lot	1	1	4
3.7.6	Push buttons, ILPBs, Electric meter, Power supply modules.	10% of each type and rating for each COLTCS = 1 Lot	Lot	1	1	4
3.8	Alarm Annunciation System					
3.8.1	logic modules, group card modules, power supply modules, Hooters and any other electronic module.	(20% of qty Installed of each type for each COLTCS= 1 Lot)	Lot	1	4	6
3.8.2	un-engraved window boxes complete with LED etc.	(5% of qty Installed of each type for each COLTCS= 1 Lot)	Lot	1	4	6
3.8.3	LEDs for annunciation facia windows and LEDs box assemblies offered for the project	(20% qty Installed of each COLTCS= 1 Lot)	Lot	1	4	6
3.8.4	Annunciator hooter	Numbers = Nos.	Nos	1	2	3
3.9	Erection Hardware					
3.9.1	Instrument valves, manifold for each type, rating, model number and size of devices supplied for the project	(10% of qty Installed of each type & size for each COLTCS= 1 Lot)	Lot	1	4	6
3.9.2	Condensate pots of each type & Size installed	(10% of qty Installed of each COLTCS= 1 Lot)	Lot	1	4	6
3.9.3	Fittings	(10% of qty Installed of each type & size for each COLTCS= 1 Lot)	Lot	1	4	6

Notes for Mandatory Spares:

- For C&I Mandatory Spare not covered above: Bidder to supply 10% or 1 no. (whichever is more) of each type of sensor/instrument, analyzers /special instruments/Electronic card, instrumentation/mechanical fittings etc. for any other electronic system,
- Spares not applicable for the Package to be specifically quoted as "NOT APPLICABLE".
- 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
- Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the total population of the item in the station (project), unless specified otherwise and the fraction will be rounded off to the next higher whole number.
- In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with Quantities generally in line with the specification
- In respect of quantity mentioned as 'Set' means the total quantity of all the components/items used in particular equipment unless otherwise specified.
- Each spare shall be clearly marked and labeled on the outside of the packing with its description. When more than one spare part is packed in single case, a general description of the contents shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purpose of identification



TITLE:

**TECHNICAL SPECIFICATION
COLTCS FOR RATE CONTRACT**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-RC-165-N002**

SECTION: **II**

SUB-SECTION: **IIA**

REV. NO. **0** DATE **05.04.2017**

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

DATE : 26.05.2016

SHEET 1 OF 11

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.

	TITLE : STANDARD TECHNICAL SPECIFICATION CONDENSER ON - LOAD TUBE CLEANING SYSTEM (Sponge Rubber Ball Type)	SPECIFICATION NO. PE-TS-999-165-N002	
		SECTION : II	
		SUB-SECTION : IIA	
		REV. NO. 01	DATE : 26.05.2016
		SHEET 2 OF	11
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.		



TITLE :

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

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

SECTION : II

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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



TITLE :

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

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

SECTION : II

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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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CONDENSER ON - LOAD TUBE CLEANING
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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.



TITLE :

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

STANDARD TECHNICAL SPECIFICATION
CONDENSER ON - LOAD TUBE CLEANING
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SECTION : II

SUB-SECTION : IIA

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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.



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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:-

- a) 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.
- b) Foundation arrangement drawings (wherever applicable) showing load data on supports, size and location of anchor bolts etc.
- c) 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.



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- 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.

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		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										
* 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				
						Vendor Q.P. NO:				PROJECT:				
		P.O. No.				Item : Ball Separator				PACKAGE : COLTCS				
						Date :				PURCHASER:				
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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														
* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.														
** M : Manufacturer / Manufacturer's Sub-contractor														
C : Contractor O : Owner														
Indicate : "P" - Perform, "W" - Witness and "V" - Verification														
Manufacturer / Sub-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.				Item : Ball Separator		Vendor Q.P. NO:		PROJECT:		
								PACKAGE : COLTCS		CUSTOMER:		
						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
		Checked							M	C	O	
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* **	10	
1.4.0	Complete Unit of Worm gear	Reduction Ratio	Critical	Functional Test	100%	Approved Sheet	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	
		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											
* Records indentified with "STAR" shall be essentially included by contractor in QA Documentation.											
** M : Manufacturer / Manufacturer's Sub-contractor											
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												
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	11
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		
Signature													

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		Manufacturer's Name & Address		STANDARD QUALITY PLAN					BHEL Doc No.: PE-QP-999-165-N008			
		P.O. No.		Item : Starter Panel		Vendor Q.P. NO:		PROJECT:				
				PACKAGE : COLTCS		CUSTOMER:						
				Date :		PURCHASER:						
				Page 14 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	M	C	O	11
8.0.0	Starter panel											
08.1.0	Incoming Material											
08.1.1	Fabricated & Painted Panel	Dimension	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--
		Panel G.A.	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--
		Paint colour	Major	Visual	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--
		Paint thickness	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--
		Paint Shade, Adhesion	Major	Visual	Sample	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--
08.1.2	Wire	Size / Colour / Rating / Surface Defects	Major	Visual / Dimension	Sample	IS 694	Specification drawings	Inspection report	-	P	--	--
08.1.3	Panel Mounting	Make, Functional, Type & Rating	Major	Visual / Electrical	100%	Approved BOM	Approved BOM	---		P	V	V
08.2.0	In Process Inspection											
10.2.1	Name Plate, Component Mounting, Etc.	Workmanship, Finish, Correctness	Major	Visual	100%	Approved Drgs.	Approved drawings	Inspection report	-	P	--	--
08.2.2	Electrical Wiring of Panels	Continuity, Colour of wires, Bunching and Grouping	Major	Visual	100%	Mounting Drawing	Approved drawings	Inspection report	-	P	--	--
08.2.3	Ferruling of Cables	Start & End	Major	Visual	100%	Manufacturer's drawing	Manufacturer's drawing	Inspection report	-	P	--	--
08.3.0	Final Inspection											
08.3.1	Workmanship, Finish & Paint shade / Thickness	Visual	Major	Visual	100%	G.A Drawing	Approved drgs.	Inspection report	*	P	W	V
08.3.2	Overall Dimension, G.A of starter panel	Measurement	Major	Visual	100%	G.A Drawing	Approved drgs.	Test Certificate	-	P	W	V
08.3.3	Component Identification	Visual	Major	Visual	100%	G.A Drawing	Approved drgs.	Inspection report	-	P	W	V
08.3.4	Degree of Protection	Ingress Protection IP55	Critical	Environmental	Verification	Approved drgs.	IS 2147	Inspection Report		P	V	V
08.3.5	IR - HV - IR	Electrical	Critical	Electrical	100%	Approved Procedure	Approved Pcedure	Inspection report	-	P	V	V
08.3.6	Functional & Continuity	Functional	Major	Functional	100%	Appd Drawing	Appd Drawing	Inspection report	*	P	W	W
LEGEND * Records identified with "STAR" shall be essentially included by contractor in QA Documentation. ** M : Manufacturer/ Sub-contractor C : BHEL O : Owner Indicate : "P" - Perform, "W" - Witness and "V" - Verification												
Manufacturer / Sub-Contractor		Contractor										
Signature										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 : FASTENERS				Vendor Q.P. NO:		PROJECT:			
Date :										PACKAGE : COLTCS				CUSTOMER:					
Page 15 of 15										PURCHASER:				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	Mfr TC / Lab report	*	P	V	V							
		Visual workmanship finish	Major	Visual	Sample	Approved sheet	drg/Data sheet		—	P	V	V							
		Dimensions	Major	Measurement	Sample	Approved sheet	drg/Data sheet		—	P	V	V							
9.2.0	Main Fasteners	Visual	Major	Visual	Sample	Approved sheet	drg/Data sheet	Inspection report / Mfr TC	*	P	V	V							
		Dimensions	Major	Measurement	Sample	Approved sheet	drg/Data sheet	Inspection report / Mfr TC	*	P	V	V							
		Chemical & Physical properties	—	Chemical & Physical test	1 sample per heat	Approved sheet	drg/Data sheet	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																			
Indicate : "P" - Perform, "W" - Witness and "V" - Verification																			
Manufacturer / Sub-Contractor Signature																			
Reviewed By																			
Name & Sign. Of approving authority & Seal																			



TITLE:
**TECHNICAL SPECIFICATION
COLTCS FOR RATE CONTRACT**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-RC-165-N002**

SECTION: **II**

SUB-SECTION: **IIB**

REV. NO. **0** DATE **05.04.2017**

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

	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 machnines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines

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

3.0

DESIGN REQUIREMENTS

3.1

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

3.2

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

3.3

Starting Requirements

3.3.1

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

3.3.2

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

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The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.		
3.3.3 The following frequency of starts shall apply i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature. ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour) iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor		
3.4 Running Requirements		
3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.		
3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.		
3.5 Stress During bus Transfer		
3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.		
3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.		
3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.		
3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.		
4.0 CONSTRUCTIONAL FEATURES		
4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy		
4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362. Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled		
4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.		

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

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



TITLE

LV MOTORS**DATA SHEET-A**

SPECIFICATION NO.

VOLUME

II B

SECTION

D

REV NO. 00

DATE 15.06.2015

SHEET 1 OF 1

- 1.0 Design ambient temperature : 50 °C
- 2.0 Maximum acceptable kW rating of LV motor: Below 175KW
- 3.0 Installation (Indoors/ Outdoors) : As required
- 4.0 Degree Of Protection (Indoor/Outdoor) : IP54/IP55
- 5.0 Type of Cooling : TEFC/CACA/TETV
- 6.0 Details of supply system
- a) Rated voltage (with variation) : 415V $\pm$ 10%
 - b) Rated frequency (with variation) : 50 Hz (Variation: +3% to -5%)
 - c) Combined voltage & freq. variation : 10% (absolute sum)
 - d) System fault level at rated voltage : 50 kA for 1 sec
 - e) Short time rating for terminal boxes
 - o 110kW & Above : 50 kA for 1 sec
(Breaker controlled)
 - o Below 110kW : 50 KA for 0.20 sec.
(Contactor controlled)
 - f) LV System grounding : Solidly
- 7.0 Class of insulation : Class 'F' with temp rise limited to class B
- 8.0 Minimum voltage for starting : 80% of rated voltage
(As percentage of rated voltage)
- 9.0 Power cables data : Shall be given during Detailed engg.
- 10.0 Earth Conductor Size & Material : Shall be given during Detailed engg.
- 11.0 Space heater supply : 240 V, 1 Φ , 50 Hz
- 12.0 Rating up to which Single phase motor : Acceptable upto 0.20 kW
- 13.0 Tests : As per Customer motor spec.(enclosed)
- 14.0 Energy efficient/ Flame proof motor : As per Customer spec. requirement
- 14.0 Makes : AS PER ANNEXURE-I

		QUALITY PLAN	CUSTOMER :			PROJECT			SPECIFICATION :			
			BIDDER/ : VENDOR			TITLE QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			NUMBER :			
									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	P	W	V	
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		
		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							
			NAME									
			SIGNATURE									
			DATE									
										BIDDER'S/VENDORS COMPANY SEAL		



TITLE:

**TECHNICAL SPECIFICATION
COLTCS FOR RATE CONTRACT**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-RC-165-N002**

SECTION: **II**

SUB-SECTION: **IIC**

REV. NO. **0** DATE **05.04.2017**

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

SUB-SECTION - IIC

STANDARD TECHNICAL SPECIFICATION (C &I)



**SPECIFICATION FOR
LOCAL CONTROL CUM STARTER PANELS

FOR COLTCS**

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

VOLUME II B

SECTION D

REV. NO. 00

DATE : 01.04.2017

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 control cum starter Panels required for control and monitoring of the package.

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, colored MIMICS, Single loop controller, Control switches / push buttons, indicating lamps/LED cluster, relays, timers and other devices required for operation and monitoring of the equipment locally.

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

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

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel

Frame thickness: Not less than 3.0mm

Enclosure thickness: Not less than 3.0 mm for load bearing sections (Mounted with instruments)
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.



**SPECIFICATION FOR
LOCAL CONTROL CUM STARTER PANELS
FOR COLTCS**

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

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SECTION D

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DATE : 01.04.2017

SHEET 2 OF 5

- 3.1.7 The class of protection shall be in accordance with IP-55 unless otherwise specified in the data sheet – A (No. PES-145-54A-DS1-0).
- 3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as given in data sheet-A (No. PES-145A-DS1-0). Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.
- 3.1.9 The cable glands of the required size and type as given in data sheet-A (No. PES-145A-DS1-0) shall be supplied alongwith the Panel.
- 3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function.
No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.
- 3.1.11 Single / dual control power supply feeders of voltage class as specified in data sheet-A (No. PES-145A-DS1-0) shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose, MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.
- 3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm² size or as decided during detailed engg. 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 twenty (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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SHEET 3 OF 5

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

4.2 BHEL's standard Quality Plan for Local control cum starter panel 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



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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. Wherever media is sea water, packing shall be suitable for sea water application.

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 control cum starter Panel: Data sheet no. PES-145A-DS1-0
- Data sheet C for Local control cum starter Panel: Data sheet no. PES-145A-DS2-0

QUALITY PLANS FOR

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



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STANDARD QUALITY PLAN FOR LOCAL CONTROL CUM STARTER PANEL

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency ^{\$}			Remarks
									P	W	V	
1.0	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

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W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor



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

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

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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 :

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Note :

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



TITLE:

**TECHNICAL SPECIFICATION
COLTCS FOR RATE CONTRACT**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-RC-165-N002**

SECTION: **III**

SUB-SECTION:

REV. NO. **0** DATE 05.04.2017

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

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER



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.

PARTICULARS

ITEM

UNIT

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

M³/hr

a) Normal

b) Maximum allowable

2.6

Flow rate through ball collector

M³/hr

a) Normal

b) Maximum allowable

Name of

Bidder/ Vendor

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Signature of Bidder/ Vendor

Authorised Representative

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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

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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.	

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Title

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

SPECIFICATION NO.

PE-TS-999-165-N001

VOLUME

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PART A

SHEET

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INSTRUCTION
TO BIDDER

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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

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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	

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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.	

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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					
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Authorised Representative					

	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)	SPECIFICATION NO. PE-TS-990-165-N001			
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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		

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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	

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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	

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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

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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		

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CONDENSER ON LOAD TUBE
CLEANING SYSTEM
(SPONGE RUBBER BALL TYPE)

SPECIFICATION NO.

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INSTRUCTION
TO BIDDER1. 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

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Signature of Bidder/ Vendor

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	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			