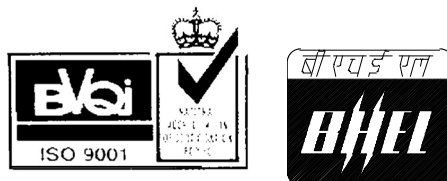


THDC INDIA LIMITED
(A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF U.P.)

2X660MW KHURJA STPP - TG PKG

**TECHNICAL SPECIFICATION
FOR
CONDENSER ON LOAD TUBE CLEANING SYSTEM
(COLTCS)**

Specification No. : PE-TS- 475-165-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 SPECIFIC TECHNICAL REQUIREMENTS	SPEC. NO.: PE-TS-475-165-N002		
	SECTION:		
	SUB-SECTION:		
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THIS TECHNICAL SPECIFICATION CONSISTS OF FOLLOWING SECTIONS:

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Note:

In case there is conflict in different clauses of specification, most stringent clause (as decided by BHEL / end customer) shall be followed, if no specific deviation is taken by bidder and accepted by BHEL during tender stage in that regard.



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SECTION - I

SPECIFIC TECHNICAL REQUIREMENTS

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SUB-SECTION – IA

SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)



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1.0 GENERAL

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

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

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

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

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

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

2.0 DESCRIPTION OF EQUIPMENTS:

3.0 CONDENSER ON LOAD TUBE CLEANING SYSTEMS (COLTCS):

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

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

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

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

4.2.1 Each set of COLTCS shall comprise following:

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



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- e) Differential pressure measuring system for ball separator.

DP measuring system shall comprise of 2 nos. DPT + 1 no. DPG for each COLTCS. Instrument shall be with Remote seal arrangement. Stubs for DPT and DPG shall be independent.

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

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

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

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

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

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

- k) Local Control cum Starter / Switch Gear Panel shall be as follows:

For each Unit, COLTCS system- Left & Right, shall be supplied with common local control cum starter /Switch Gear panel and its MIMIC and annunciator for its operation (applicable as per C&I Specification). Extent of MIMICs and annunciators shall be decided during detailed engg. (For details refer C&I Specification)

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

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

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

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

- o) One Set of balls as First Fill (For handing over to Customer) also to be carried at the time of commissioning of each COLTCS system.



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

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

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

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

- a) Installation checks (Erection in BHEL's scope).
- b) Commissioning of equipment.

Pressure drop across Ball Separator, Life of sponge rubber balls & Number of balls lost during 1000 hrs of plant operation shall be demonstrated during commissioning (along with all COLTCS Mechanical, C&I and Electrical Systems) for which the bidder has to furnish the procedure and get the approval of employer.

- **For drawings/documents approval**

In the event of order all drawings / documents in soft as well as hard copy shall be submitted as per NIT.

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:**

Bidder to consider cost of two site visits for three days each and one site visit for fifty days for installation check & commissioning of COLTCS for each unit.

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



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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 Adequate provision for future installation of Cathodic Protection for COLTCS (Sacrificial type) shall be kept by the bidder in the equipment.
- 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 Tests and Bid Evaluation criteria for Condenser on Load Tube Cleaning System.

Performance Parameters to be tested by bidders **during commissioning** 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).
 - ii) Life of Sponge Rubber Ball (Min. 3 weeks).
 - iii) Max. Pressure drop in ball separator in clean condition – not exceeding 0.2 MWC.
- The Bids shall be technically rejected for pressure drop quoted higher than 0.2 MWC.



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

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

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

9.0 SPARES:

9.1 Mandatory Spares

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

10.0 Quality Plan

Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ Customer approval and customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. Charges for 3rd party inspection (TUV/ equivalent) for imported components wherever required shall be included by bidder in the base price itself. If BHEL or BHEL customer decides to witness the tests along with third party, the cost of travel of BHEL or BHEL customer shall be borne by BHEL or BHEL customer themselves.

11.0 DELIVERY & DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE:

a. Delivery of Equipment shall be as per NIT.

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

PACKAG E	BHEL DRG NO	DRG TITLE
COLTCS	PE-V2-475-165-N001	P&ID OF COLTCS SYSTEM
	PE-V2-475-165-N002	TECHNICAL DATA SHEET-COLTCS
	PE-V2-475-165-N003	INSTALLATION PLAN- COLTCS
	PE-V2-475-165-N004	GENERAL ARRANGEMENT OF BALL SEPERATOR
	PE-V2-475-165-N005	DETAILS OF BR SKID,BALL INJECTION PIPE & FIXING DETAILS
	PE-V2-475-165-N006	C&I Part-I,PANEL-TDS, I/O LIST, CABLE SCH AND CONTROL PHILOSPHY FOR COLTCS
	PE-V2-475-165-N008	QP-COLTCS
	PE-V2-475-165-N007	C&I Part-II, GA & WIRING DIAGRAM OF PANEL- COLTCS
	PE-V2-475-165-N009	O& M MANUAL -COLTCS
	PE-V2-475-165-N010	COMMISSIOING PROCEDURE -COLTCS



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Drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.

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

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

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

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



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base using the foundation holes for further transportation up to site.

15.2 Protection of parts:

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

Gross Weight [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



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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.

16.0 Following to be complied by the bidder:

- a. Supplier to submit detailed 'Bill of Material' (BoM) at the time of drawing/document submission after placement of PO. Each item of the BoM to be uniquely identified with item code no. or item serial no.
- b. Supplier to ensure that all items which will find separate mention in the packing list are covered in this detailed BoM.
- c. Supplier to give following undertaking in the BoM"
"The BoM provided herewith completes the scope (in content and intent) of material supply under PO no.-----, dated__.
Any additional material which may become necessary for the intended application of the supplied items(s)/package will be supplied free of cost in most reasonable time."



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SUB-SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)



**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
COLTCS
2X660MW KHURJA STPP
(TG AND ASSOCIATED PACKAGES)**

SPECIFICATION NO.

VOLUME NO. : II-B

SECTION : C

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SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER/ PURCHASER

- b) Services and equipment as per "Electrical Scope between BHEL and Vendor".
- c) 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.
- d) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- e) Electrical load requirement for COLTCS.
- f) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- g) 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.
- h) 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.
- i) Motor shall meet minimum requirement of motor specification.
- j) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
- k) 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.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

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

4.0 LIST OF ENCLOSURES

- 4.1 Electrical Scope Between BHEL & Vendor (Annexure-I).
- 4.2 Electrical Load Data Format (Annexure-II).
- 4.3 Cable Schedule Format (Annexure-III).
- 4.4 Data Sheet-A.
- 4.5 Data Sheet-C.
- 4.6 Technical Requirements-Motors.
- 4.7 Standard Quality Plan.
- 4.8 Motor Sub Vendor List

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

PACKAGES: COLTCS

SCOPE OF VENDOR: SUPPLY

PROJECT: 2X660 MW KHURJA STPP-TG

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC Starter cum control panel (if applicable)	BHEL Vendor	BHEL BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor. OR (DE to select the choice applicable for their project))
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor. (in case, where local starter panel is not applicable.)
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: 2X660 MW KHURJA STPP-TG



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.


	TITLE LV MOTORS DATA SHEET-A 2X660 MW KHURJA STPP-TG		SPECIFICATION NO.	
			VOLUME	II B
			SECTION	D
			REV NO. 00	DATE 29.09.20
			SHEET	I OF 1
1.0	Design ambient temperature	:	50 °C	
2.0	Maximum acceptable kW rating of LV motor	:	Upto 200KW	
3.0	Installation (Indoors/ Outdoors)	:	As required	
4.0	Details of supply system			
	a)	Rated voltage (with variation)	:	415V ± 10%
	b)	Rated frequency (with variation)	:	50 Hz (Variation: ± 5%)
	c)	Combined voltage & freq. variation	:	10% (sum of absolute values)
	d)	System fault level at rated voltage	:	50 kA for 1 sec
	e)	Short time rating for terminal boxes		
		* 110 kW and above (Breaker Controlled) :		50 KA for 0.25 sec.
		* Below 110 kW (Contactor Controlled) :		50 KA protected by HRC fuse
	f)	LV System grounding	:	Solidly
5.0	Class of insulation	:	Refer clause 7.03.00 of Motor cust. spec.	
6.0	Minimum voltage for starting (As percentage of rated voltage)	:	Refer clause 6.03.00 of Motor cust. spec.	
7.0	Power cables data	:	Shall be given during Detailed engg.	
8.0	Earth Conductor Size & Material	:	Shall be given during Detailed engg.	
9.0	Space heater supply (30KW & ABOVE)	:	240 V, 1Φ , 50 Hz	
10.0	Rating up to which Single phase motor	:	Acceptable below 0.20 Kw	
11.0	Locked rotor current			
	a)	Limit as percentage of FLC	:	As per IS 12615
12.0	Makes	:	BHEL/ Customer approval (Package owner to take care)	
13.0	Paint shade	:	Blue (RAL 5012)	
14.0	Additional tests	:	As per QP	
15.0	Degree Of protection for motor/ terminal box	:	Degree of protection for various enclosures as per IEC60034-05 shall be as follows:- i) Indoor motors - IP 54 ii) Outdoor motors - IP 55 iii) Cable box-indoor area - IP 54 iv) Cable Box-Outdoor area - IP 55	
16.0	Type of starter provided in MCC	:	As per IS/IEC: IEC-60947-4-1, DOL	
17.0	Cooling	:	As per Specification	
* LT motors of continuous duty shall be energy efficient IE3 class conforming to IS-12615				
18.0	TESTING REQUIREMENTS: IN LINE WITH SPECIFICATION			
➤ Also detailed Customer spec. for Motors is to be referred as enclosed with technical spec.				


CLAUSE NO.	TECHNICAL REQUIREMENTS		
	<div>MOTORS</div>		
1.00.00	GENERAL REQUIREMENTS		
1.01.00	For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.		
1.02.00	All equipment shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.		
1.03.00	Contractor shall provide fully compatible electrical system, equipment, accessories and services.		
1.04.00	All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.		
1.05.00	Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.		
1.06.00	The responsibility of coordination with electrical agencies and obtaining all necessary clearances for contractors equipment and systems shall be under the contractor scope.		
1.07.00	Degree of Protection		
	Degree of protection for various enclosures as per IEC60034-05 shall be as follows:-		
	i) Indoor motors	-	IP 54
	ii) Outdoor motors	-	IP 55
	iii) Cable box-indoor area	-	IP 54
	iv) Cable box-Outdoor area	-	IP 55
2.00.00	CODES AND STANDARDS		
	1) Three phase induction motors	:	IS/IEC:60034
	2) Single phase AC motors	:	IS/IEC:60034
	3) Crane duty motors	:	IS:3177, IS/IEC:60034
	4) DC motors/generators	:	IS/IEC:60034
	5) Energy Efficient motors	:	IS 12615, IEC: 60034-30
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION B-02 MOTORS
			PAGE 1 OF 9


CLAUSE NO.	 TECHNICAL REQUIREMENTS 		
3.00.00	TYPE		
3.01.00	AC Motors: <ul style="list-style-type: none"> a) Squirrel cage induction motor suitable for direct-on-line starting. b) Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30. HT motors shall have minimum design efficiency of 95 % Tolerance on efficiency value applicable as per IEC 60034. c) Crane duty motors shall be squirrel cage Induction motor as per the requirement. d) Motor operating through variable frequency drives shall be suitable for inverter duty with VPI insulation. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable. e) Motors operating through variable frequency drives shall also meet the requirements mentioned in subsection for VFD. 		
3.02.00	DC Motors	Shunt wound	
4.00.00	RATING		
	<ul style="list-style-type: none"> (a) Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor. (b) Whenever the basis for motor or driven equipment ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations. 		
5.00.00	TEMPERATURE RISE		
	Air cooled motors		
	70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation.		
	Water cooled		
	80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.		
	41 deg.C over inlet cooling water maximum temperature of 39 deg.C for thermal class 90 (Y) wet wound Boiler circulation pump motor.		
6.00.00	OPERATIONAL REQUIREMENTS		
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION B-02 MOTORS
			PAGE 2 OF 9


CLAUSE NO.	<div><div></div><div>TECHNICAL REQUIREMENTS</div><div></div></div>	
6.01.00	Starting Time	
6.01.01	For motors with starting time upto 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.	
6.01.02	For motors with starting time more than 20 secs. and upto 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.	
6.01.03	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.	
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.	
6.02.00	Torque Requirements	
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.	
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.	
6.03.00	Starting voltage requirement (a) Up to 85% of rated voltage for ratings below 110 KW (b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW (c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW (d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW (e) Up to 75 % of rated voltage for ratings above 4000KW Except AOP & JOP motors running on D.G emergency supply, starting voltage shall be 80%.	
7.00.00	DESIGN AND CONSTRUCTIONAL FEATURES	
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.	
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). The method of movement	
<div><div><div>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES</div><div>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371</div><div>SUB-SECTION B-02 MOTORS</div><div>PAGE 3 OF 9</div></div></div>		

CLAUSE NO.	TECHNICAL REQUIREMENTS			
7.03.00	of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per IEC 60034-6. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor. Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS: 2148 as detailed below			
	(a)	Fuel oil area	: Group – IIB	
	(b)	Hydrogen generation	: Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA / IEC60034)	
	Winding and Insulation			
	(a)	Type	: Non-hygroscopic, oil resistant, flame resistant	
	(b)	Starting duty	: Two hot starts in succession, with motor initially at normal running temperature.	
	(c)	11kV & 3.3 kV AC motors	: Thermal class 155 (F) insulation. The winding insulation process shall be Global Vacuum Pressure Impregnated i.e. resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15. However winding insulation for wet wound Boiler circulation pump motor shall be thermal class 90 (Y) or better.	
	(d)	240VAC, 415V AC & 220V DC motors	: Thermal Class (B) or better	
	7.04.00	Motors rated above 1000KW shall have insulated bearings/housing to prevent flow of shaft currents.		
	7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.		
7.06.00	Noise level for all the motors shall be limited to 85dB (A) except for BFP motor for which the maximum limit shall be 90 dB(A). Vibration shall be limited within the limits prescribed in IS/IEC 60034-14. Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.			
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer and 2 numbers duplex platinum resistance type temperature detectors.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
7.08.00	Motor body shall have two earthing points on opposite sides.			
7.09.00	11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386. The offered SIC terminations shall be provided with protective cover and trifurcating sleeves. SIC termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.			
7.10.00	3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Suitable termination kit shall be provided for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non-magnetic material for single core cables) shall be provided.			
7.11.00	The spacing between gland plate & center of bottom terminal stud shall be as per Table-I.			
7.12.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.			
7.13.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.			
7.14.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.			
7.15.00	The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.			
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP motor.			
	(a)	From 50KW & upto 110KW	:	11.0
	(b)	From 110 KW & upto 200 KW	:	9.0
	(c)	Above 200 KW & upto 1000KW	:	10.0
	(d)	From 1001KW & upto 4000KW	:	9.0
	(e)	Above 4000KW	:	6 to 6.5
9.00.00	CW motor shall be designed with minimum power factor of 0.8 at design duty point.			
10.00.00	TYPE TEST			
10.01.00	HT MOTORS			
10.01.01	The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION B-02 MOTORS
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
	<p>tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.</p>			
10.01.02	<p>The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.</p>			
10.01.03	<p>In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the employer for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.</p>			
10.01.04	<p>Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED "and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval.</p>			
10.01.05	<p>LIST OF TYPE TESTS TO BE CONDUCTED</p> <p>The following type tests shall be conducted on each type and rating of HT motor</p> <p>(a) No load saturation and loss curves upto approximately 115% of rated voltage.</p> <p>(b) Measurement of noise at no load.</p> <p>(c) Momentary excess torque test (subject to test bed constraint).</p> <p>(d) Full load test (subject to test bed constraint)</p> <p>(e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the</p>			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION B-02 MOTORS	PAGE 6 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS			
10.01.06	<p>test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.</p> <p>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</p> <p>The following type test reports shall be submitted for each type and rating of HT motor</p> <p>(a) Degree of protection test for the enclosure followed by IR, HV and no load run test.</p> <p>(b) Terminal box-fault level withstand test for each type of terminal box of HT motors only.</p> <p>(c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15</p> <p>(d) Surge-withstand test on interturn insulation shall be as per clause no. 4.2 of IEC 60034, part-15</p>			
10.02.00	LT Motors			
10.02.01	LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for employer's approval the reports of all the type tests as listed in this specification and carried out within last <i>ten</i> years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.			
10.02.02	However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the employer either at third party lab or in presence of client/ employer's representative and submit the reports for approval.			
10.02.03	<p>LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED</p> <p>The following type test reports shall be submitted for each type and rating of LT motor of above 100 KW only</p> <p>1. Measurement of resistance of windings of stator and wound rotor.</p> <p>2. No load test at rated voltage to determine input current power and speed</p> <p>3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors)</p> <p>4. Full load test to determine efficiency power factor and slip.</p> <p>5. Temperature rise test.</p> <p>6. Momentary excess torque test.</p>			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION B-02 MOTORS	PAGE 7 OF 9

CLAUSE NO.	<div><div><div>एनटीपीसी</div><div>NTPC</div></div></div> TECHNICAL REQUIREMENTS <div></div>																					
	<div><div>7. High voltage test.</div><div>8. Test for vibration severity of motor.</div><div>9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section)</div><div>10. Test for degree of protection and</div><div>11. Over speed test.</div><div>12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1</div></div>																					
10.03.00	All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.																					
10.04.00	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.																					
	<div>TABLE - I</div> <div>DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS</div> <table><tr><th>Motor MCR in KW</th><th>Minimum distance between centre of bottom terminal stud and gland plate in mm</th></tr><tr><td>UP to 3 KW</td><td>As per manufacturer's practice.</td></tr><tr><td>Above 3 KW - upto 7 KW</td><td>85</td></tr><tr><td>Above 7 KW - upto 13 KW</td><td>115</td></tr><tr><td>Above 13 KW - upto 24 KW</td><td>167</td></tr><tr><td>Above 24 KW - upto 37 KW</td><td>196</td></tr><tr><td>Above 37 KW - upto 55 KW</td><td>249</td></tr><tr><td>Above 55 KW - upto 90 KW</td><td>277</td></tr><tr><td>Above 90 KW - upto 125 KW</td><td>331</td></tr><tr><td>Above 125 KW-upto 200 KW</td><td>385/203 (For Single core cables only)</td></tr></table>		Motor MCR in KW	Minimum distance between centre of bottom terminal stud and gland plate in mm	UP to 3 KW	As per manufacturer's practice.	Above 3 KW - upto 7 KW	85	Above 7 KW - upto 13 KW	115	Above 13 KW - upto 24 KW	167	Above 24 KW - upto 37 KW	196	Above 37 KW - upto 55 KW	249	Above 55 KW - upto 90 KW	277	Above 90 KW - upto 125 KW	331	Above 125 KW-upto 200 KW	385/203 (For Single core cables only)
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<div><div><div>KHURJA SUPER THERMAL POWER PROJECT</div><div>(2X660 MW)</div><div>TURBINE GENERATOR AND ASSOCIATED PACKAGES</div></div><div><div>TECHNICAL SPECIFICATION</div><div>SECTION – VI, PART-B</div><div>BID DOC. NO.:</div><div>THDC/RKSH/CC-9915-371</div></div><div><div>SUB-SECTION B-02</div><div>MOTORS</div></div><div><div>PAGE</div><div>8 OF 9</div></div></div>																						

CLAUSE NO.	<div><div><div>एन टी पी सी</div><div>NTPC</div></div></div>	TECHNICAL REQUIREMENTS	<div><div><div></div><div></div><div></div></div></div>								
	<p>For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.</p> <p>PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:</p> <p>NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:</p> <table><tr><td>Motor MCR in KW</td><td>Clearance</td></tr><tr><td>UP to 110 KW</td><td>10mm</td></tr><tr><td>Above 110 KW and upto 150 KW</td><td>12.5mm</td></tr><tr><td>Above 150 KW</td><td>19mm</td></tr></table>			Motor MCR in KW	Clearance	UP to 110 KW	10mm	Above 110 KW and upto 150 KW	12.5mm	Above 150 KW	19mm
Motor MCR in KW	Clearance										
UP to 110 KW	10mm										
Above 110 KW and upto 150 KW	12.5mm										
Above 150 KW	19mm										
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION B-02 MOTORS	PAGE 9 OF 9								



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

SPEC. NO.: **PE-TS-475-165-N002**
SECTION: **I**
SUB-SECTION: **IC**
REV. NO. **00** DATE **20.01.2021**
SHEET **1** OF **1**

SUB-SECTION – IC
SPECIFIC TECHNICAL REQUIREMENTS (C &I)

	2X660 MW KHURJA STPP-TG PKG	
	TECHNICAL SPECIFICATION (C&I) FOR CONDENSER ON LOAD TUBE CLEANING SYSTEM	
<div>SPECIFIC C&I TECHNICAL REQUIREMENT FOR COLTCS</div>		

	2X660 MW KHURJA STPP (TG PACKAGE)	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) FOR COLTCS SYSTEM	
<p>Specific Technical Requirements (C&I):</p> <p>1.0 COLTCS system shall be operated from DCS (DCS-BHEL Scope of supply) through operator work stations.</p> <p>2.0 Bidder to provide local control panel(LCP)/starter panel for COLTCS system. This LCP/starter panel will act as interface between the DCS and the field devices for commands & feedbacks. In addition, LCP/starter panel shall have the provision of command (start/stop) & feedback interface with plant DCS</p> <p>3.0 Bidder to supply all the instruments (DPT, DPG etc.) required for the package along with necessary fittings, accessories and valve manifold etc. All instruments shall be provided with durable epoxy coating for housing and all exposed surfaces of the instruments.</p> <p>4.0 All the Electronic Transmitter for Pressure, Differential Pressure and DP based Flow /Level measurements shall be genuine, verifiable PROFIBUS PA protocol compatible instruments. The transmitters shall be connected to DCS through PROFIBUS PA protocol complying to IEC 61158 directly from transmitter. This is subject to customer approval and BHEL decision shall be final.</p> <p>5.0 ON OFF and INCHING type actuators (Non-intrusive type) shall be PROFIBUS-DP compatible with Open/Close command termination logic suitably built inside the actuator.</p> <p>6.0 The PROFIBUS protocol design shall be further validated by BHEL and approved by NTPC/Customer during detailed engineering and any variation/ changes required based on DCS system requirements and actual field installation, operational philosophy etc. shall be considered by bidder without any implications.</p> <p>7.0 All transmitters shall be suitably grouped together and mounted inside (i) Local Instruments Enclosures (LIEs) in case of open areas of the plant and (ii) In Local Instrument Racks (LIRs) in case of covered areas.</p> <p>8.0 All the transmitters and gauges shall be remote seal type having minimum capillary length of 10 m.</p>		

	2X660 MW KHURJA STPP (TG PACKAGE)	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) FOR COLTCS SYSTEM	
9.0	Complete C&I system for COLTCS System is in bidder's scope of supply. Items not specifically mentioned however required for the completeness of the system shall be supplied by bidder without any commercial implication.	
10.0	The Contractor shall provide complete Instrumentation for control, monitoring and operation of entire COLTCS system. The requirements given are to be read in conjunction with detailed Technical specification enclosed in the specification. Further in case of any discrepancy in the requirement within the same section noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre- bid clarification. In absence of any pre-bid clarification, the more stringent requirement as per interpretation of customer shall prevail without any commercial implication.	
11.0	The quantity of instruments for the system shall be as per tender P & ID wherever provided of the respective system as a minimum, for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.	
12.0	415V AC Power supply shall be provided by BHEL at a single point (Please refer the Electrical Specification for more detail), further distribution to various instruments/equipment of the system shall be in bidder scope. Bidder to include necessary power distribution board, changeover circuit in his scope. Any power supply other than the above, UPS power etc., if required by any instrument/equipment has to be derived by the bidder from the above supply & all necessary hardware for the same shall be in bidder scope. Bidder to submit the power requirement along with the bid.	
13.0	Power supply derived for contact interrogation, interposing relay and solenoid shall generally be ungrounded 24 V D.C. only.	
14.0	The make of the items shall be from sub-vendor list. However the make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict or repetition of clauses in the specification, the more stringent requirements among them are to be complied with.	

	2X660 MW KHURJA STPP (TG PACKAGE)	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) FOR COLTCS SYSTEM	
15.0	The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards.	
16.0	The scope of cable shall be referred in Electrical scope split sheet in Electrical portion of the specification.	
17.0	Bidder shall provide Cable Schedule in BHEL excel format provided in Electrical portion of the specification. All cable interconnection details for complete system shall be in Bidders' scope.	
18.0	Instrument installation and accessories required for the same shall be in Bidder's scope and shall be subject to customer/BHEL's approval during detailed engineering.	
19.0	Bidder to provide erection hardware including junction boxes, canopies, structural steel as required.	
20.0	Every panel-mounted instrument, requiring power supply, shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.	
21.0	Provision for separate Terminal block/wiring diagram for power and control blocks of control panel to be ensured.	
22.0	To ensure availability, adequate redundancy in system design shall be provided at hardware, software and sensor level. For the protection system, independent sensing device shall be provided to ensure adequate safety of plant equipment.	
23.0	Redundancy of sensors shall be provided by bidder (i) Triple redundancy for all analog and binary inputs required for protection of system/drives. (ii) For all other control functions dual redundancy of the sensors shall be provided by the bidders.	
24.0	The design of the control systems and related equipment shall adhere to the principle of 'Fail Safe' Operation wherever safety of personnel / plant equipment is involved and shall not cause a hazardous condition. However,	

	2X660 MW KHURJA STPP (TG PACKAGE)	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) FOR COLTCS SYSTEM	
	<p>it shall also be ensured that occurrence of false trips are avoided/minimized.</p>	
25.0	<p>All panels, cabinets shall be provided with a continuous bare copper ground bus. The ground bus shall be bolted to the panel structure on bottom on both sides. The bolts shall face inside of panels. The system ground shall be isolated from the panel ground with suitable isolators. All internal component grounds or common shall be connected to the system ground, which shall be fabricated of copper flat (size 25mm x 6mm min., length as applicable).</p>	
26.0	<p>Bidder to perform tests of C&I items/instruments/systems as per quality plans/type test attached in the specification.</p>	
27.0	<p>The requirements given are to be read in conjunction with detailed Technical specification enclosed.</p>	
28.0	<p>The bidders shall specifically mention any deviation they would like to take on the C&I specification. In absence of only deviation, a "No deviation" certificate is to be furnished.</p>	
29.0	<p>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. 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 (SS316 material), nuts & bolts etc. shall also be included, wherever required with the field instruments.</p>	
30.0	<p>For instruments which are not located inside covered building, suitable canopy/ protective arrangement shall be provided which shall be approved during detail engineering.</p>	
31.0	<p>All the wetted parts of the instruments including the accessories like root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments as well as valves shall be of SS-316 material, suitable pressure class and same shall be in bidder's scope.</p>	
32.0	<p>All instruments should be supplied with valid calibration and test certificates provided by OEM.</p>	


	2X660 MW KHURJA STPP (TG PACKAGE)	
	SPECIFIC TECHNICAL REQUIREMENTS (C&I) FOR COLTCS SYSTEM	
33.0	At least 20% spare unused terminals shall be provided everywhere including local junction boxes, instrument racks/enclosures, termination/marshalling cabinets, etc.	
34.0	Double root valve shall be provided for all pressure tapings where the design pressure exceeds 40kg/cm2.	
35.0	All the instruments PG/DPG/DPT/PT etc. as applicable shall have chemical/diaphragm seal.	
36.0	Number of pairs to be selected for Screen/ Control cable (a) F-Type: 2P/4P/8P/12P(Size : 0.5 mm2) (b) G-Type: 2P/4P/8P/12P(Size : 0.5 mm2) (c) Core Cable: 3CX2.5sqmm2/ 5CX2.5sqmm2/ 12CX1.5sqmm2	
37.0	Drive control philosophy/signal exchange list attached elsewhere in the specification are Tentative and shall be finalized during detailed engineering.	
38.0	Bidder to provide mandatory spares as per mandatory spares list. Attached elsewhere in the specification	
39.0	Editable & pdf copy of Drawings/Documents and data to be furnished after award of the contract: List of Drawings/Documents and data to be furnished by bidder after award of the contract are mentioned under section" List Of Documents/Deliverables".	
Note:-		
1. All equipment items shall be of latest design with proven on track record.		
2. The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.		
3. Documents of C&I System shall be submitted to end user/owner for approval during detail engineering. Changes, if any, shall be accommodated by the bidder without any price/time implication.		

	2X660 MW KHURJA STPP-TG PKG	
	TECHNICAL SPECIFICATION (C&I) FOR CONDENSER ON LOAD TUBE CLEANING SYSTEM	

C&I SCOPE MATRIX FOR COLTCS

SCOPE MATRIX - COLTCS SYSTEM		
S.No.	PROJECT	2X660 MW KHURJA STPP TG
1	CONTROL SYSTEM APPLICABLE: CONDENSER ON LOAD TUBE CLEANING SYSTEM (COLTCS)	Y
2	CONTROL SYSTEM CONFIGURATION: UNITISED OR COMMON OR AS APPLICABLE	2 SETS OF COLTCS SHALL HAVE ONE COMMON STARTER PANEL (SWITCH GEAR PANEL) PER UNIT
3	CONTROL SYSTEM	REFER NOTE-1
4	LOCATION OF CONTROL SYSTEM	
5	CONTROL SYSTEM SCOPE (BIDDER /BHEL/ CUSTOMER)	
6	CONTROL FROM PUSH BUTTONS ON STARTER PANEL	Y; REFER NOTE 3
7	ANNUNCIATION ON STARTER PANEL (Y/N) -- IF Y, MIN NO. OF HARDWIRED ALARMS / INDICATIONS	Y; REFER NOTE-4
8	MIMIC ON STARTER PANEL (Y/N)	NA
9	PROTECTION CLASS FOR STARTER PANEL	AS PER DATASHEET OF 'LOCAL CONTROL CUM STARTER PANEL' (herein also referred as 'Starter Panel' or 'Local Control Panel' or 'Switchgear Panel' interchangeably)
10	ACTUATOR WITH INTEGRAL STARTER(Non-intrusive type)) (Y/N) - SHALL BE PROFIBUS-DP PROTOCOL COMPATIBLE.	Y
11	DPG/ DPT PER COLTCS SYSTEM * TRANSMITTERs SHALL BE PROFIBUS-PA PROTOCOL COMPATIBLE.	DIFFERENTIAL PRESSURE TRANSMITTER = 2 nos. (Across each Filter) DIFFERENTIAL PRESSURE GAUGE = 1 no. (Across each Filter)
12	SEA WATER APPLICATION	NA
	NOTES:	
1	Type of control system shall be DCS based in BHEL scope. Field instrumentation and starter panels for the package are in bidder's scope of supply.	
2	Condenser on load tube cleaning system shall be supplied with its Local control panel/Starter panel and its annunciation for its operation. Extent of annunciation shall be decided during detailed engg.	
3	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.	
4	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 if redundant feeder is applicable.	
5	Bidder to terminate all control elements in the local control cum starter panel/Junction box for further cabling to DCS.	
6	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	
7	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.	
8	LIR/LIE shall be provided for mounting the instruments in the field.	
9	Mandatory spare list shall be referred in 'List of mandatory spares' attached elsewhere in the specification and shall be supplied by bidder.	
10	Open/close limit switch feedback of valves are to be connected to DCS for remote viewing and for interlock & protection.	
11	The Vendor list/ sub-vendor list shall be subject to BHEL / Customer approval during contract stage.	
12	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.	

	2X660 MW KHURJA STPP-TG PKG	
	TECHNICAL SPECIFICATION (C&I) FOR CONDENSER ON LOAD TUBE CLEANING SYSTEM	
<div>GENERAL TECHNICAL REQUIREMENTS (COLTCS SYSTEM)</div>		

	SPECIFICATION FOR CONTROL & INSTRUMENTATION FOR AUX PACKAGES	SPECIFICATION NO.:	
		VOLUME	
		SUB SECTION	
		REV. NO.	DATE :
		SHEET	OF

GENERAL REQUIREMENT

1.0 Bidder shall provide complete and independent control & instrumentation system with all accessories, auxiliaries and associated equipments for the safe, efficient and reliable operation of auxiliary systems.

2.0 The quantity of instruments for auxiliary system shall be as per tender P & ID wherever provided of the respective system as a minimum, for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.

3.0 Measuring instruments/equipment and subsystems offered by the bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Further all the instruments shall be of proven reliability, accuracy, and acceptable international standards and shall be subject to employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specification, ranges, makes/ numbers as approved by the employer' during detail engineering.

4.0 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments; sensors, switches etc for external connection including spare contacts shall be wired out to suitably located junction boxes.

5.0 The customer specification attached as Specific Technical Requirement will supercede the Data sheets, if there is any mismatch.

	2X660 MW KHURJA STPP-TG PKG	
	TECHNICAL SPECIFICATION (C&I) FOR CONDENSER ON LOAD TUBE CLEANING SYSTEM	
<div>LIST OF DOCUMENTS/DELIVERABLES</div>		

LIST OF DELIVERABLES OF PEM - C&I DEPARTMENT FOR 2X660 MW KHURJA STPP-TG PACKAGE


DOCUMENT NUMBER PE-GL-475-145-I100 SHEET 1 of 1

Sl.No.	DRAWING NO.	DRAWING/DOCUMENT TITLE	CATEGORY
1	PE-V0-475-145-I901	CONTROL & OPERATIONAL WRITE-UP FOR THE SYSTEM	A
2	PE-V0-475-145-I902	CONTROL SCHEME/LOGIC DIAGRAM(TO BE IMPLEMENTED IN DDCMIS)	A
3	PE-V0-475-145-I903	HMI PICTURES/PLANT SCHEMATICS	A
4	PE-V0-475-145-I904	INSTRUMENT SCHEDULE WITH SET POINTS	A
5	PE-V0-475-145-I905	I/O LIST (ANALOG & BINARY)	A
6	PE-V0-475-145-I906	DRIVE LIST/SOLENOID/ACTUATOR VALVE LIST WITH LOCATION DATA	A
7	PE-V0-475-145-I907	FIELD JB/LIE/LIR, DRIVES TERMINATIONS	A
8	PE-V0-475-145-I908	DATASHEETS FOR INSTRUMENTS, JBs, etc.	A
9	PE-V0-475-145-I909	QUALITY PLANS (INSTRUMENTS,LCP etc.)	A
10	PE-V0-475-145-I910	INSTRUMENT HOOK UP DRAWING	A
11	PE-V0-475-145-I911	THERMOWELL SIZING CALCULATION	A
12	PE-V0-475-145-I913	CABLE SCHEDULE & INTERCONNECTION	A
13	PE-V0-475-145-I914	ANNUNCIATION & SOE LIST	A

NOTES:

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

	2X660 MW KHURJA STPP-TG PKG	
	TECHNICAL SPECIFICATION (C&I) FOR CONDENSER ON LOAD TUBE CLEANING SYSTEM	
<div><p>SPECIFICATION FOR MEASURING INSTRUMENTS (PRIMARY & SECONDARY) AND CONTROL PANEL</p></div>		

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.00.00	MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)			
1.01.00	Measuring instruments/equipment and subsystems offered by the Bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Refer Sub-section Basic Design Criteria. Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance and shall comply with the acceptable international standards and shall be subject to Employer's approval.			
1.02.00	Every panel-mounted instrument requiring power supply shall be provided with easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.			
1.03.00	All transmitters, sensors, switches and gauges for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance as well as for operator and management information (including all computation) of equipment in the system under the scope of specification shall be provided on as required basis with in quoted lump sum price. The Contractor shall furnish all Instrumentation / Control equipment & accessories under this specification as per technical specification, ranges, makes & model as approved by the Employer during detailed engineering.			
1.04.00	The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.			
1.07.00	The instruments which are proposed to be used for PG test as indicated in the tender P&IDs shall meet the minimum requirements specified in ASME PTC or subsequent clauses in this chapter whichever is better.			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915- 371	SUB-SECTION-IIIC-04 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	PAGE 1 OF 30

SPECIFICATIONS FOR PR. GAUGE, D.P. GAUGE, TEMP. GAUGE AND LEVEL GAUGE.

Sl. No	FEATURES	ESSENTIAL/MINIMUM REQUIREMENTS		
		Pr. Gauge/ DP Gauge/ Draught gauges	Temperature Gauge	Level Gauge
1	Sensing Element and material	Bourdon for high pressure, Diaphragm/Bellows for low pr. Of 316 SS	Mercury in steel for below 450°C and inert gas actuated for above 450°C of SS bulb and capillary.	Tempered * toughened Borosilicate gauge glass steel armoured reflex or transparent type.
2	Body material	Die-cast aluminium	Die-cast aluminium	Forged carbon steel/304 SS
3	Dial size	150mm	150 mm	Tubular covering entire range
4	End connection	1/2 inch NPT (M)	3/4" NPT (M)	Process connection as per ASME PTC and drain/vent 15 NB
5	Accuracy	±1% of span	± 1% of span	± 2%
6	Scale	Linear, 270° arc graduated in metric units	Linear, 270° arc graduated in °C	Linear vertical
7	Range selection	Cover 125% of max. of scale	Cover 125% of max. of scale	Cover 125% of max. of scale
8	Over range test	Test pr. for the assembly shall be 1.5 to the max. Design pr. at 38°C.		
9	Housing	Weather and dust proof as per IP-55	Weather and dust proof as per IP-55	CS/304 SS leak proof
10	Zero/span adjustment	Provided	Provided	--
11	Identification	Engraved with service legend or laminated phenolic name plate		

12	Accessories	Blow out disc, siphon, snubber, pulsation dampener, chemical seal (if required by process) gauge isolation valve	SS Thermowell	Gasket for all KEL-F shield for transparent type vent and drain valves of Steel/SS as per CS/Alloy process Requirement.
13	Material of Bourdon/ movement	316 SS / 304 SS	316 SS / 304 SS	

Notes:-

*Bicolour type level gauges will be provided for applications involving steam and water except for condensate and feed water services.

Length of gauge glass shall not be more than 1400 mm. If the vessel is higher, multiple gauge glasses with 50 mm overlapping shall be provided.

Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.

16.00.00



NOT USED

17.00.00

SOLENOID VALVES

Solenoid valves shall fulfil the following requirements:

- a. Type 2/3/4 way SS 316/Forged Brass (depending on the application subject to Employer's approval during detailed Engg.)
- b. Power supply : 24 V DC \pm 10%.
- c. Plug and socket electrical connection.
- d. Insulation : Class 'H'
- e. IP Class : IP65

CLAUSE NO.	TECHNICAL REQUIREMENT			A□□□□□r□ IIIC-02K	
					
1.00.00	GENEREAL REQUIREMENTS FOR FIELDBUS INSTRUMENTS AND ACTUATORS				
	This section provides the basic guidelines for the design and implementation of Fieldbus (Foundation Field Bus/ Profibus) based control system.				
1.01.00	The requirements given herein are minimum requirements to be considered by Contractor to ensure uniformity in basic design and shall not be considered as final requirements. The Fieldbus design shall be further validated by contractor and approved by Employer during detailed engineering and any variation/ changes required based on DDCMIS system requirements and actual field installation, operational philosophy etc. shall be considered by contractor without any implications.				
1.02.00	<p>The fieldbus segment design shall be finali□ed and validated based on functional requirements as per□</p> <ul style="list-style-type: none">• Process requirements (P&IDs/ operational requirements).• Loop response time of different loops device communication time i.e. cycle time for fast and slow loops with scheduled and unscheduled organi□ation as per pro□ect.• Area classification requirements (e.g. ha□ardous or safe).• Fieldbus devices specifications (maximum current drawn from bus, block execution speeds, power conditioner suitable for field barrier, etc.)• Length of segments.• Instrument location plans with elevation details.• Host-system documentation showing configuration rules or restrictions.• For Foundation Fieldbus & Profibus PA chicken foot/ branch/ or combination of both topology shall be provided. For Profibus DP, Bus/ Line topology in Redundant mode shall be provided. That is, for Profibus DP redundant cables connected to redundant ports of devices shall be provided. <p>Suitable field bus segment design shall be considered keeping the safety & integrity of the system intact so that the cabling, marshalling, □unction boxes and system performance shall be optimi□ed.</p> <p>However, all such segment device allocation, topology shall be decided during detailed engineering.</p>				
1.03.00	Contractor to provide all standard functional blocks for all Foundation Fieldbus/ Profibus devices as per latest FF/ Profibus version and standard guidelines. Fieldbus components including power supply, terminators, isolators, etc. provided by Contractor shall comply to IEC □115□ and other standard Fieldbus guidelines.				
1.04.01	Redundant host/ master card and redundant power supply along with advance diagnostic module shall be provided. All required libraries to execute various tasks like data acquisition, control/protection etc. shall be provided.				
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION - IIIC-02 DDCMIS ANNEXURE IIIC-02K	
				PAGE 1 OF 3	

In fieldbus system following spare capacity in each FG shall be provided ☐

I	Software Blocks	Spare capacity
Controller	Software Blocks	30%
	Host	30%
Host/Power supply	Installed spare capacity	10%
Host/Power supply space	Only spare space	20%
Segment spare capacity		40%


If in a FG, conventional and fieldbus system both are implemented then above spare capacity shall be in proportion to fieldbus/ conventional system implementation.

The contractor shall present complete implementation scheme, including wiring scheme during detailed engineering stage for review and approval by Employer.



Fieldbus cable (specifically used for Foundation Fieldbus/ Profibus PA and Profibus DP) shall be Individually shielded twisted pair, with round steel wired armour (SWA) complying to IEC 60332-1, Type A. The cable construction shall meet IEC 60332-1 standard for physical properties and the outer sheath shall be of PVC-TM53 as per IEC 60332-1-22. Continuous operating temperature of Fieldbus cable shall be minimum 90 Deg C. For laying of fieldbus cables, cable trays envisaged for instrumentation cable with all the accessories shall be used by the contractor. Minimum 300 mm spacing to be kept between the fieldbus trays and other high voltage cables to avoid any interference.



SS Junction boxes specially designed for fieldbus application shall be provided on as required basis. These SS JB's shall house field mounted fieldbus components like distributors, tee, etc. These SS JB's shall have suitable cover and gasket and shall have protection class of IP-65 or better. SS Cable glands and blind plugs shall be provided by the Contractor.

Comprehensive Fieldbus Maintenance and Diagnostic software shall be provided. This software shall be capable of collecting complete diagnostic information from fieldbus network and all fieldbus devices and presenting in user friendly interface for detailed diagnostic and troubleshooting of the system. It shall be possible to completely configure parameters of fieldbus network and fieldbus devices from centralized system through this software. This software shall have feature of providing data related to maintenance of fieldbus devices as available through fieldbus system. This system/ software shall have provision to get updated to latest version/ release of various fieldbus devices.

CLAUSE NO.	<div><div><div>एनटीपीसी</div><div>NTPC</div></div></div> <div>TECHNICAL REQUIREMENT</div> <div>A□□□□□r□ IIIC-02K</div> <div></div>
1.07.00	During FAT suitable arrangement shall be made by Contractor to test Fieldbus modules including field devices as per approved FAT procedure.
1.0□.00	The contractor shall use fieldbus segment design tool / software to design complete network verifying various design parameters like device voltage, total cable length, spur length, system power requirements etc. the contractor shall provide device voltage calculations for all segments, based on calculation in software package. All these calculations shall be handed over during detailed engineering in electronic format in a way that Employer can thoroughly verify design basis/ calculations carried out by Contractor.
1.09.00	Suitable short circuit protection, surge protection, grounding requirements shall be provided for all devices, so that fault in one device shall not impact the availability of other devices in the segment.
1.10.00	All required diagnostic and configuration tools/ hand held devices shall be provided for configuration and troubleshooting of devices and network.
<div><div><div>KHURJA SUPER THERMAL POWER PROJECT</div><div>(2X660 MW)</div><div>TURBINE GENERATOR AND ASSOCIATED PACKAGES</div></div><div><div>TECHNICAL SPECIFICATION</div><div>SECTION – VI, PART-B</div><div>BID DOC. NO.: THDC/RKSH/CC-9915-371</div></div><div><div>SUB-SECTION - IIIC-02 DDCMIS</div><div>ANNEXURE IIIC-02K</div></div><div><div>PAGE</div><div>3 OF 3</div></div></div>	

11.00.00	FIELD INSTRUMENTS BASED ON FIELDBUS The following instruments shall be connected to DDCMIS through fieldbus i.e. FOUNDATION Fieldbus/PROFIBUS PA protocol complying to IEC 61158 directly from transmitter.		
11.01.00	Electronic Transmitter for Pressure, Differential Pressure and DP based Flow / Level measurements.		
	S No.	Features	Essential/Minimum Requirements
	1.	Type of Transmitter	FOUNDATION Fieldbus/PROFIBUS PA based output
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-IIIC-18 WIRELESS INSTRUMENTS & SYSTEM INCLUDING FIELDBUS INSTRUMENTS
			PAGE 7 OF 10

CLAUSE NO.		TECHNICAL REQUIREMENTS 		
	<p>2 Accuracy</p> <p>3. Stability</p> <p>4 Turn down</p> <p>5 Housing</p> <p>6. Electrical connection</p> <p>7. Process connection</p> <p>8. Operating Ambient temperature</p> <p>Overpressure</p> <p>9 Accessories</p>	<p>± 0.060 % of calibrated range (minimum) for calibrated range greater than 400 mmwc.</p> <p>+0.065% of calibrated range (minimum) for calibrated range greater than 250 kg/cm2.</p> <p>± 0.10 % of calibrated range (minimum) for calibrated range less than 400 mmwc.</p> <p>0.25 % of calibrated range for 10 years for calibrated range greater than equal to 400 mmwc on standard conditions of manufacturer.</p> <p>0.2 % of calibrated range for 1 years for calibrated range less than 400 mmwc on standard conditions of manufacturer.</p> <p>0.15% of calibrated range for 5 years for DPT with static pressure greater than 250 kg/cm2.</p> <p>50:1 for greater than or equal to span of 400mmwcl.</p> <p>20:1 for span below 400mmwcl.</p> <p>10:1 for span greater than 250 kg/cm2</p> <p>(Above mentioned (2,3,4) parameters/features of offered models shall be strictly as defined in standard published catalogue of the manufacturer only).</p> <p>Weather proof as per IP-67, metallic housing with durable corrosion resistant coating</p> <p>½" NPT(F) FOUNDATION Fieldbus/PROFIBUS PA compatible</p> <p>½" NPT (F)</p> <p>85 deg C without display.</p> <p>70 deg C with display.</p> <p>150% of max operating pressure</p> <p>-Diaphragm seal, pulsation dampeners, syphon etc. as required by service and operating condition.</p> <p>-2 valve manifold for absolute & gauge pressure transmitters, -3-valve for DP and 5 valve manifold for level/flow applications.</p> <p>-The valve manifold shall be non-integral type.</p> <p>-For hazardous area, enclosure as described in NEC article 5.</p>		
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-IIIC-18 WIRELESS INSTRUMENTS & SYSTEM INCLUDING FIELD BUS INSTRUMENTS PAGE 8 OF 10



CLAUSE NO.		TECHNICAL REQUIREMENTS 
	<p>10. Mounting</p> <p>11. Diagnostics & display</p> <p>Notes</p> <ul style="list-style-type: none"> - For primary air/ secondary air/flue gas/ furnace pressure applications, DP type transmitters shall be provided for pressure measurement below 2000 mmwc. - LVDT type is not acceptable. - Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application. 	<p>2 inch pipe mounting with Enclosure/Rack/Canopy.</p> <p>Self-Indicating feature and digital display on transmitter</p>

KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-IIIC-18 WIRELESS INSTRUMENTS & SYSTEM INCLUDING FIELDBUS INSTRUMENTS	PAGE 9 OF 10
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10.00.00**CONTROL CABINETS / PANELS**

10.01.00

The cabinets shall be IP-22 protection class. The Contractor shall ensure that the packaging density of equipment in these cabinets is not excessive and abnormal temperature rise, above the cabinet temperature during normal operation or air-conditioning failure, is prevented by careful design. This shall be demonstrated to the Employer during the factory testing of the system. The Contractor shall ensure that the temperature rise is limited to 10 deg. C above ambient and is well within the safe limits for system components even under the worst condition as specified in Sub-section-basic Design criteria (Part-B, Section-VI) and specification requirements for remote I/O cabinets. Ventilation blowers shall be furnished as required by the equipment design and shall be sound proof to the maximum feasible extent. If blowers are required for satisfactory system operation, dual blowers with blower failure alarm shall be provided in each cabinet with proper enclosure and details shall be furnished with proposal. Suitable louvers with wire mesh shall be provided on the cabinet.

CLAUSE NO.	 TECHNICAL REQUIREMENTS 
10.01.01	The cabinets shall be designed for front access to system modules and rear access to wiring and shall be designed for bottom entry of the cables.
10.01.02	The cabinets shall be totally enclosed, free standing type and shall be constructed with minimum 2 mm thick steel plate frame and 1.6 mm thick CRCA steel sheet or as per supplier's standard practice for similar applications, preferred height of the cabinet is 2200 mm. The cabinets shall be equipped with full height front and rear doors. The floor mounting arrangement for other cabinets shall be as required by the Employer and shall be furnished by the Contractor during detailed engineering.
10.01.03	Cabinet doors shall be hinged and shall have turned back edges and additional bracing where required ensuring rigidity. Hinges shall be of concealed type. Door latches shall be of three-point type to assure tight closing. Detachable lifting eyes or angles shall be furnished at the top of each separately shipped section and all necessary provisions shall be made to facilitate handling without damage. Front and rear doors shall be provided with locking arrangements with a master key for all cabinets. If width of a cabinet is more than 800 mm, double doors shall be provided.
10.01.04	<p>Two spray coats of inhibitive epoxy primer-surface shall be applied to all exterior and interior surfaces. A minimum of 2 spray coats of final finish colour shall be applied to all surfaces. The final finished thickness of paint film on steel shall not be less than 65-75 micron for sheet thickness of 2 mm and 50 microns for sheet thickness of 1.6 mm. The finish colors for exterior and interior surfaces shall conform to following shades:</p> <p>(a.) Exterior:- As per RAL 9002 (End panel sides RAL 5012), to be finalized during detailed engineering.</p> <p>(b.) Interior:- Same as above.</p>
10.01.05	Paint films which show sags, checks or other imperfections shall not be acceptable.
10.01.06	As an alternative, single coat of anodic dipcoat primer along with single textured powder coating with epoxy polyester meeting the thickness requirement is also acceptable.
10.01.07	Refer Subsection Basic Design Criteria, Part B, and Section VI for grounding requirements.
10.01.08	The mimic shall be configured on the OWS and it shall be possible to control, monitor and operate the plant from the same.
10.01.09	The technical specification covering panel fabrication details, wiring and termination details etc. shall be as described under Sub-Section INST CABLE of this specification.

KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915- 371	SUB-SECTION-IIIC-09 PLANT AUXILIARY SYSTEM	PAGE 8 OF 10
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SPECIFICATION FOR LOCAL PANELS

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

VOLUME II B

SECTION D

REV. NO. 03

DATE : 16-09-2013

SHEET 1 OF 6

1.0 SCOPE

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

2.0 CODES AND STANDARDS

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

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

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

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

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

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

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

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel

Frame thickness: Not less than 3.0mm

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

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

Gland plate thickness: 3.0mm

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

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

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



SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A	
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- 3.1.7 The class of protection shall be in accordance with IP-42 unless otherwise specified in the data sheet – A (No. PES-145-54A-DS1-0).
- 3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as given in data sheet-A (No. PES-145A-DS1-0). Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.
- 3.1.9 The cable glands of the required size and type as given in data sheet-A (No. PES-145A-DS1-0) shall be supplied alongwith the Panel.
- 3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function.
No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.
- 3.1.11 Single / dual control power supply feeders of voltage class as specified in data sheet-A (No. PES-145A-DS1-0) shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.
- 3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm² size. AC & DC wires shall be kept separate from each other. Separate coloured wires to be used for AC and DC circuits. All wires shall be properly numbered and identified with ferrules as per the Control scheme / wiring diagram. Wires shall be routed and run through PVC troughs.
- 3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm² to 2.5mm² external cables. **The TB points in terminal block shall be cage clamp type / screw type.** The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm **height from finished floor. The panel shall have ten (20) percent spare terminal.**
- 3.1.14 The interior of each panel shall be suitably illuminated through fluorescent **lamps / tube lights with shrouded cover of minimum 15W** operable on 240V 50 Hz AC power supply through panel door switch. A 15 Amp. 3-pin Power receptacle shall be provided.
- 3.1.15 Suitable space heaters operable on 240 Volts 50 Hz AC power system shall be provided at the panel bottom. These shall be designed to maintain the panel temperature five (5) deg. C above the ambient temperature during maintenance shutdown. Suitable isolating and control devices comprising of MCB, thermostat etc. shall be provided for the space heater.
- 3.1.16 The panel shall be provided with a copper earth bus of 25 x 6 mm size running throughout the width of the panel. It shall be terminated internally with 10 mm bolts at extreme ends for connection to; main station earth. The panel mounted equipments / devices shall be connected to earth bus through green coloured PVC insulated stranded copper conductor of 2.5 mm² size.
- 3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte



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

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

3.2 Hazardous Area Panel Requirement

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

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

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

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

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

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

3.3 Control & Monitoring devices

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

3.3.2 Alarm Annunciator System

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

3.3.3 Relays

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

3.3.4 Timers

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



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3.3.5 Control / Selector Switches

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

3.3.6 Push Buttons / Indicating Lights

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

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

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

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

3.3.7 Ammeters

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

3.3.8 Miniature Circuit Breaker (MCB)

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

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

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

4.0 TESTING AND INSPECTION

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

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



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

4.3.1 Routine Tests

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

4.3.2 Type Tests

1. Enclosure Class Test



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5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

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

5.2. Mandatory Spares

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

5.3. Recommended Spares

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

6.0 DRAWINGS AND DOCUMENTS

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

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

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

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

7.0 MARKING AND PACKING



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

8.0 APPLICABLE DATA SHEET FORMS

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

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

	2X660 MW KHURJA STPP-TG PKG	
	TECHNICAL SPECIFICATION (C&I) FOR CONDENSER ON LOAD TUBE CLEANING SYSTEM	
<div>INSTRUMENTATION CABLE, CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY</div>		

CLAUSE NO.	<div><div></div><div>TECHNICAL REQUIREMENTS</div><div></div></div>														
1.00.00	INSTRUMENTATION CABLE, CONTROL & POWER SUPPLY CABLE, INTERNAL WIRING AND ELECTRICAL FIELD CONSTRUCTION MATERIAL (CABLE SUB-TRAYS ETC)														
1.01.00	General requirements														
1.01.01	All cables including special cables, internal wiring and electrical field construction material shall conform to this specification, Employer approved detail engineering drawings & documents and the latest edition of the relevant standards & guidelines. The Bidder shall furnish all material and services required for the completeness of the work identified in his scope as per this specification.														
1.01.02	The Contractor shall supply, erect, terminate and test all instrumentation cables for control and instrumentation equipment/devices/systems included under Contractor's scope and ensuring completeness of the control system.														
1.01.03	Any other application where it is felt that instrumentation cables are required due to system/operating condition requirements, are also to be provided by Contractor.														
1.01.04	Other type of cables like fiber optic/co-axial cables for system bus, cables for connection of peripherals etc. (under Contractor's scope) are also to be furnished by the Contractor.														
1.01.05	Contractor shall supply all cable erection and laying hardware from the main trunk routes like branch cable trays/sub-trays, supports, flexible conduits, cable glands, lugs, pull boxes etc. on as required basis for all the systems covered under this specification.														
1.01.06	Wherever the quantity has been defined as on as required basis, the same are to be furnished by contractor on as required basis within his quoted lump sum price without any further cost implication to the Employer.														
2.00.00	SPECIFICATION OF INSTRUMENTATION CABLE														
2.01.00	Common Requirements														
	<table><tr><th>S. No.</th><th>Property</th><th>Requirement</th></tr><tr><td>1</td><td>Operating Voltage</td><td>225 V (peak value)</td></tr><tr><td>2.</td><td>Codes and standard</td><td>All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IS-8784, IS-10810 (latest editions) and their amendments read along with this specification.</td></tr><tr><td>3.</td><td>Continuous operation suitability</td><td>At 205 Deg C for Type-C cables & heat resistant cables, at 70 Deg C for all other type of cables.</td></tr></table>			S. No.	Property	Requirement	1	Operating Voltage	225 V (peak value)	2.	Codes and standard	All instrumentation cables shall comply with VDE 0815, VDE 0207, Part 4, Part 5, Part 6, VDE 0816, VDE 0472, SEN 4241475, ANSI MC 96.1, IS-8784, IS-10810 (latest editions) and their amendments read along with this specification.	3.	Continuous operation suitability	At 205 Deg C for Type-C cables & heat resistant cables, at 70 Deg C for all other type of cables.
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S. No.	Property	Requirement
4.	Marking :- a.Progressive automatic on-line sequential marking of length in meters to be provided at every one meter on outer sheath. b.Marking to read 'FRLS' to be provided at every 5 meters on outer sheath except for Type-C cable c.Durable marking at intervals not exceeding 625 mm shall include manufacturer's name, insulation material, conductor's size, number of pairs, voltage rating, type of cable, year of manufacturer to be provided on outer sheath.	
5.	Allowable Tolerance on overall diameter	+/- 2 mm (maximum) over the declared value in data sheet
6.	Variation in diameter	Not more than 1.0 mm throughout the length of cable.
7.	Ovality at any cross-section	Not more than 1.0 mm
8.	CAGE-CLAMP suitability	To be provided
9.	Color	The outer sheath shall be of blue color.
10.	Others	Repaired cables shall not be acceptable.

2.02.00



Specific Requirements

Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable
A. CONDUCTORS				
Cross section area	0.5 sq. mm			
Conductor material	ANSI type KX	ANSI type SX	Annealed bare copper	ANSI type KX
Colour code	Yellow-Red	Black-Red	As per VDE-815	Yellow-Red
Conductor Grade	As per ANSI MC 96.1		Electrolytic	As per ANSI MC 96.1
No & dia of strands	7x0.3 mm (nom)			
No. of Pairs	2	2	2/4/8/12/16/24 / 48	2

Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable
Max. conductor loop resistance per Km (in ohm) at 20 deg. C	As per ANSI MC 96.1		73.4	As per ANSI MC 96.1
Reference Standard	As per ANSI MC 96.1		VDE : 0815	As per ANSI MC 96.1
B. INSULATION				
Material	Extruded PVC type YI 3			Teflon (i.e. extruded FEP)
Thickness in mm (Min/Max)	0.25/0.35			0.4 / 0.50 (nominal)
Volume Resistivity (Min) in ohm-cm	1 x 10 ¹⁴ at 20 deg. C & 1x10 ¹¹ at 70 deg. C.			2.8x 10 ¹⁴ at 20 deg. C & 2x10 ¹¹ at 205 deg. C.
C. PAIRING & TWISTING				
Max. lay of pairs (mm)	50			
Single layer of binder tape on each pair provided	Each core printed with number or Numbered binder tape to be provided on each pair		Yes	Each core printed with number or Numbered binder tape to be provided on each pair
Bunch (Unit Formation) for more than 4P	N.A		To be provided	N.A
Conductor /pair identification as per VDE0815	N.A.		To be provided	N.A.
D. SHIELDING				
Type of shielding	Al-Mylar tape			
Individual pair shielding	No		To be provided for F-type cable	No
Minimum thickness of Individual pair shielding	No		0.028mm (28 micron)	No

Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable
Overall cable assembly shielding	To be provided			
Minimum thickness of Overall cable assembly shielding	0.055 mm (55 micron)			
Coverage / Overlapping	100% / 20%			
Drain wire provided for individual shield	N.A.	Yes (for F-type) Size- 0.5 sqmm No of strands-7 Dia of strands- 0.3mm Annealed Tin coated copper	N.A.	
Drain wire provided for overall shield	Yes, Size- 0.5 sqmm,No of strands-7,Dia of strands- 0.3mm,Annealed Tin coated copper			
E. FILLERS (if applicable)				
Non-hygroscopic, flame retardant	To be provided			
F. OUTER SHEATH				
Material	Extruded PVC compound YM1 with FRLS properties			Teflon (i.e. extruded FRP)
Minimum Thickness at any point	1.8 mm			0.4 mm
Nominal Thickness at any point	>1.8 mm			0.5 mm
Resistant to water, fungus, termite & rodent attack	Required			
Minimum Oxygen index as per ASTMD-2863	29 %			N.A.
Minimum Temperature index as per ASTMD-2863	250 deg.C			N.A.

Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable
Maximum Acid gas generation by weight as per IEC-60754-1	20%			N.A.
Maximum Smoke Density Rating as per ASTMD-2843	60% (defined as the average area under the curve when the results of smoke density test plotted on a curve indicating light absorption vs. time as per ASTMD-2843)			N.A.
Reference standard	VDE207 Part 5,VDE-816			VDE207 Part 6 ASTM D2116
G. Electrical Parameters				
Mutual Capacitance Between Conductors At 0.8 Khz (Max.)	200 nF/km		120 nF/km for F type 100 nF/km for G-type	200 nF/km
Insulation Resistance (Min.)	100 M Ohm/Km			
Cross Talk Figure (Min.) At 0.8 Khz	60 dB		60 dB	60dB
Characteristic Impedance (Max) At 1 Khz	N.A.		320 OHM FOR F-TYPE 340 OHM FOR G-TYPE	N.A.
Attenuation Figure At 1 Khz (Max)	N.A.		1.2 db/km	N.A.
H. COMPLETE CABLE				
Complete Cable assembly	Shall pass Swedish Chimney test as per SEN-SS 4241475 class F3.			N.A.

CLAUSE NO.	<div></div> <div>TECHNICAL REQUIREMENTS</div> <div></div>				
	Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable
	Flammability	Shall pass flammability as per IEEE-383 read in conjunction to this specification			As per manufacturer's standard subject to employer's approval
	I. CABLE DRUM				
	Type	Non-returnable wooden drum (wooden drum to be constructed from seasoned wood free from defects with wood preservative applied to entire drum) or steel drum.			
	Length	1000 m \pm 5% for up to & including 12 pairs 500 m \pm 5% for above 12 pairs			
Note: Heat resistant instrumentation cable shall have same specification as of G/F type instrumentation cable as specified above, except that insulation and outer sheath material shall be Teflon and cable shall be suitable for continuous operation at 205 Deg. C					

5.00.00

INSTRUMENTATION CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY



The cable interconnection philosophy to be adopted shall be such that extensive grouping of signals by large scale use of field mounted Group Junction Boxes (JBs) at strategic locations (where large concentration of signals are available, e.g. valves limit & torque switches, switchgear) is done and consequently cable with higher number of pairs are extensively used. The details of termination to be followed are mentioned in the given Table A.



TABLE A: CABLE TERMINATION TO BE FOLLOWED



Application		Type Of Termination		Type Of Cable
FROM (A)	TO (B)	END A	END B	
Valves/dampers drives (Integral Junction box)	Marshalling / Marshalling – cum Termination Cubicle / local group JB	Plug in connector	Post mount cage clamp type.	G
Transmitters, Process Actuated switches mounted in LIE/LIR	Integral Junction box of LIE/LIR	Plug in connector	Cage clamp (Rail mount) type.	F,G
RTD heads	Local junction box	Plug in connector	Cage clamp (Rail mount) type.	F
Thermocouple	Local junction box / CJC box (if applicable)	Plug in connector	Cage clamp (Rail mount) type.	A, B, C*
Other Field mounted Instrument	Local JB / Group JB	Plug in connector	Cage clamp (Rail mount) type.	F,G
RTD	Temperature transmitter	Plug in connector	Screwed, Cage clamp type	F
Thermocouple	Temperature transmitter	Plug in connector	Screwed, Cage clamp type	A, B, C*



Application		Type Of Termination		Type Of Cable
FROM (A)	TO (B)	END A	END B	
Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/ MCC/SWGR	Group JB	Cage clamp (Rail mount) type.	Cage clamp (Rail mount) type.	F,G
Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/ Group JB / MCC/SWGR	Marshalling / Marshalling – cum Termination Cubicle	Cage clamp (Rail mount) type.	Cage clamp (Post mounted) type.	F,G
Marshalling cubicle/ Termination Cabinet	Electronic system cabinet	Cage clamp (Post mounted) type.	Plug-in connector / other system as per Mfr.'s Standard	Internal wiring
Marshalling/ Termination System Cabinets	UCD mounted equipments	Cage clamp (Post mounted) type.	Plug in connector / Cage clamp type (rail mounted).	F,G (with plug-in connector at one end)
DDCMIS/PLC cabinets	PC, Printers etc.	Plug in connector	Plug in connector	Mfr.'s Standard


- Notes
- 1 Normally 10% spare cores shall be provided when the numbers of pairs of cables are more than four pairs, except for pre-fabricated cables which shall be as per manufacturer's standard.
 - 2 For analog signals, individual pair shielding & overall shielding & for Binary signals, only overall shielding of instrumentation cables shall be provided.
 - 3 * For high temperature applications only.
 - 4 For Cable type and cable termination scheme for the instruments/ equipment that are connected to Steam Turbine and Generator (STG) control system defined at Part A, sub section IIC, clause no. 2.03.01 (a) (ii) above and hydrogen generation plant auxiliaries system, Contractor's standard and proven practice is also acceptable. However, for termination of instrumentation cable at marshalling cabinets/DCS panel end, cage-clamp termination shall be offered. For power and control cable termination, Contractor's standard and proven practice would be acceptable.


CLAUSE NO.	<div></div> <div>TECHNICAL REQUIREMENTS</div> <div></div>				
5.01.00	<p>Following general guidelines are to be followed for terminating the signal cables at DCS marshalling panel:</p> <ol style="list-style-type: none">Between a) field and DCS (for ungrouped signals) and b) field JB and DCS (for grouped signals), cables of 4 pair or its multiples shall be used.2 pair cables can be used between instrument/field devices to field JB only. However, use of 2P cable from integral JB of LIE/LIR upto group JB in field is acceptable.All the cores of a cable shall be terminated in the marshalling panel sequentially as per the color coding philosophy indicated in tender drawing no. 0000-999-POI-A-065. Number of marshalling posts required shall depend on number of pairs in the cable e.g. 8 pair cable shall be terminated on 2 consecutive marshalling posts and a 12 pair cable shall be terminated on 3 consecutive marshalling posts. Further, splitting of one bundle of a cable on posts located in separate rows should be avoided.Preferably similar sequence of termination of binary & analog signals to be followed in all marshalling panels e.g a sequence like all binary signals are terminated first and then analog signals are terminated in every marshalling panel may be followed.Signals of Redundant drives shall not be assigned in one cable.If both analog & binary signals are required to be taken through one cable, then F type cable shall be used.It should be ensured that all the cables in the marshalling cabinet are laid through suitable glands on the gland plate. Contractor to substantiate the compliance of the above through details of the number and types of cables engineered per panel during Factory Acceptance Test. <p>Above points are to be read in conjunction with tender drawing no. 0000-999-POI-A-065.</p>				
6.00.00	TERMINAL BLOCKS				
6.01.00	All terminal blocks shall be rail mounted/post mounted, cage clamp type with high quality non-flammable insulating material of melamine suitable for working temperature of 105 deg. C. The terminal blocks in field mounted junction boxes, temperature transmitters, instrument enclosures/racks, etc., shall be suitable for cage clamp connections. The terminal blocks in Control Equipment Room logic/termination/marshalling cubicles shall be suitable for post mounted cage clamp connection at the field input end. The exact type of terminal blocks to be provided by the Bidder and the technical details of the same including width etc. shall be subject to Employer's approval.				
6.02.00	All the terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, partitions, small partitions, transparent covers, support brackets, distance sleeves, warning label, marking, etc.				
6.03.00	The marking on terminal strips shall correspond to the terminal numbering on wiring diagrams. At least 20% spare unused terminals shall be provided everywhere including local junction boxes, instrument racks/enclosures, termination/marshalling cabinets, etc. All terminal blocks shall be numbered for identification and grouped according to the function. Engraved labels shall be provided on the terminal blocks.				
6.04.00	For terminating each process actuated switches, drive actuators, control valves, Thermocouple, RTD, etc. in Local Junction Boxes, etc, refer Drg no. 0000-999-POI-A-065.				
<table><tr><td>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES</td><td>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371</td><td>SUB-SECTION-IIIC-07 INSTRUMENTATION CABLES</td><td>PAGE 9 OF 14</td></tr></table>		KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-IIIC-07 INSTRUMENTATION CABLES	PAGE 9 OF 14
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CLAUSE NO.	<div><div></div><div>TECHNICAL REQUIREMENTS</div><div></div></div>		
6.05.00	The terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks and between terminal blocks and junction box walls.		
7.00.00	INTERNAL PANELS/ SYSTEM CABINETS WIRING		
7.01.00	Internal panel/cabinet wiring shall be of multi-stranded copper conductor with FRLS PVC insulation without shield and outer sheath meeting the requirements of VDE 0815.		
7.02.00	All internal wires shall be provided with tag and identification nos. etched on tightly fitted ferules at both ends. All wires directly connected to trip devices shall be distinguished by one additional red colour ferrule.		
7.03.00	All external connection shall be made with one wire per termination point. Wires shall not be tapped or spliced between terminal points.		
7.04.00	All floor slots of desk/panels/cabinets used for cable entrance shall be provided with removable gasketed gland plates and sealing material. Split type grommets shall be used for prefabricated cables.		
7.05.00	All the special tools as may be required for solder less connections shall be provided by Bidder.		
7.06.00	Wire sizes to be utilised for internal wiring. <div><div><div>(i)</div><div>Current (4-20 mA), low voltage signals (48V); Ammeter/Voltmeter circuit, control switches etc. for electrical system.</div><div>0.5 Sq.mm.</div></div><div><div>(ii)</div><div>Power supply and internal illumination.</div><div>2.5Sq.mm. minimum (shall be as per load requirement.)</div></div></div>		
8.00.00	INSTRUMENTATION CABLE INSTALLATION AND ROUTING		
8.01.00	All cables assigned to a particular duct/conduit shall be grouped and pulled in simultaneously using cable grips and suitable lubricants. Cables removed from one duct/conduit shall not be reused without approval of Employer.		
8.02.00	Cables shall be segregated as per IEEE Std.-422. In vertically stacked trays, the higher voltage cable shall be in higher position and instrumentation cable shall be in bottom tier of the tray stack. The distance between instrumentation cables and those of other system shall be as follows: <div><div><div>From 11 kV/6.6 kV/3.3 kV tray system</div><div>-</div><div>914 mm</div></div><div><div>From 415V tray system</div><div>-</div><div>610 mm</div></div><div><div>From control cable tray system</div><div>-</div><div>305 mm</div></div></div>		
8.03.00	Cables shall terminate in the enclosure through cable glands. All cable glands shall be properly gasketed. Sealing (to prevent ingress of dust entry and propagation of fire) shall be provided for all floor slots used for cable entrance. Compression cable glands (double for armoured and single for other cables) shall be provided.		
8.04.00	Not in use		
<div><div><div>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES</div><div>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371</div><div>SUB-SECTION-IIIIC-07 INSTRUMENTATION CABLES</div><div>PAGE 10 OF 14</div></div></div>			

CLAUSE NO.	<div><div></div><div>TECHNICAL REQUIREMENTS</div><div></div></div>			
8.05.00	The cables emanating from redundant equipment/devices shall be routed through different paths. The above segregation of cables & wiring for redundant equipments/devices shall be in accordance with IEEE-Std-422.			
9.00.00	CABLE LAYING AND ACCESSORIES			
9.01.00	CABLE LAYING			
	<div><div>1</div><div>Cables shall be laid strictly in line with cable schedule.</div></div> <div><div>2</div><div>Identification tags for cables.</div><div>Indelible tags to be provided at all terminations, on both sides of wall or floor crossing, on each conduit/duct/pipe entry/exit, and at every 20 m in cable trench/tray.</div></div> <div><div>3</div><div>Cable tray numbering and marking.</div><div>To be provided at every 10m and at each end of cable way & branch connection.</div></div> <div><div>4</div><div>No jointing is permissible for Instrumentation cables. For other cables Jointing for more than 250 Meters run of cable shall be permitted.</div></div> <div><div>5</div><div>Buried cable protection</div><div>With concrete slabs; Route markers at every 20 Meters along the route & at every bend.</div></div> <div><div>6</div><div>Road Crossings</div><div>Cables to pass through buried high density PE pipes encased in PCC. At least 300 mm clearance shall be provided between</div><div><div>-</div><div>HT power & LT power cables,</div></div><div><div>-</div><div>LT power & LT control/instrumentation cables,</div></div><div>Spacing between cables of same voltage grade shall be in accordance with the derating criteria adopted for cable sizing.</div></div> <div><div>7</div><div>Segregation (physical isolation to prevent fire jumping)</div><div><div>a</div><div>All cable associated with the unit shall be segregated from cables of other Units.</div></div><div><div>b</div><div>Interplant cables of station auxiliaries and unit critical drives shall be segregated in such a way that not more than half of the drives are lost in case of single incident of fire.</div></div></div> <div><div>8</div><div>Cable clamping</div><div>All cables laid on trays shall be neatly dressed up & suitably clamped/tied to the tray. For cables in trefoil formation, trefoil clamps shall be provided.</div></div>			
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-IIIIC-07 INSTRUMENTATION CABLES	PAGE 11 OF 14



CLAUSE NO.	<div><div></div><div>TECHNICAL REQUIREMENTS</div><div></div></div>		
	<div>9</div> <div>Optical fiber cables (OFCs) :</div> <div>Outside Building Area - to be laid necessarily inside covered cable tray of 100 mm with support from Trestle structure.</div> <div>Inside Building Area – to be laid on separate cable sub-trays</div> <div>While buried- in separate buried trench approx.1.0 meter depth, to be laid in 2” rodent proof HDPE conduits covered with sand, brick, laid breadth-wise and soil along the pipe line route by contractor;</div> <div>While crossing roads - to be laid in rodent proof HDPE conduits with sand filling at bottom and sand, soil filling at top with cement concrete;</div> <div>While crossing canals/river- to be laid in rodent proof HDPE conduits within hume pipe.</div>		
	<div>10</div> <div>Laying of Network Cable (UTP/STP) :</div> <div>Out side Building Area- to be laid necessarily inside covered cable tray of 100 mm with support from Trestle structure.</div> <div>Inside Building Area- to be laid necessarily inside separate covered cable sub-trays.</div>		
9.02.00	Bidder shall supply and install all cable accessories and fittings like Light Interface Units, Surge suppressors, Opto isolators, Interface Converters, Fibre Optic Card Cage, Fibre Optic Line Driver, Repeater / Modem (for Optical Fibre Cables), cable glands, grommets, lugs, termination kits etc. on as required basis.		
9.03.00	Cables, which terminate in cabinets of draw out sections shall have sufficient cable coiled in the bottom of the cabinet to permit full withdrawal of draw out sections without disconnecting the cables. When prefabricated cables with factory connectors on both ends are longer than required, the excess cable shall be coiled in the bottom of one or both termination cabinets.		
9.04.00	The Bidder shall be responsible for proper grounding of all equipment under this package. Further, proper termination of cable shields shall be verified and the grounding of the same shall be coordinated so as to achieve grounding of all instrumentation cable shields at same potential. This shall be completed prior to system tests.		
9.05.00	The Contractor shall take full care while laying / installing cables as recommended by cable manufacturers regarding pulling tensions and cable bends. Cables damaged in any way during installation shall be replaced at the expense of the Contractor.		
10.00.00	FIELD MOUNTED LOCAL JUNCTION BOXES		
	<div><div>(i)</div><div>No. of ways</div><div>12/24/36/48/64/72/96/128 with 20% spares terminals.</div></div>		
	<div><div>(ii)</div><div>Material and Thickness</div><div>4mm thick Fiberglass Reinforced Polyester (FRP).</div></div>		
	<div><div>(iii)</div><div>Type</div><div>Screwed at all four corners for door. Door gasket shall be of synthetic rubber.</div></div>		
<div><div><div>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES</div><div>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371</div><div>SUB-SECTION-IIIC-07 INSTRUMENTATION CABLES</div><div>PAGE 12 OF 14</div></div></div>			

CLAUSE NO.	<div>एनटीपीसी NTPC</div> <div>TECHNICAL REQUIREMENTS</div> <div></div>			
	<div><div><div>(iv)</div><div>Mounting clamps and accessories</div><div>Suitable for mounting on walls, columns, structures etc. The brackets, bolts, nuts, screws, glands required for erection shall be of SS, included in Bidders scope of supply.</div></div><div><div>(v)</div><div>Type of terminal blocks</div><div>Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm². A M6 earthing stud shall be provided.</div></div><div><div>(vi)</div><div>Protection Class</div><div>IP: 55 minimum for indoor & IP-65 minimum for outdoor applications.</div></div><div><div>(vii)</div><div>Grounding</div><div>To be provided.</div></div><div><div>(viii)</div><div>Color</div><div>RAL 7035</div></div></div> <div>Note : For solenoid valve box, the material for the enclosure shall be of steel plate (SS304) with minimum 2 mm thick frame and minimum 2 mm thick steel (SS-304) sheet. Provision of individual isolation for each solenoid shall be provided inside the box. Minimum 100 mm space between the solenoids shall be ensured for ease of access and maintenance. All other specifications shall be as per above.</div>			
11.00.00	CONDUITS			
11.01.00	<p>Conduits shall be generally used for interconnecting cables from field instruments to Local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanised rigid mild steel in accordance with IS: 9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate. Flexible conduit shall be heat resistant terne coated steel with , water leak, fire and rust proof protected for the areas of Mills,Drum, Main Steam, RH steam Air Heaters and Furnace, BFPDT's .</p> <p>And for remaining applications, water leak, fire and rust proof flexible GI conduits shall be provided. The temperature rating of flexible conduit shall be suitable for actual application.</p>			
11.02.00	<p>All rigid conduit fittings shall conform to the requirements of IS: 2667, 1976. Galvanized steel fitting shall be used with steel conduit. All flexible conduit fittings shall be liquid tight, galvanized steel. The end fittings shall be compatible with the flexible conduit supplied.</p>			
11.03.00	<p>Conduit sealing, explosion proof, dust proof and other types of special fittings shall be provided as required by these specifications and shall be consistent with the area and equipment with which they are installed. Fittings installed outdoors and in damp locations shall be sealed and gasketed. Hazardous area fittings and conduits sealing shall conform with NEC requirements for the area classification.</p>			
11.04.00	<p>Contractor shall provide double locknuts on all conduit terminations not provided with threaded hubs and couplings. Water tight conduit unions and rain tight conduit hubs shall be utilised for all the application which shall be exposed to weather. Moisture pockets shall be eliminated from conduits.</p>			
11.05.00	<p>Conduits shall be securely fastened to all boxes and cabinets.</p>			
12.00.00	CABLE SUB-TRAY & SUPPORT			
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CLAUSE NO.	<div><div><div>एनटीपीसी</div><div>NTPC</div></div></div> <div>TECHNICAL REQUIREMENTS</div> <div></div>		
12.01.00	The cable sub-trays and the supporting system, to be generally used between Local/Group JBs and the main cable trays and the same shall be furnished and installed by the Contractor. It is the assembly of sections and associated fittings forming a rigid structural system used to support the cable from the equipment or instrument enclosure upto the main cable trays (trunk route).		
12.02.00	The covers on the cable sub-trays shall be used for protection of cables in areas where damage may occur from falling objects, welding spark, corrosive environment, etc. & shall be electrically continuous and solidly grounded.		
<div><div><div>KHURJA SUPER THERMAL POWER PROJECT</div><div>(2X660 MW)</div><div>TURBINE GENERATOR AND ASSOCIATED PACKAGES</div></div><div><div>TECHNICAL SPECIFICATION</div><div>SECTION – VI, PART-B</div><div>BID DOC. NO.: THDC/RKSH/CC-9915-371</div></div><div><div>SUB-SECTION-IIIC-07</div><div>INSTRUMENTATION CABLES</div></div><div><div>PAGE</div><div>14 OF 14</div></div></div>			

	2X660 MW KHURJA STPP-TG PKG	
	TECHNICAL SPECIFICATION (C&I) FOR CONDENSER ON LOAD TUBE CLEANING SYSTEM	
<div>INSTRUMENT INSTALLATION DRAWING</div>		

CLAUSE NO.	<div>एनटीपीसी NTPC</div> <div>TECHNICAL REQUIREMENTS</div> <div></div>										
	<div>PROCESS CONNECTION AND PIPING</div>										
1.00.00	<div>PROCESS CONNECTION PIPING</div>										
1.01.00	<div>The Contractor shall provide, install and test all required material for completeness of Impulse Piping System and Air Piping System as per the requirements of this Sub-Section on as required basis for the connection of all instruments and control equipments of entire plant.</div>										
1.01.01	<div>IMPULSE PIPING, TUBING, FITTINGS, VALVES AND VALVE MANIFOLDS</div>										
1.01.02	<div>All impulse pipes shall be of seamless type conforming to ANSI B36.10 for schedule numbers. The material of the impulse pipe shall be same as that of main process pipe or equivalent. The size of impulse pipe shall be ½” for Steam & Water Application and ¾” for Air & Flue Gas applications. The rating of material of impulse pipes, tubes, fittings, valves and their installation thereof shall conform to the latest edition of standards as per following table:</div> <table><tr><td>Impulse Pipes, Tubes (Material, Rating)</td><td>ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70</td></tr><tr><td>Valves (Material, Pr. Class, Size)</td><td>ASTM A182/ASTM A105 as per ASME 16.34</td></tr><tr><td>Fittings (Size, Rating, Material)</td><td>ANSI B31.1, ANSI B31.1a, ASME B16.11-2009</td></tr><tr><td>Installation Schemes</td><td>BS 6739-2009, ANSI/ISA 77.70</td></tr></table> <div>Stainless steel tube shall be provided inside enclosures & racks from tee connection to valve manifold and then to instrument. The source shut-off (primary process root valve) and blow down valve shall be of 1/2 inch size globe valve type for all applications except for air and flue gas service wherein no source shut-off valves are to be provided. Two root valves are to be used wherever pressure is more than 40 Kg/cm² or Temp>280 °C. The end connections of valves shall be of socket welded type. Typical installation scheme of DP Transmitter (inside LIE/LIR) mounted below instrument source point is indicated in Drg. No. 0000-999-POI-A-036. Same scheme with necessary changes shall be applied for other instruments.</div>			Impulse Pipes, Tubes (Material, Rating)	ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70	Valves (Material, Pr. Class, Size)	ASTM A182/ASTM A105 as per ASME 16.34	Fittings (Size, Rating, Material)	ANSI B31.1, ANSI B31.1a, ASME B16.11-2009	Installation Schemes	BS 6739-2009, ANSI/ISA 77.70
Impulse Pipes, Tubes (Material, Rating)	ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70										
Valves (Material, Pr. Class, Size)	ASTM A182/ASTM A105 as per ASME 16.34										
Fittings (Size, Rating, Material)	ANSI B31.1, ANSI B31.1a, ASME B16.11-2009										
Installation Schemes	BS 6739-2009, ANSI/ISA 77.70										
1.01.03	<div>The valve manifolds of 316 SS with pressure rating suitable for intended application shall be provided as given below:</div> <table><tr><th>Manifold</th><th>Application/M Measurement</th></tr><tr><td>2 Valve</td><td>Pressure measurements using pressure transmitters/pressure switches</td></tr><tr><td>3 Valve</td><td>Pressure measurements using differential pressure transmitter/ switches</td></tr><tr><td>5 Valve</td><td>Differential Pressure, Flow and Level Measurements</td></tr></table> <div>For Pr./D.P gauges, two-way globe/gate valve shall be provided on each impulse line to the instrument in Fluid/Air & Flue Gas applications respectively .</div>			Manifold	Application/M Measurement	2 Valve	Pressure measurements using pressure transmitters/pressure switches	3 Valve	Pressure measurements using differential pressure transmitter/ switches	5 Valve	Differential Pressure, Flow and Level Measurements
Manifold	Application/M Measurement										
2 Valve	Pressure measurements using pressure transmitters/pressure switches										
3 Valve	Pressure measurements using differential pressure transmitter/ switches										
5 Valve	Differential Pressure, Flow and Level Measurements										
2.00.00	<div>AIR SUPPLY PIPING</div>										
2.01.01	<div>All pneumatic piping, fittings, valves, air filter cum regulator, purge rotameter and other accessories required for instrument air for the various pneumatic devices/ instruments shall be provided. This will include as a minimum air supply to pneumatically operated control valves, actuators, instruments, continuous and intermittent purging requirements etc.</div>										
2.02.00	<div>Instrument air and Service air supply shall be provided for continuous and intermittent purging respectively for all transmitters of mill, dirty air and flue gas applications. Purging Scheme shall be as per Drg. No. 0000-999-POI-A-036.</div>										
2.03.00	<div>The Contractor shall also provide SS Tubing and associated fittings (screwed type) of suitable sizes for all pneumatic equipments/actuators (including supply air, signal air and output to actuators) conforming to ANSI 31.1 and 31.3 standard. All other air supply lines</div>										
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-III-C-06 PROCESS CONNECTION AND PIPING <div>PAGE 1 OF 4</div>								

CLAUSE NO.	 TECHNICAL REQUIREMENTS 
	<p>shall be of mild steel hot dipped galvanized inside and outside as per IS-1239, heavy duty with threaded ends. Fittings for air supply line shall be of forged carbon steel A234 Gr. WPB galvanized inside and outside, screwed as per ASA B2.1. Dimensions of fittings shall be as per ASA B16.11 of rating 3000 lbs. Air supply piping shall be adequately sloped to prevent accumulation of condensed water within the pipe. The air supply headers, sub-headers and branch pipes shall be supported properly by clamps or supports.</p>
2.04.00	<p>The instrument/service air supply to each equipment/devices requiring air supply shall be provided by a well designed air distribution scheme comprising of 2" GI Pipe Header feeding 1" GI Pipe sub-header feeding ½" pipe at each equipment/device. Instrument air filters cum regulator set with mounting accessories shall be provided for each pneumatic device requiring air supply except for Ash Handling System wherein it shall be provided on instrument air header at each location.</p>
2.05.00	<p>All the isolation valves in the air supply line shall be gate valves as per ASTM B62 inside screw rising stem, screwed female ends as per ASA B2.1. Valve bonnet shall be union type & trim material shall be stainless steel, body rating 150 pounds ASA. The valve sizes shall be ½ inch to 2 inch.</p>
2.06.00	<p>Instrument air filters cum regulator set with mounting accessories shall be provided for pneumatic device requiring air supply. The filter regulators shall be suitable for 10-kg/ sq.cm max. Inlet pressure. The filter shall be of size 5 microns and of material sintered bronze. The air set shall have 2-inch size pressure gauge and built in filter housing blowdown valve. The end connection shall be as per the requirement to be finalized during detailed engineering.</p>
3.00.00	<p>INSTALLATION AND ROUTING</p>
3.01.01	<p>All instrument piping, tubing and its accessories shall be supported in a safe manner to prevent excessive vibrations and anchored sufficiently to prevent undue strain on connected equipment. Impulse piping shall be supported at an interval not exceeding 1.5 meters. The slope of the impulse pipe from the process connection to the instrument shall be as per ANSI/ISA 77.70 latest edition and BS 6739-2009. All impulse piping shall be installed to permit free movement due to thermal expansion. Wherever required expansion loops shall be provided.</p> <p>Condensate pots shall be provided for all level measurements in steam and water services, all flow measurement in steam services and for flow measurements in water services above 120 Deg. C. Colour coding of all impulse pipes shall be done by the Contractor in line with the colour coding being followed for the parent pipes.</p>
4.00.00	<p>SHOP AND SITE TESTS</p>
4.01.01	<p>The equipment and work performed as per this Sub-section shall be subject to shop and site test as per requirements of Sub-section-IIIE-04 (Quality Assurance & Inspection) other applicable clauses of this Sub-section and Employer approved quality assurance plan.</p>
4.01.02	<p>Hydrostatic and Pneumatic leakage tests shall be performed on all pipes, tubing and systems and shall conform to ANSI B31.1.</p>

KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-IIIC-06 PROCESS CONNECTION AND PIPING	PAGE 2 OF 4
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CLAUSE NO.	 TECHNICAL REQUIREMENTS 
5.01.00	<p>The GA of LIR shall be similar to LIE except for front/rear doors and side panels.</p> <p>The internal layout shall be such that the impulse piping/ blow down lines are accessible from back side of the enclosure / rack and the transmitters etc. are accessible from front side for easy maintenance. Bulkheads, especially designed to provide isolation from process line vibration shall be installed on instrument enclosures/racks to meet the process sensing line connection requirement. Vibration dampeners shall be installed for each enclosure / rack. The Degree of Protection of LIE and JB of LIE/LIR shall be IP-55.</p> <p>The instrument racks shall be constructed from 1.6 mm sheet plate and shall be free standing type constructed of suitable 3 mm thick channel frame of steel and shall be provided with a canopy to protect the equipment mounted in racks from falling objects, water etc. The canopy shall not be less than 3 mm thick steel, and extended beyond the ends of the rack.</p> <p>Enclosures/Racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein. Centre posts or any member which would reduce access shall not be provided.</p> <p>Contractor shall provide not more than three variants for LIE/LIR with respect to max. no. transmitters mounted in each LIE/LIR.</p> <p>ENCLOSURE / RACKS FOR DUAL/SINGLE I/P TEMPERATURE TRANSMITTERS</p> <p>All Dual/Single Input temperature transmitters in Boiler Turbine Generator measurements shall be suitably grouped together and mounted inside (i) Enclosures in case of open areas of the plant like boiler area, etc. and (ii) Racks in case of covered areas like Turbine/Generator area. Integral JB shall be provided with each Enclosure and Rack.</p> <p>The internal layout shall be such that the transmitters are accessible from both front and back side of the enclosure / rack for easy maintenance.</p> <p>Enclosure/ Racks shall be of robust and rugged design. Vibration dampeners shall be installed for each enclosure / rack. The Degree of Protection of Enclosure and JB shall be IP-55.</p> <p>Enclosure and Racks shall be free standing type.</p> <p>Enclosures/Racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein.</p> <p>Contractor shall provide not more than five variants for Enclosure/ Rack with respect to max. no. transmitters mounted in each Enclosure/ Rack. However, the maximum number of Transmitters that can be grouped in one Enclosure/ Rack shall be decided during detail Engineering.</p>

KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-III-C-06 PROCESS CONNECTION AND PIPING	PAGE 3 OF 4
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1. THE MATERIAL SPECIFICATION AND SCHEDULE NO. OF IMPULSE PIPE & NIPPLE AS LISTED HEREIN SHALL BE AS PER TECHNICAL SPECIFICATIONS.
2. THE MATERIAL SPECIFICATION AND RATING OF FITTINGS AS LISTED SHALL BE AS PER SPECIFICATIONS. WELDED/THEADED FITTINGS SHALL CONFORM TO ANSI-B.16-11.
3. INSTRUMENTS VALVES BODY STEM MATERIAL AND PRESSURE CLASS SHALL BE AS PER TECHNICAL SPECIFICATIONS.
4. FOR BOILER AIR/FLUE GAS SERVICES SOURCE CONNECTIONS IMPULSE PIPING AND ALL FITTINGS SHALL BE OF 3/4" NB SIZE.
5. GAUGES SHALL NOT BE MOUNTED ON THE PIPE. IT WILL BE MOUNTED ON A CHANNEL OR FRAME OR A RACK..
6. * SLOPE APPROX. 50 MM / METRE.

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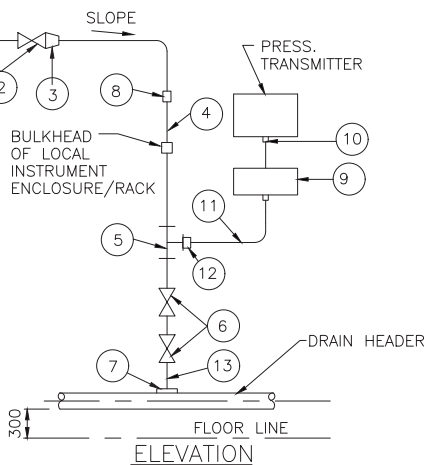
TYPICAL THERMAL POWER PROJECT

INSTRUMENT INSTALLATION DIAGRAM (FOR PRESSURE GAUGE)

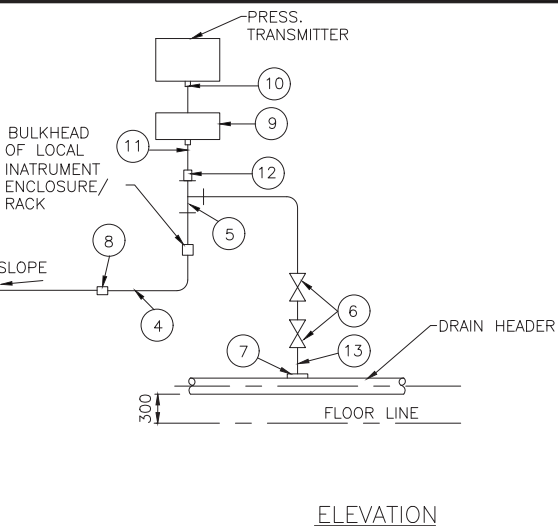
0000-110-POI-A-022

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A	FIRST ISSUE										26.04.06
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
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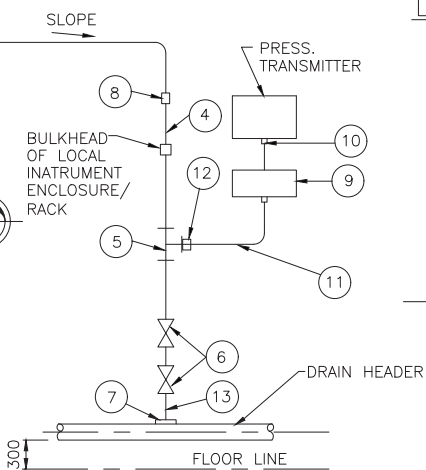


TRANSMITTER MOUNTED BELOW INSTRUMENT SOURCE POINT

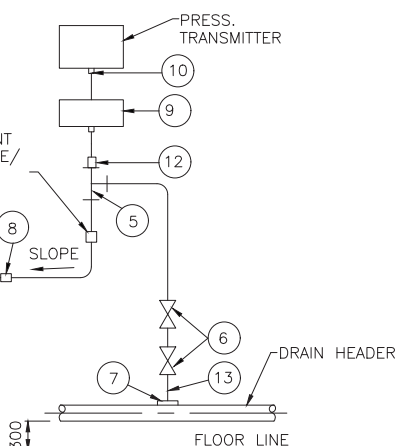


TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

LIQUID PRESSURE MEASUREMENT

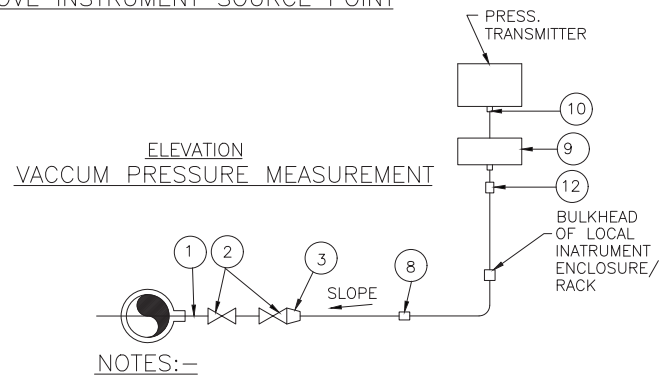


ELEVATION
TRANSMITTER MOUNTED BELOW
INSTRUMENT SOURCE POINT



ELEVATION
TRANSMITTER MOUNTED ABOVE
INSTRUMENT SOURCE POINT

STEAM PRESSURE MEASUREMENT



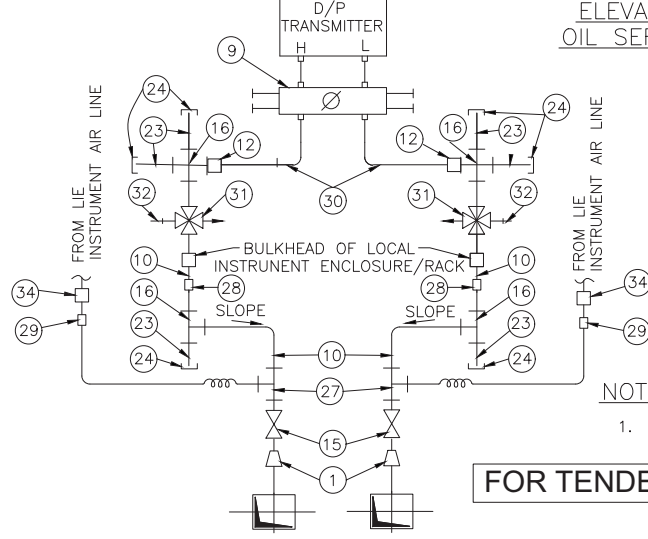
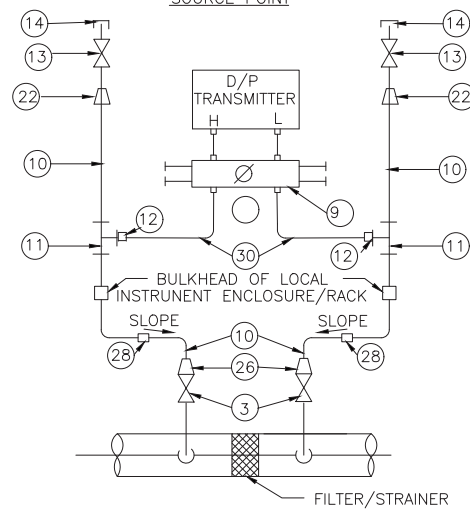
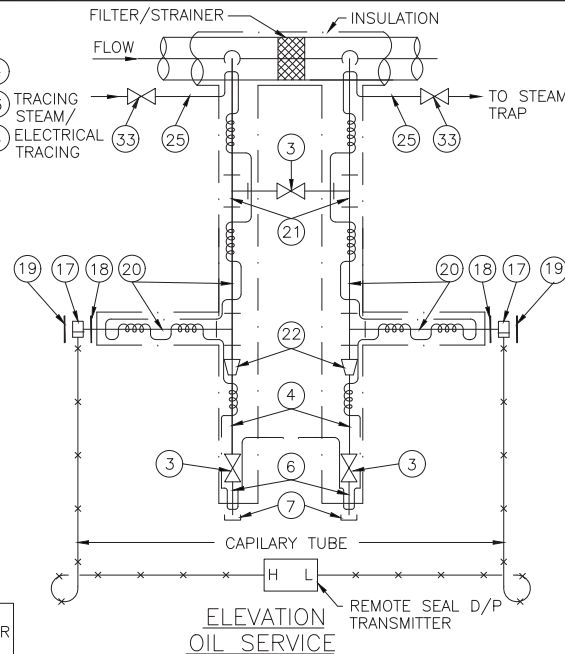
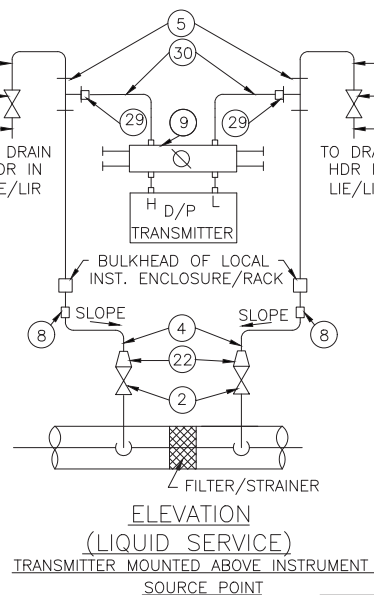
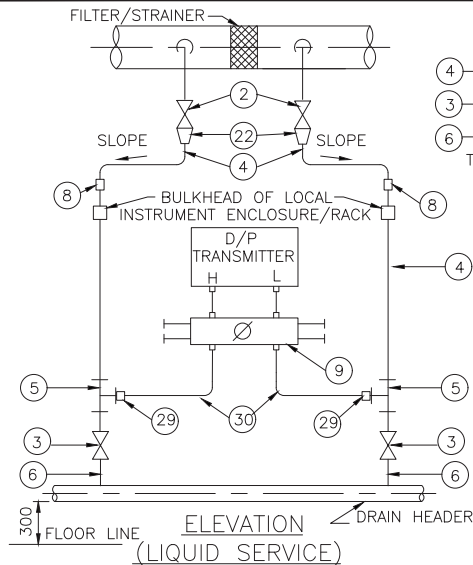
NOTES:—

1. SAME NOTES UNDER DRG. NO. 0000-999-POI-A-023.
2. FOR VACUUM APPLICATION OTHER PORT OF TRANSMITTER SHALL BE KEPT OPEN TO ATMOSPHERE.

FOR TENDER PURPOSE ONLY

ITEM NO.	DESCRIPTION
1.	1/2"/ 3/4"/1"NPS SCH. 80/160/XXS/P91 NIPPLE OF MATERIAL SAME AS THAT OF MAIN PIPE.
2.	3/4"/1" SW GLOBE VALVE.
3.	3/4"/1" TO 1/2" REDUCING INSERT
4.	1/2" NPS PIPE
5.	1/2" SW EQUAL TEE
6.	1/2"SW GLOBE VALVE
7.	1/2"NPS SCH. 80/160 SWx1/2"CS/AS COUPLER
8.	1/2" PIPE UNION
9.	2/3 VALVE MANIFOLD (FOR DETAIL SEE DRAWING NO.0000-102-POI-A-023.
10.	SUITABLE ADAPTER
11.	SS TUBE
12.	1/2" PIPE x 1/2" TUBE UNION
13.	1/2"NPS SCH. 80/160 SWx1/2" NPT(M) CS/AS NIPPLE

												<div><div><div>NTPC</div></div><div>(A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION</div></div>			
												PROJECT <div>TYPICAL THERMAL POWER PROJECT (TG PACKAGE)</div>			
												TITLE <div>INSTRUMENT INSTALLATION DIAGRAM (PRESSURE MEASUREMENT USING PRESS /DP TRANSMITTERS STEAM/LIQUID VACUUM)</div>			
A	FIRST ISSUE										26.04.06				
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE	SIZE	SCALE	DRG. NO.	REV. NO.
					CLEARED BY				A3			N.T.S.	0000-110-POI-A-025		A



NOTES:-

1. SAME NOTES AS UNDER DRG. NO. 0000-999-POI-A-023.

FOR TENDER PURPOSE ONLY

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	42x2 TO 3/4" SW REDUCING INSERT.
2.	3/4" SW GLOBE VALVE.
3.	1/2" SW GLOBE VALVE FOR LIQUID APPLICATION & 3/4"/1" IN GAS/AIR APPLICATION
4.	1/2" NPS 40/80/160 (AS PER PROCESS REQUIREMENT) CARBON/ALLOY STEEL PIPE.
5.	1/2" SW EQUAL TEE.
6.	1/2" NPS SW x 1/2" NPT (M) NIPPLE.
7.	1/2" NPT (F) CAP.
8.	1/2" PIPE x 1/2" PIPE UNION.
9.	5 VALVE MANIFOLD (FOR DETAIL REFER DRAWING NO.0000-999-POI-A-026.
10.	3/4" SCH 80 CARBON/ALLOY STEEL PIPE.
11.	3/4"/1/2" SW EQUAL TEE.
12.	3/4"x1/2" TUBE UNION.
13.	1/2" SCREWED GLOBE VALVE.
14.	1/2" NPT (M) PLUG.
15.	3/4" SW GATE VALVE.
16.	3/4" SW EQUAL CROSS.
17.	WAFER ELEMENT FOR USE WITH 3"ANSI R.F. VALVE.
18.	3"BLIND 300lbs R.F. WELD NECK FLANGE DRILLED FOR 1" SCH. 40/80 PIPE.
19.	3" BLIND FLANGE.
20.	1"NPS SCH. 40/80 (AS PER PROCESS REQUIREMENT) CS PIPE.
21.	1" SW EQUAL TEE.
22.	3/4" x 1/2"SW REDUCING INSERT.
23.	3/4" SW x 3/4" NPT (M) CS/AS NIPPLE
24.	3/4" NPT (F) CS/AS CAP.
25.	1/4" NPS ALLOY STEEL PIPE.
26.	1" x 3/4" SW REDUCING INSERT.
27.	3/4" SW x 1/2" PSW BRANCH TEE.
28.	3/4" PIPE UNION
29.	1/2" CLAMP UNION (THREADED) SUITABLE FOR FLEXIBLE CONNECTION OF NYLON REINFORCED PVC TUBE.
30.	SS TUBE
31.	3/4" SW 4 WAY VALVE.
32.	QUICK DISCONNECT FITTINGS.
33.	1/4" SW ISOLATION VALVE 316SS
34.	1/2" x 1/2" SS PIPE UNION.

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ENGINEERING DIVISION

PROJECT

TYPICAL THERMAL POWER PROJECT
(TG PACKAGE)

TITLE

INSTRUMENT INSTALLATION DIAGRAM
DIFF. PRESS.MEASUREMENT (LIQUID, OIL, AIR/GAS SERVICE)

SIZE
A3

SCALE
N.T.S.

DRG. NO.

REV. NO.
A

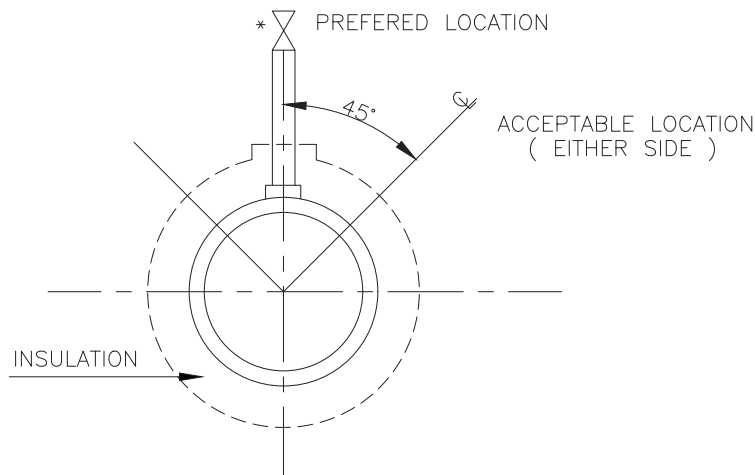
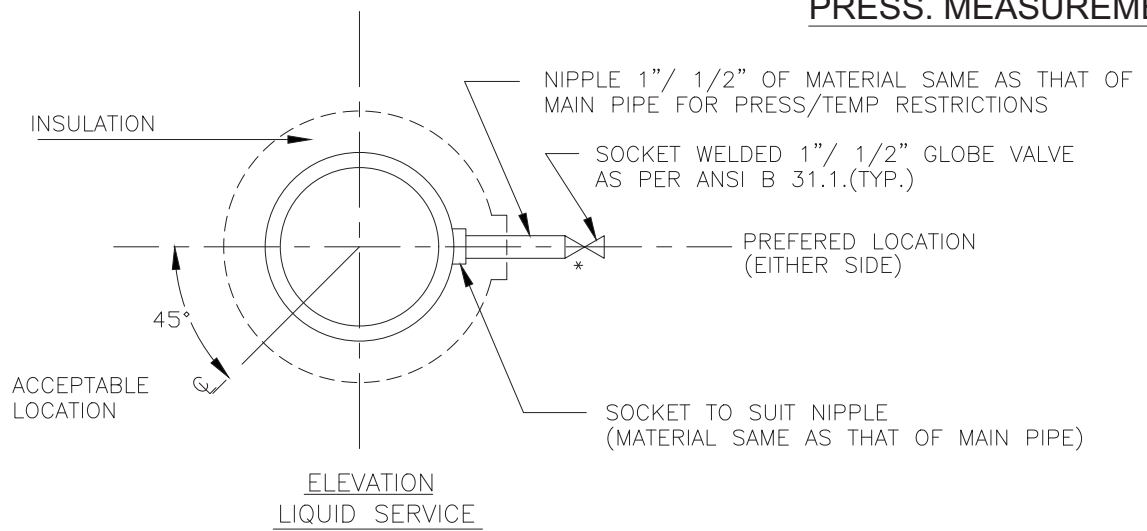
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A	FIRST ISSUE										26.04.06
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE

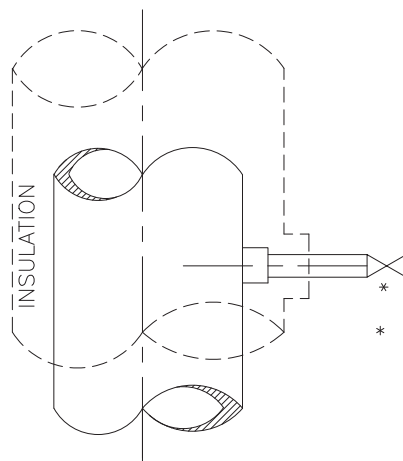
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	2X660 MW KHURJA STPP-TG PKG	
	TECHNICAL SPECIFICATION (C&I) FOR CONDENSER ON LOAD TUBE CLEANING SYSTEM	
<div>INSTRUMENT STUB DETAILS</div>		

PRESS. MEASUREMENT



PRESSURE CONNECTION ON HORIZONTAL PIPE



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PRESSURE CONNECTIONS ON VERTICAL PIPES

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ENGINEERING DIVISION

PROJECT **TYPICAL THERMAL POWER PROJECT (TG PACKAGE)**

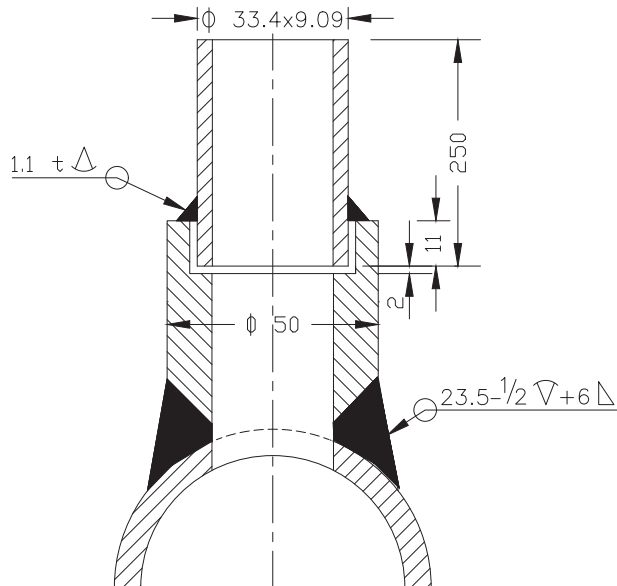
TITLE **INSTRUMENT SOURCE CONNECTION DETAILS**

A	FIRST ISSUE										26.04.06
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE

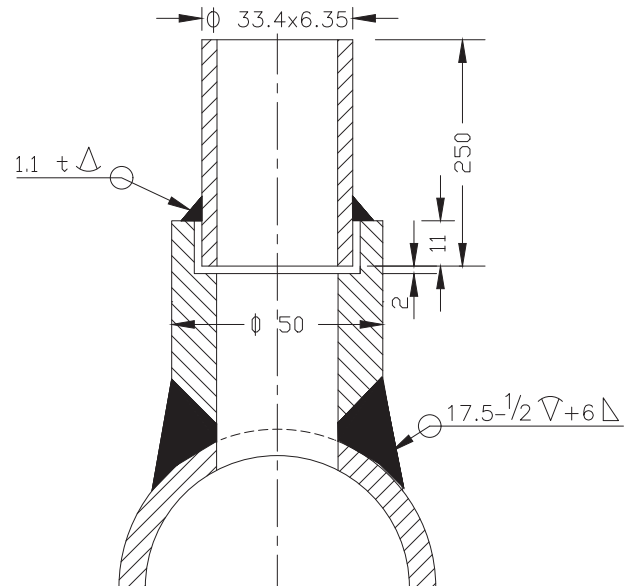
SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-110-POI-A-035	A

PRESSURE MEASUREMENT

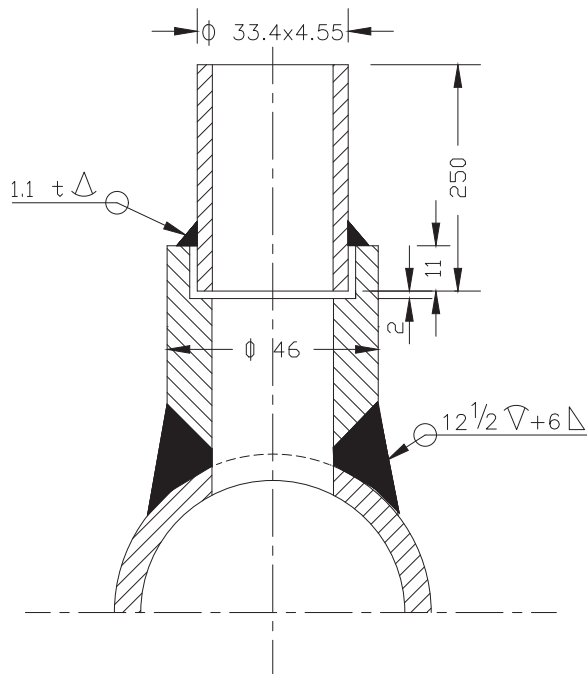
(SYSTEM PR.>40Kg/Sq Cm CL 9000)



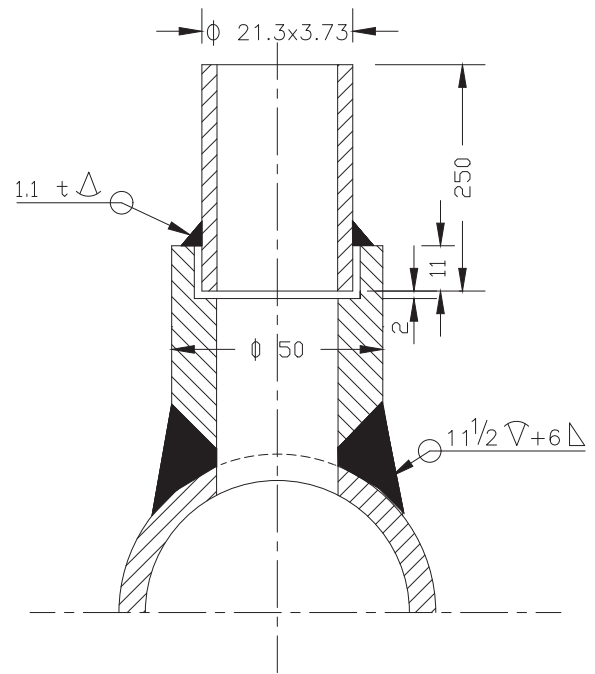
(SYSTEM PR.>40Kg/Sq Cm CL 6000)



(SYSTEM PR. <40Kg/Sq cm Nb 25 CL 3000)



(SYSTEM PR. <40Kg/Sq cm Nb 15 CL 3000)



NOTES:—

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFIRM TO ANSI B 16.11.
2. THE LENGTH OF THE NIPPLE SHOULD BE 250mm.
3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1" GLOBE VALVE OF MATERIAL AS PER ANSI B 16.1.
4. TWO ISOLATED VALVES ARE TO BE USED FOR PRESSURE = $>40 \text{ Kg/Cm}^2$.
5. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY ($1/64"$ RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES.
6. ORIENTATION OF TAP WILL BE VARY WITH TYPE OF PROCESS FLUID AND NATURE OF RUN OF THE PIPE.
7. ACTIVITIES TO BE COMPLETED AT THE SHOP, WELD THE COUPLING (OR BOSS) ON THE PIPE AND DRILL PRESSURE CONNECTION HOLE (SAME AS I D OF NIPPLE) IN THE PIPE IN ALLIGNMENT WITH HOLE IN THE COUPLING.
8. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED.

FOR TENDER PURPOSE ONLY

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ENGINEERING DIVISION

PROJECT

TYPICAL THERMAL POWER PROJECT (TG PACKAGE)

TITLE

INSTRUMENT SOURCE CONNECTION DETAILS

A	FIRST ISSUE										26.04.06
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD.	DATE
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SIZE

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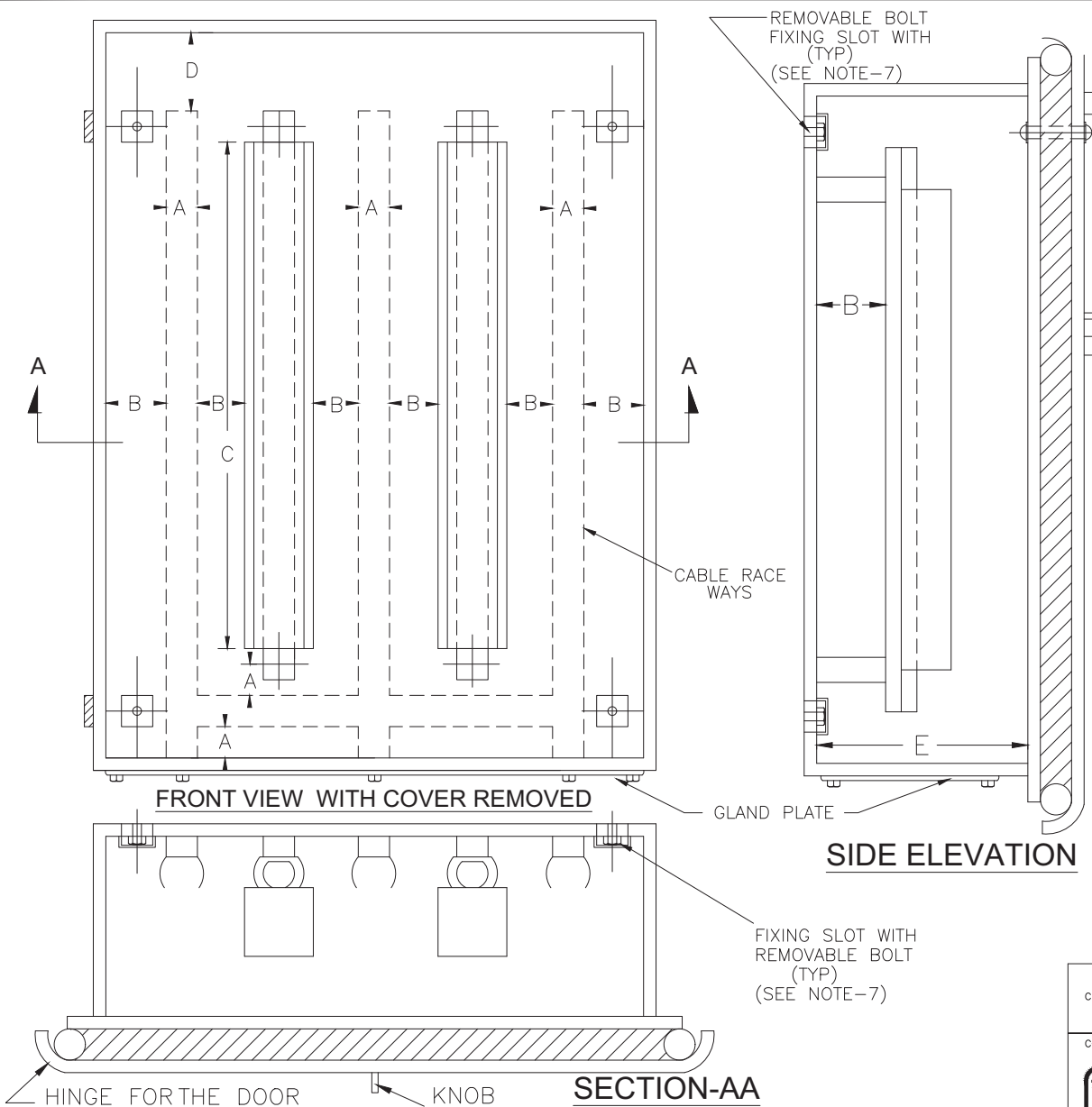
DRG. NO.

0000-110-FOI-A-033

REV. NO.

A

Sh-2 Of 14




- A - 25 mm
B - 75 mm
C - SEE NOTE-4
D - 100 mm
E - 150 mm

NOTES:-

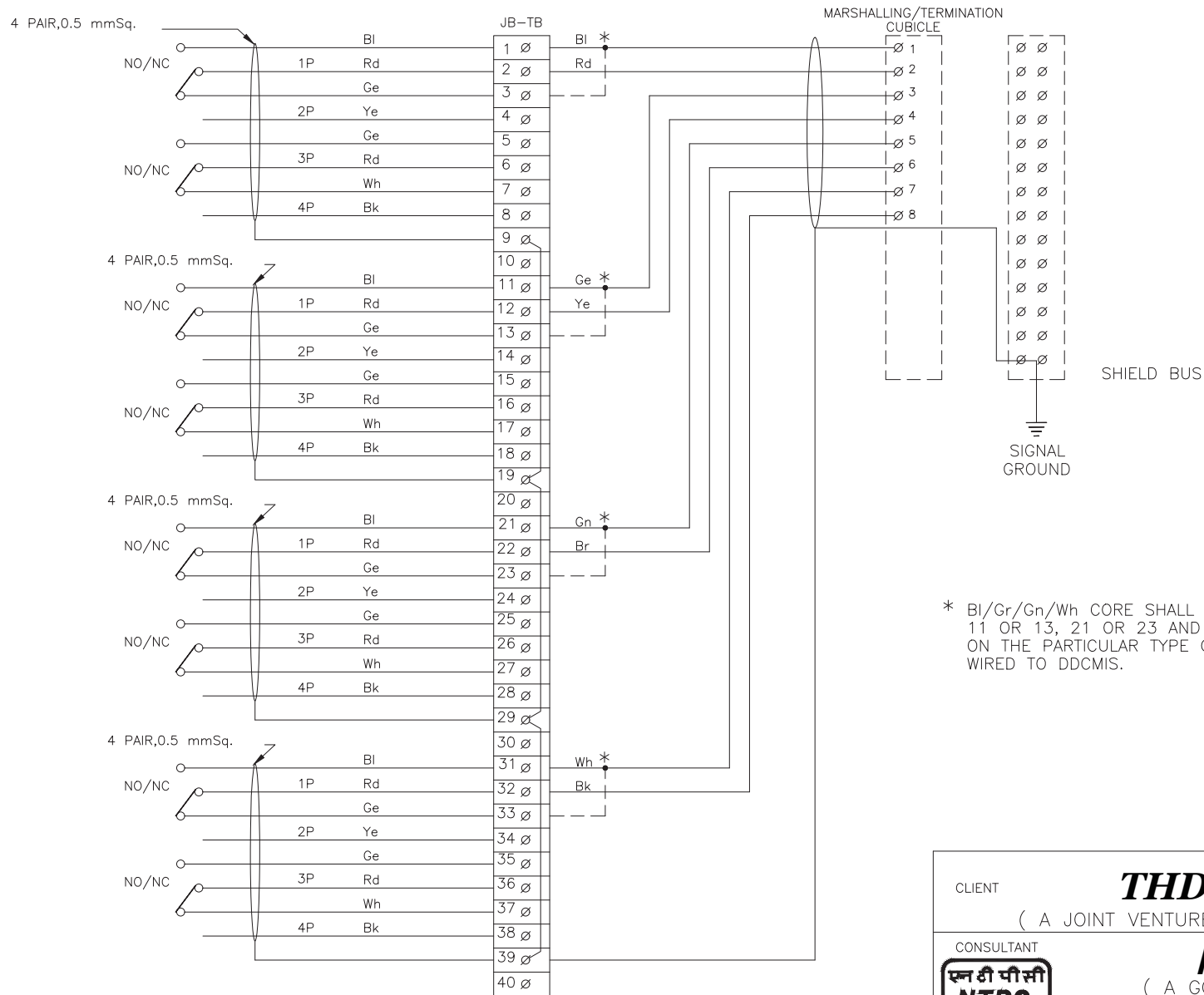
- JUNCTION BOXES SHALL HAVE GLAND PLATES AT THE BOTTOM OF THE BOX ONLY.
- TUBULAR TYPE GASKETS WILL BE USED.
- FRP JUNCTION BOXES, SHALL BE PROVIDED WITH POLYEUTHERENE COATING. ALSO REFER SUB SECTION INST CABLE, PART-B SECTION-VI FOR DETAILS.
- DIMENSION OF 'C' SHALL BE BASED ON NO. OF TERMINAL BLOCKS.
- THE EXACT TYPE & DIMENSION OF JUNCTION BOXES TO BE USED FOR A PARTICULAR APPLICATION SHALL BE AS DECIDED DURING DETAIL ENGG. STAGE AND SHALL BE SUBJECT TO EMPLOYER'S APPROVAL WITHOUT ANY PRICE REPERCUSSION.
- THE KNOB FOR ALL THE JUNCTION BOXES SHALL BE IDENTICAL.
- ANY TYPE OF SEALED FIXING ARRANGEMENT AS PER MANUFACTURER'S STANDARD CAN ALSO BE PROVIDED SUBJECT TO EMPLOYER'S APPROVAL.

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PROJECT		TYPICAL THERMAL POWER PLANT	
TITLE		LOCAL JUNCTION BOX CONNECTION DETAILS	
REV.NO.	DESCRIPTION	DRAWN	DESIGN
		CHKD.	
		M	E
		C	C&I
		ARCH.	APPD
		DATE	
SIZE	SCALE	DRG. NO.	REV. NO.
A4	N.T.S.	0000-999-POI-A-017	D

	2X660 MW KHURJA STPP-TG PKG	
	TECHNICAL SPECIFICATION (C&I) FOR CONDENSER ON LOAD TUBE CLEANING SYSTEM	
<div>SIGNAL EXCHANGE BETWEEN DRIVES AND DCS</div>		

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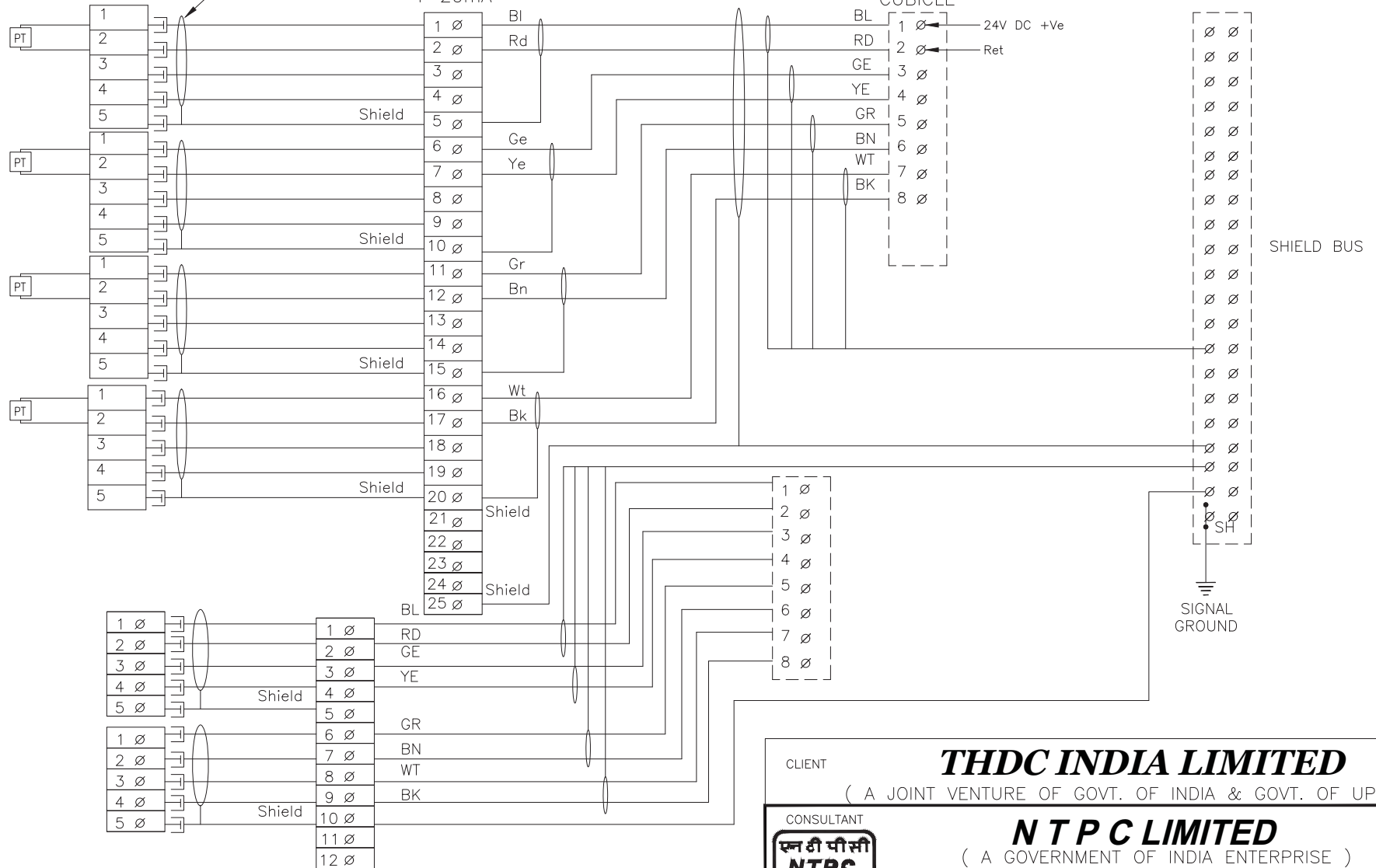
CLIENT	THDC INDIA LIMITED (A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF UP)		
CONSULTANT	NTPC LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION		
PROJECT	TYPICAL THERMAL POWER PROJECT		
TITLE	INTERFACING OF FIELD INSTRUMENTS SWITCH TERMINATION DETAILS NO/NC		
REV.NO.	A	FIRST ISSUE	29.04.06
REV.NO.	DESCRIPTION		REV. NO.
DRAWN	DESIGN	CHKD.	
M	E	C	C&I
ARCH.			
APPD			
DATE			
SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065	A
SH 02 OF 14			

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INTERNAL WIRING/2 PAIR,0.5 mmSq.(TYP)

INT. JB OF LIE/LIR,
FIELD JB
4-20mA

MARSHALLING/TERMINATION
CUBICLE



CLIENT

THDC INDIA LIMITED

(A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF UP)

CONSULTANT



NTPC LIMITED

(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT

TYPICAL THERMAL POWER PROJECT

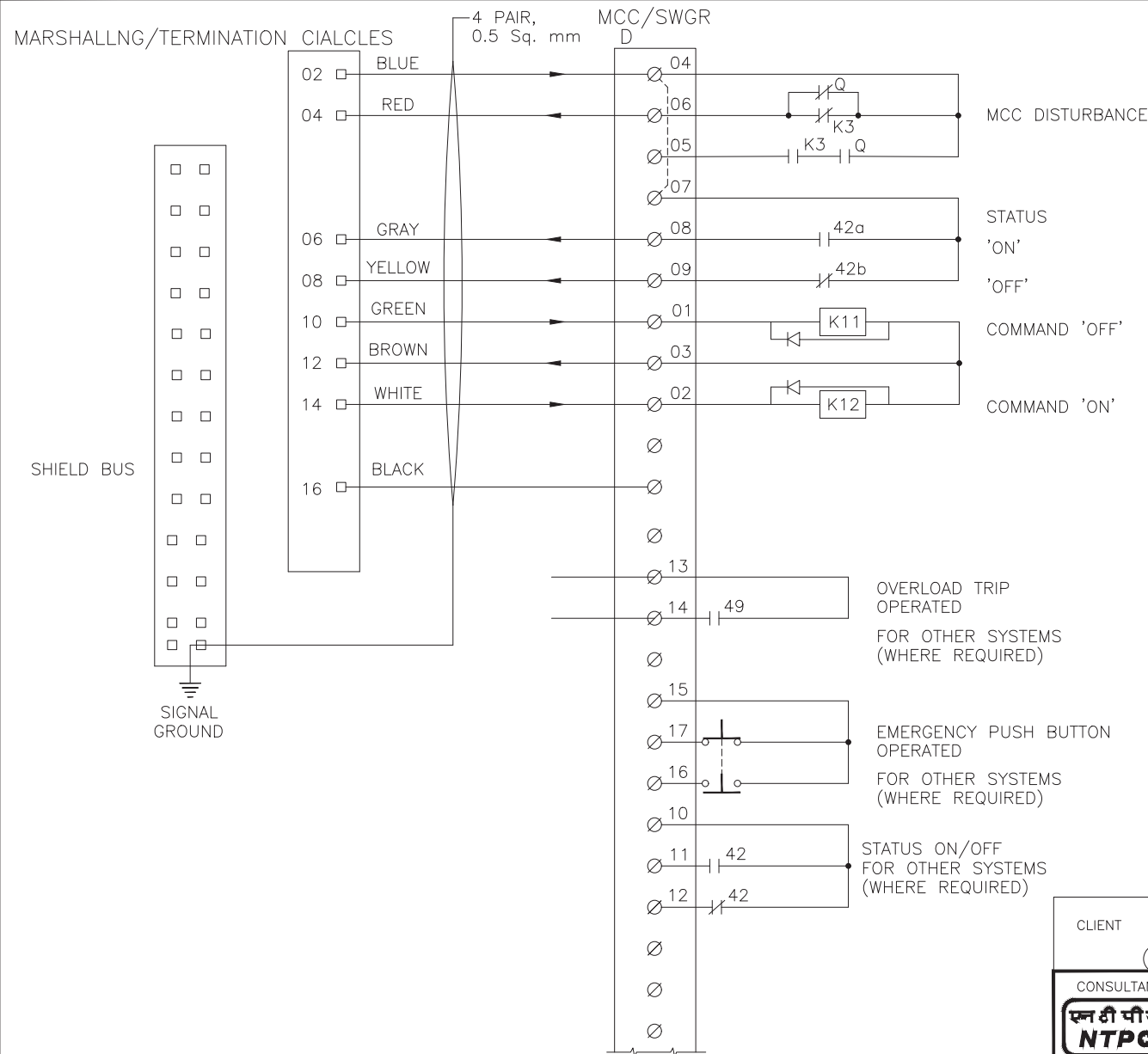
TITLE

**INTERFACING OF FIELD INSTRUMENTS
4-20mA**

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										

SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065	A

SH 04 OF 14



A	FIRST ISSUE										29.04.06
REV.NO.	D E S C R I P T I O N	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
					C L E A R E D B Y						

CONSULTANT



(A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF UP)

(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

TYPICAL THERMAL POWER PROJECT


INTERFACING OF FIELD INSTRUMENTS INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR (LT MOTORS)



RFV. NO.


SH 05 OF 14

A


	2X660 MW KHURJA STPP-TG PKG	
	TECHNICAL SPECIFICATION (C&I) FOR CONDENSER ON LOAD TUBE CLEANING SYSTEM	
<div>QUALITY ASSURANCE FOR INSTRUMENTS & LCP AND TYPE TEST REQUIREMENTS</div>		


CLAUSE NO.	TECHNICAL REQUIREMENTS			
2.00.00	SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS			
2.01.00	<p>The minimum type test reports, over and above the requirements of above clause, which are to be submitted for each of the major C&I systems shall be as indicated below:</p> <p>i) Surge Withstand Capability (SWC) for Solid State Equipments/ Systems</p> <p>All solid state systems/ equipments shall be able to withstand the electrical noise and surges as encountered in actual service conditions and inherent in a power plant. All the solid state systems/ equipments shall be provided with all required protections that needs the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Hence, all front end cards which receive external signals like Analog input & output modules, Binary input & output modules etc. including power supply, data highway, data links shall be provided with protections that meets the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Complete details of the features incorporated in electronics systems to meet this requirement, the relevant tests carried out, the test certificates etc. shall be submitted along with the proposal. As an alternative to above, suitable class of EN 61000-4-12 which is equivalent to ANSI 37.90.1/ IEEE-472 may also be adopted for SWC test.</p> <p>ii) Dry Heat test as per IEC-68-2-2 or equivalent.</p> <p>iii) Damp Heat test as per IEC-68-2-3 or equivalent.</p> <p>iv) Vibration test as per IEC-68-2-6 or equivalent.</p> <p>v) Electrostatic discharge tests as per EN 61000-4-2 or equivalent.</p> <p>vi) Radio frequency immunity test as per EN 61000-4-6 or equivalent.</p> <p>vii) Electromagnetic Field immunity as per EN 61000-4-3 or equivalent.</p> <p>Test listed at item no. v, vi, vii, above are applicable for electronic cards only as defined under item (i) above.</p>			
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-III-C-10 TYPE TEST REQUIREMENTS	PAGE 2 OF 9


CLAUSE NO.	<div><div></div><div>TECHNICAL REQUIREMENTS</div><div></div></div>					
3.00.00	TYPE TEST REQUIREMENT FOR C&I SYSTEMS					
	Sl. No	Item	Test Requirement	Standard	Test To Be Specifically Conducted	NTPC's Approval Req. On Test Certificate
	Col 1	Col 2	Col 3	Col 4	Col 5	Col 6
	1	Elect. Metering instruments	As per standard (col 4)	IS-1248	No	No
	2	Transducers	As per standard (col 4)	IEC-60688,IS12784	No	No
	3	Thermocouple	Degree of protection test	IS-13947	No	No
	4	RTD	As per standard (col 4)	IEC-60751	No	No
	5	Electronic transmitter	As per standard (col 4)	BS-6447 / IEC-60770	No	No
	6	E/P converter	As per standard (col 4)	Mfr. standard	No	No
	7	Dust emission monitor	Degree of protection test	IS-13947	No	No
	8	Instrumentation Cables Twisted & Shielded*				
		-Conductor	Resistance test	VDE-0815	No	No
			Diameter test	IS-10810	No	No
			Tin Coating test (Persulphate test)	IS-8130	No	No
		-Insulation	Loss of mass	VDE 0472	No	No
			Ageing in air ovens**	VDE 0472	No	No
			Tensile strength and	VDE 0472	No	No
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-III-C-10 TYPE TEST REQUIREMENTS		PAGE 3 OF 9

CLAUSE NO.	<div><div><div>एनटीपीसी</div><div>NTPC</div></div></div> <div>TECHNICAL REQUIREMENTS</div> <div></div>				
		elongation test before and after ageing**			
		Heat shock	VDE 0472	No	No
		Hot deformation	VDE 0472	No	No
		Shrinkage	VDE 0472	No	No
		Bleeding & blooming	IS-10810	No	No
	-Inner sheath***	Loss of mass	VDE 0472	No	No
		Heat shock	VDE 0472	No	No
		Cold bend/ cold impact test	VDE 0472	No	No
		Hot deformation	VDE 0472	No	No
		Shrinkage	VDE 0472	No	No
	-Outer sheath	Loss of mass	VDE 0472	No	No
		Ageing in air ovens**	VDE 0472	No	No
		Tensile strength and elongation test before and after ageing**	VDE 0472	No	No
		Heat shock	VDE 0472	No	No
		Hot deformation	VDE 0472	No	No
		Shrinkage	VDE 0472	No	No
		Bleeding & blooming	IS-10810	No	No
		Colour fastness to water	IS-5831	No	No
		Cold bend/ cold impact test	VDE-0472	No	No
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS	PAGE 4 OF 9


CLAUSE NO.	NTPC TECHNICAL REQUIREMENTS				
		Oxygen index test	ASTMD-2863	No	No
		Smoke Density Test	ASTMD-2843	No	No
		Acid gas generation test	IEC-60754-1	No	No
	-fillers	Oxygen index test	ASTMD-2863	No	No
		Acid gas generation test	IEC-60754-1	No	No
	-AL-MYLAR shield	Continuity test		No	No
		Shield thickness		No	No
		Overlap test		No	No
	-Over all cable	Flammability Test	IEEE 383	No	No
		Swedish Chimney Test	SEN 4241475	No	No
		Noise interference	IEEE Trans-actions	No	No
		Dimensional checks	IS 10810	No	No
		Cross talk	VDE-0472	No	No
		Mutual capacitance	VDE-0472	No	No
		HV test	VDE-0815	No	No
		Drain wire continuity		No	No
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS	
				PAGE 5 OF 9	

CLAUSE NO.	<div><div><div>एनटीपीसी</div><div>NTPC</div></div></div> <div>TECHNICAL REQUIREMENTS</div> <div></div>																										
	<p>* 1.0 All cables to be supplied shall be of type tested quality. The Contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last Ten years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.</p> <p>2.0 In case the Contractor is not able to submit report of the type test(s) conducted within last Ten years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests either in an independent laboratory or at manufacturer's works in presence of Owner's representative under this contract free of cost to the Owner and submit the reports for approval.</p> <p>**These tests shall be carried out as per VDE0207 Part 6 & ASTM-D-2116 for TEFLON insulated & outer sheathed cables</p> <p>***Applicable for armoured cables only</p> <p>9 DC Power Supply System (Applicable for each model and rating)</p> <p>1)The Type Test reports for offered rectifier module and the controller module irrespective of the rectifier bank shall be acceptable</p> <table><tr><td>Surge Withstand Capability(SWC)</td><td>ANSI 37.90.1, No IEEE-472,EN 61000-4-12</td><td>No</td></tr><tr><td>Dry Heat Test</td><td>IEC-68-2-2 or No equivalent</td><td>No</td></tr><tr><td>Damp Heat test</td><td>IEC-68-2-3 or No equivalent</td><td>No</td></tr><tr><td>Vibration test</td><td>IEC68-2-6 or No equivalent</td><td>No</td></tr><tr><td>Electrostatic discharge test</td><td>EN 61000-4-2 No orr equivalent</td><td>No</td></tr><tr><td>Radio frequency immunity test</td><td>EN-61000-4-3 No orr equivalent</td><td>No</td></tr><tr><td>Electromagneti c field immunity</td><td>EN 61000-4-3 No orr equivalent</td><td>No</td></tr><tr><td>Degree of Protection</td><td>IS-13947 oi No equivalent</td><td>No</td></tr></table>			Surge Withstand Capability(SWC)	ANSI 37.90.1, No IEEE-472,EN 61000-4-12	No	Dry Heat Test	IEC-68-2-2 or No equivalent	No	Damp Heat test	IEC-68-2-3 or No equivalent	No	Vibration test	IEC68-2-6 or No equivalent	No	Electrostatic discharge test	EN 61000-4-2 No orr equivalent	No	Radio frequency immunity test	EN-61000-4-3 No orr equivalent	No	Electromagneti c field immunity	EN 61000-4-3 No orr equivalent	No	Degree of Protection	IS-13947 oi No equivalent	No
Surge Withstand Capability(SWC)	ANSI 37.90.1, No IEEE-472,EN 61000-4-12	No																									
Dry Heat Test	IEC-68-2-2 or No equivalent	No																									
Damp Heat test	IEC-68-2-3 or No equivalent	No																									
Vibration test	IEC68-2-6 or No equivalent	No																									
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Radio frequency immunity test	EN-61000-4-3 No orr equivalent	No																									
Electromagneti c field immunity	EN 61000-4-3 No orr equivalent	No																									
Degree of Protection	IS-13947 oi No equivalent	No																									
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS																								
			PAGE 6 OF 9																								

CLAUSE NO.	TECHNICAL REQUIREMENTS					
	<div><div><div>एनटीपीसी</div><div>NTPC</div></div><div></div></div>					
	10	Battery ##	As per standard (col 4)	IS-10918 (Ni-Cd Batteries)	No	No
				IS-1652 (Lead Acid Plante Batteries)	No	No
	11	NOT APPLICABLE				
	12	UPS (Applicable for each model and rating)				
		1) Type Test reports of same series of UPS with similar PCB's cards and controllers as the target UPS system shall be acceptable.				
		2) For Dry heat, Damp heat and vibration, the tests conducted on individual PCB's shall be acceptable.				
		Surge Withstand Capability(SWC)	ANSI 37.90.1, No IEEE-472,EN 61000-4-12	No		No
		Dry Heat Test	IEC-68-2-2 or equivalent	No		No
		Damp Heat test	IEC-68-2-3 or equivalent	No		No
		Vibration test	IEC68-2-6 or equivalent	No		No
		Electrostatic discharge test	EN 61000-4-2 or equivalent	No		No
		Radio frequency immunity test	EN-61000-4-3 or equivalent	No		No
		Electromagnetic field immunity	EN 61000-4-3 or equivalent	No		No
		Degree of protection test	IS-13947	No		No
		Fuse Clearing Capability	Approved procedure	No		No
		Short Circuit current capability	IEC 60146-2	No		No
	13	Voltage Stabilisers	Over Load Test	Approved procedure	No	No
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS		PAGE 7 OF 9

CLAUSE NO.	<div><div><div>एनटीपीसी</div><div>NTPC</div></div></div> <div>TECHNICAL REQUIREMENTS</div> <div></div>					
	<div><div>Temp rise test without redundant fans</div><div>Approved procedure</div><div>No</div><div>No</div></div>					
14	Public Address System					
	IP based PA system components	As per Standard	IEC 60268-16	No	Yes	
15	LIE / LIR	Degree of protection test	IS-13947	No	No	
16	Flue analyzers	gas Degree of protection test	IS-13947	No	No	
17	Master Clock	Functional test	As per approved procedure	No	No	
18	CJC Box	Degree Of protection test	IS-13947	No	No	
19	Junction Box	Degree Of protection Test	IS-13947	No	No	
20	OPC Data Access Server, Data Exchange Server & Historical Data Access Server	OPC Compliance Testing		No	No (Self certification is also acceptable)	
21	Conductivity Type Level Switch	Degree of protection test	IS-2147	No	No	
22	Local Gauges	Degree of protection test	IS-2147	No	No	
23	Process actuated Switches	Degree of protection test	IS-2147	No	No	
24	Control Valves	CV test	ISA 75.02&75.11	No	No	
25	PLCs	As per standard (Col	IEC 1131	No	No	

<div>KHURJA SUPER THERMAL POWER PROJECT</div> <div>STAGE-I (2X660 MW)</div> <div>TURBINE GENERATOR AND ASSOCIATED PACKAGES</div>	<div>TECHNICAL SPECIFICATION</div> <div>SECTION – VI, PART-B</div> <div>BID DOC. NO.: THDC/RKSH/CC-9915-371</div>	<div>SUB-SECTION-IIIC-10</div> <div>TYPE TEST REQUIREMENTS</div>	<div>PAGE</div> <div>8 OF 9</div>
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CLAUSE NO.	<div><div><div>एनटीपीसी</div><div>NTPC</div></div><div>TECHNICAL REQUIREMENTS</div><div></div></div>					
	<div>4)</div> <div><div>26</div><div>Flow Orifice Venturi</div><div>Nozzle plates,</div><div>Calibration</div><div>ASME PTC BS 1042</div><div>No</div><div>No</div></div> <div>## The contractor shall submit for Employers approval the reports of all the type test as per latest IS-10918 carried out within last ten years from the date of Bid opening and the test(s) should have been either conducted at an independent laboratory or in presence / owners representative. The complete type test reports shall be for any rating of Battery in a particular group based on plate dimensions being manufactured by supplier.</div> <div>Note:</div> <div>Type Tests are to be conducted only for the items, which are being supplied as a part of this Package.</div>					
KHURJA SUPER THERMAL POWER PROJECT STAGE-I (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-IIIC-10 TYPE TEST REQUIREMENTS		PAGE 9 OF 9

MEASURING INSTRUMENTS (PRIMARY AND SECONDARY) Page- 1/2

TESTS ITEMS									
	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard (R)	Insulation Resistance (R)	IBR Certification (if applicable) (R)	Hydro Test (R)	Material Test certificate ®
1. PR Gauge (IS-3624)	Y	Y	Y	Y	Y				
2. Temp. Gauge (BS-5235)	Y	Y	Y	Y	Y				
3. Pr./D.P.Switch (BS-6134)	Y	Y	Y	Y	Y	Y			
4. Electronic Transmitter (IEC-60770)	Y	Y	Y	Y	Y	Y			
5. Temp. Switch	Y	Y	Y	Y	Y	Y			
6. Recorder (IS-9319/ANSI C-39.4)	Y	Y	Y	Y	Y	Y			
7. Vertical indicators	Y	Y	Y	Y		Y			
8. Digital Indicators	Y	Y	Y	Y		Y			
9. Integrators	Y	Y	Y	Y					
10. Electrical Metering Instrument (IS-1248)	Y	Y	Y	Y	Y	Y			
11. Transducer (IEC-688)	Y	Y	Y	Y	Y	Y			
12. Thermocouples (IEC – 754 / ANSI-MC-96.1)	Y	Y	Y	Y	Y	Y			
13. RTD (IEC-751)	Y	Y	Y	Y	Y	Y			
14. Thermowell	Y		Y				Y	Y	Y
R-Routine Test A- Acceptance Test Y – Test applicable									
: Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.									

MEASURING INSTRUMENTS (PRIMARY AND SECONDARY) Page- 2/2

ITEMS	TESTS											
	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Requirement as per standard (R)	WPS approval (A)	Non-destructive testing (R)	Calculation for accuracy (R)	Insulation Resistance (R)	IBR Certification as applicable (R)	Hydro test (R)	Material test certificate (A)
15. Cold junction compensation box	Y	Y	Y	Y					Y			
16. Orifice plate(BS-1042)	Y	Y	Y	Y*	Y	Y**	Y**			Y	Y**	Y
17. Flow nozzle(BS-1042)	Y	Y	Y	Y*	Y	Y	Y			Y	Y	Y
18. Impact head type element	Y	Y	Y					Y				Y
19. Level transmitter/float type switch	Y	Y	Y	Y					Y	Y	Y	Y
20. Analysers	Y	Y	Y	Y								
21. Dust emission monitors	Y	Y	Y	Y								
*Calibration to be carried out on one flow element of each type and size if calibration carried out as type test same shall not be repeated.												
** If applicable												
R-Routine Test A- Acceptance Test Y – Test applicable												
Note: 1) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.												

ITEMS	Visual ®	GA, BOM, Layout of component & construction feature®	Dimension ®	Paint Shade/thickness ®	Flattening,flaring,hydrotest,hardness check as per ASTM standard (A)	Component Ratings ®	Wiring ®	Make, Model, Type, Rating®	IR & HV ®	Review of TC for instrument/devices (R)	Accessability of TBs/Devices ®	Illumination,grounding ®	Tubing ®	Leak/Hydro test(A)	Chemical/physical properties of material (A)	Proof pressure test,Dismantling & reassembly test,Hydraulic impulse and vibration test (R)	Tests as per standards & specification
Local Instrument enclosure	Y Y Y Y	Y Y Y Y Y	Y Y Y Y	Y Y Y Y	Y												
Local instruments racks	Y Y Y Y	Y Y Y Y Y	Y Y Y Y	Y Y Y Y													
Junction Box	Y Y Y Y* Y Y Y																
Gauge Board	Y Y Y Y Y Y Y Y	Y Y															
Impulse pipes and tubes	Y Y Y	Y Y															
Socket weld fittings ANSI B-16.11		Y Y Y		Y Y													
Compression fittings	Y Y Y	Y Y Y															
Instrument valves & Valve manifolds		Y Y Y		Y Y													
Copper tubings ASTM B75	Y	Y															

*-applicable for painted junction boxes.

Note: R-Routine Test A- Acceptance Test Y – Test applicable

Note: This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.



INSTRUMENTATION CABLE												
ITEMS	TESTS											
	Conductor Resistance ® & (A)	High Voltage ® & (A)	Insulation Resistance ® & (A)	Constructional detail, dimensions (A)	Outer-Sheathe/core marking, end sealing (A)	Thermal Stability (A) +	Visual, Surface finish (A) +	Electrical Parameters ** (A) +	Persulphate Test (A) +	Overall/Coverage/Continuity (A)	Swidesh chimney Test (SS-4241475) (A) ++	FRLS Test * (A) ++

1. Instrument cable twisted and shielded

Conductor(IS-8130)	Y			Y			Y					
Insulation(VDE-207)				Y	Y	Y	Y					Y
Pairing/Twisting				Y	Y		Y					
Shielding				Y			Y			Y		
Drain wire	Y			Y			Y		Y	Y		
Inner Sheath				Y	Y	Y	Y				Y	Y
Outer Sheath				Y	Y	Y	Y				Y	Y
Over all cable	Y	Y	Y	Y	Y		Y	Y		Y		Y
Cable Drums(IS-10418)				Y			Y					

Note : High Temp. cables shall be subjected to tests as per VDE-207(Part-6) Compensating cables shall be checked for Thermal EMF/Endurance test as per IS 8784.

Note : This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating his practice & Procedure along with relevant supporting documents during QP finalization for all items.

Note : ® - Routine Test A - Acceptance Test Y - Test Applicable


Note : Sampling Plan for Acceptance test shall be as per IS 8784 (As applicable)

- * FRLS Tests: Oxygen / Temp Index (ASTM D-2863), Smoke Density Rating (ASTM – D 2843), HCL Emission (IEC-754-1)

- ** Characteristic Impedance, Attenuation, Mutual Capacitance, Cross Talk (As applicable)

+ Sample size will be One No. of each size/type per lot.

++ Sample size will be One No. sample for complete lot offered irrespective of size/type.

CLAUSE NO.	<div><div>एनटीपीसी NTPC</div><div>QUALITY ASSURNACE & INSPECTION</div></div>														
ELECTRICAL ACTUATOR WITH INTEGRAL STARTER															
ITEM/ COPONENT/ SUB SYSTEM ASSEMBLY/ TESTING	Test/Attributes Characteristics														
		RPM ®	No Load Current ®	IR & HV Test®	Mounting Dimension®	All routine Test as per Standard & Specification®	Correct Phase Sequence®	Operation & Setting of limit Switch/Torque Switch®	Stall Torque/Current (A)	Hand Wheel operation/ Auto de clutch function (A)	Function of Aux. like Potentiometer, space heater, position	EPT output ®	Grease leakage ®	Local/ Remote (Open-Stop-Close) Operation® Safety check (Single phasing, Phase correction, Tripping etc.) (A)	
	ELECTRICAL ACTUATOR WITH INTEGRAL STARTER(IS 9334)														
	Motor	Y	Y	Y	Y	Y									
	Final Testing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Note: 1) Detailed procedure of Burn-in and Elevated Temperature test shall be as per Quality Assurance Programme in General Technical Conditions 2) This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the practices and procedure adopted along with relevant supporting documents.															
® - Routine Test (A) - Acceptance Test Y - Test applicable															

KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371	SUB-SECTION-E-31 ELECTRICAL ACTUATOR WITH INTEGRAL STARTER	PAGE 1 OF 1
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TITLE:
**TECHNICAL SPECIFICATION
COLTCS**

SPECIFIC TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-475-165-N002**

SECTION: **I**

SUB-SECTION: **ID**

REV. NO. **00** DATE 20.01.2021


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

SUB-SECTION – ID

DATASHEET-A

			DATA SHEET - A	SPECIFICATION NO.: PE-TS-475-165-N002
CONDENSER ON LINE TUBE CLEANING SYSTEM(COLTCS)				REV. NO.: 00. DATE : 20.01.2021
				SECTION : I. SUB-SECTION : ID
SL NO	DESCRIPTION	UNITS	2X660 MW KHURJA STPP TG PKG	
1.00	GENERAL			
1.1	Nos. of tube cleaning systems sets required for station	Nos.	Total Four (4) nos. viz. Two (02) Nos. for One Unit. viz. One independent set common for each half of two condensers placed in series There are 2 nos. condenser per Unit in Series,i.e. Balls from one Separator/ Collector has to pass through two nos. Condensers placed in Series.	
1.2	Liquid Handled		Clarified water (Refer enclosed water analysis at Annexure II)	
1.3	Size of COLTCS	NB	2300	
1.4	Length of Ball Separator	mm	4200 Note: 1. Scope of Ball Separator counter flange is in Purchaser's scope. (Associated Gaskets, nuts and bolts are in Bidder's Scope) 2. Ball Separator shall be mounted directly on the existing Butterfly valve - Refer Annexure III. 3. Flap of butterfly valve shall be extended to approx 950-1050 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	
2.2	Design Pressure for ball separator	kg/cm2 (g)	5.0 kg/cm ² (g) & 0.1 Kg/cm2 (abs)	
2.3	Design Mechanical temperature	Deg. C	50	
2.4	Condenser Details			
	a) Type of condenser		Single pass	
	b) No. of Condenser sections	Nos.	Two (2)	
	c) No. of passes per condenser section (viz. condenser half)	Nos.	One (1)	
	d) No. of tubes per condenser	Nos.	26400	
	• Condensing zone	Nos.	26056	
	• Air Cooling zone	Nos.	344	
	e) Tube Dia. OD x Thickness			
	• Top two rows	mm x mm	25.0 x 0.889	
	• Remaining	mm x mm	25.0 x 0.7112	
	f) Length of tubes between ends.	mm	13600	
	g) Tube material		Welded SS 316L	
	h) Pressure drop across condenser - At Normal flow (between Inlet and Outlet flanges of condenser)	MWC	2X2.4 MWC (excl. interconnection pipes) (However the actual value can vary +/-10% of the design value)	
2.5	CW flow rate through each ball separator			
	- Normal	cu.m/hr	33500	
	- Maximum	cu.m/hr	43550	
2.6	Design differential pressure for ball separator strainer/screen	kg/cm2 (g)	0.3	
2.7	Pressure drop across ball separator i.e. between inlet & outlet flanges in clean condition at normal flow.	MWC	0.2	
2.8	Pressure drop across ball separator in choked condition when strainer backwashing starts	MWC	Not to exceed 0.30	
2.9	No. of balls required for COLTCS per condenser section		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	
	b) O.D. X Thickness		2340 X 20	
3.2	Condenser outlet pipe			
	a) Material		Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589	
	b) O.D. X Thickness		2340 X 20	
3.3	Manhole		Yes, 600 NB size	
4	MATERIALS OF CONSTRUCTION			
4.1	BALL SEPARATOR			
	a) Body / housing		Carbon Steel to IS -2062 Gr.B. with epoxy painted inside (with minimum housing thickness same as connecting pipe thickness)	
	b) Screen / Strainer		SS-316	
	c) Strainer shaft		SS-316	
	e) Internal Hardware in contact with circulating water including nuts, bolts , etc.		SS-316	
	f) Site Glass provision		YES	
4.2	BALL RECIRCULATING PUMP		Non clog Type	
	a) Casing		2% Ni Cl to IS 210 FG-260	
	b) Impeller		SA 351 CF8M	
	c) Shaft		SS-410	
4.3	BALL COLLECTOR			
	a) Body / housing		Carbon Steel to IS -2062 Gr. B	
	b) Screen / Strainer/other internals		SS-316	
	c) Site Glass Provision		YES	
4.4	Differential pressure measuring system		SS-316	
4.5	Injection nozzle		Carbon Steel as per IS 1239 / 3589	
4.6	Valves			
4.6.1	Check Valves (65 NB & Above)		Swing check type	
	a) Body & Bonnet		ASTM A 216 Gr. WCB, Flanged Ends	
	b) Disc for Check Valve		ASTM A 216 Gr. WCB	
	c) Stem / Trim		ASTM A 182 Gr. F6 or Better	
4.6.2	Check Valves (50 NB & Below)		Swing check type	
	a) Body & Bonnet		ASTM A105, Socket welded Ends	
	b) Disc for Check Valve		ASTM A105	

			DATA SHEET - A	SPECIFICATION NO.: PE-TS-475-165-N002
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SL NO	DESCRIPTION	UNITS	2X660 MW KHURJA STPP TG PKG	
	c) Stem / Trim		ASTM A 182 Gr. F6 or Better	
4.6.3	Gate/ Globe Valves 50 Nb & Below			
	Body & Bonnet		ASTM A105, Socket welded Ends	
4.6.4	Gate/Globe Valves (65NB & above)			
	a) Body & Bonnet		ASTM A 216 Gr. WCB, Flanged Ends	
	b) Disc		ASTM A 216 Gr. WCB	
	c) Stem		ASTM A 182 Gr. F6 or Better	
	d) Companion Flange		Carbon Steel	
4.6.5	BFV Valves (65NB & above)			
	a) Body & Disc		2% Ni Cl as per IS 210, FG 260	
	b) Sealing, Retaining segment & internals		18-8 SS	
	c) Bearing		Self lubricating type	
	d) Companion Flange		Carbon Steel	
4.6.6	Ball valves			
	a) Body		ASTM A105	
	b) Ball		SA 351 CF8M	
	c) Stem		ASTM A 182 Gr. F6 or Better	
4.7	Interconnecting Piping		By Bidder	
	Material		Carbon Steel as per IS 1239 (Heavy) / 3589 Gr 410	
5	COUNTER FLANGES FOR BALL SEPARATOR			
5.1	MATERIAL			
	a) Flanges		Carbon Steel to IS 2062 Gr. B or eq for thickness, drilling etc refer Annexure II in section C1(In Purchaser's Scope)	
	b) Fasteners		A 193 & A 194 (In Bidder's scope).	
	c) Gaskets		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)	
6.1	MATERIAL			
	a) Flanges		Carbon Steel to IS 2062 Gr. B or eq (In Bidder's Scope)	
	b) Fasteners		A 193 & A 194 (In Bidder's scope).	
	c) Gaskets		Min 4 mm thick rubber (In Bidder's scope).	
7	Material of Other components not specified above		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	
	b) Primer		Two coat of Epoxy based Red Oxide Zinc phosphate with minimum thickness of 25 microns dft of each coat	
	c) Intermediate		Epoxy based TiO2 pigmented coat (Min. DFT 30 microns)	
	d) Final paint		Two (2) coats of High build Epoxy paint with minimum thickness of 35 microns dft of each coat to achieve total DFT of min. 150 microns	
8.2	Internal Surface			
	a) Surface preparation		SA - 2.5 of Swedish Specn. SIS-05-59-00-1967	
	b) Primer		Two coat of Epoxy Resin based Red oxide primer	
	c) Final paint		Adequate no. of coats (min. Two) of Synthetic Enamel paint to achieve total DFT of min. 200 microns. Colour- code shall be as per IS 9404	
9	Adequate provision for future installation of cathodic protection		YES	
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.	
11	The tube cleaning system shall be designed for following operation modes			
	a) Automatic start up initiated by push button		YES	
	b) Automatic shut down with ball collection effected by : i. Push button ii. Adjustable timer iii. Ball monitoring system		YES	
	c) Automatic backwashing of ball separator with ball collection effected by : a. Push button b. Adjustable timer c. Diff. Pressure measuring system		YES	
	d) Automatic emergency backwashing of ball separator effected by diff. Pressure measuring system		YES	
	e) Automatic ball sorting initiated by push button		YES	
	f) Provision for manual operation of complete tube cleaning system in case of control system failure		YES	
	g) Whether the contacts for DPG and DPT are independent		YES	
	h) Timer for Backwashing		YES	

		DATA SHEET - A		SPECIFICATION NO.: PE-TS-475-165-N002	
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				SECTION : I. SUB-SECTION : ID	
SL NO	DESCRIPTION	UNITS	2X660 MW KHURJA STPP TG PKG		
	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		
	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		
	k) Whether provision for self-testing and self-calibration are made		YES		
12	MANDATORY SPARES - to be supplied under this specification –		NA		
13	Documents enclosed for bidder's reference				
	a. Water Analysis		Attached as per Annexure-I		
	b. Counter Flange details		Attached as per Annexure-II		
	c. GA of CW piping in TG hall		Attached as per Annexure-III		
	d. End Customer Specification		Attached as per Annexure-IV		

ANNEXURE-I

DESIGN CLARIFIED WATER ANALYSIS

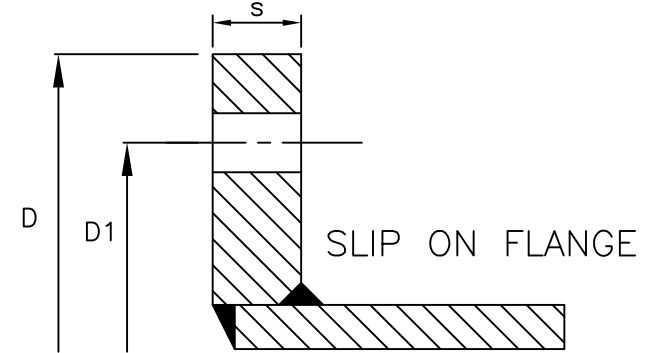
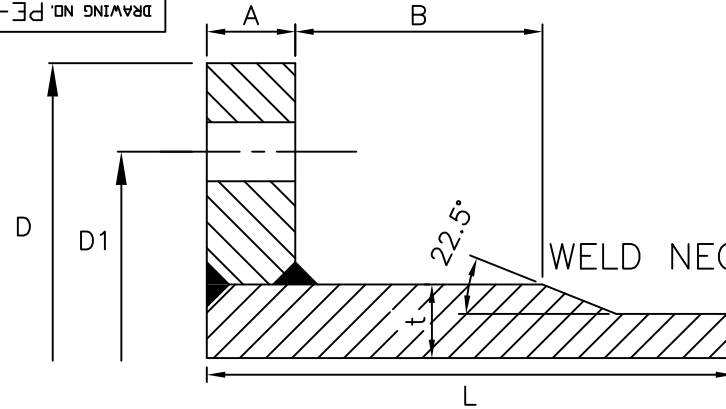
S.No	PARAMETER	UNIT	Clarified Water Analysis
			Calculated
1	pH .	-	6.8-7.3
2	Sp. Cond.	µs/cm	325
3	TDS	mg/l	230
4	Turbidity	NTU	10
5	Total hardness	mg/l As CaCO ₃	155
6	Calcium	mg/l As CaCO ₃	148.8
7	Magnesium	mg/l As CaCO ₃	45
8	Sodium	mg/l CaCO ₃	45
9	Potassium		
10	P Alkalinity	mg/l As CaCO ₃	-
11	M Alkalinity	mg/l As CaCO ₃	125.3
12	Chlorides	mg/l As as CaCO ₃	42
13	Sulphate	mg/l As CaCO ₃	71.5
14	Silica (Total)	mg/l As SiO ₂	21
15	Silica (Reactive)	mg/l As SiO ₂	20
16	Silica (Collidal)	mg/l As SiO ₂	1
17	TOC	mg/l	6
18	COD	mg/l	45
19	BOD	mg/l	18
20	Fe	mg/l	-

Note: Cooling water system is expected to operate at a design minimum cycle of concentration (C.O.C) of about 5 to 5.5.

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

DRAWING NO. PE-DG-999-141-M017



PIPE SIZE	PIPE THK.	FLANGE OD 'D'	Bolt PCD 'D1'	WELD NECK FLANGE				SLIP-ON FLANGE THICKNESS S*
				FLANGE THK. 'A'	NECK THK. 't'	NECK Length 'B'	Appx. Total Length 'L'	
1000	10	1289	1200	34	20	70	200	70
1200	10-12	1465	1380	40	24	70	200	90
1400	14	1675	1590	50	24	70	200	100
1600	14	1915	1820	60	32	80	220	110
1800	14-16	2115	2020	70	32	90	250	120
2000	18	2325	2230	75	36	100	250	130
2200	18	2550	2420	80	36	100	300	140
2300	20	2660	2550	80	36	110	310	145
2400	20	2760	2650	80	40	110	310	150
2500	20	2860	2760	80	40	120	350	155
2600	20	2960	2850	85	40	130	350	160
2700	20	3070	2960	90	40	130	350	165
2800	20	3180	3070	90	40	140	350	-
2900	20	3290	3180	90	40	150	350	-

NOTES:-

Flange thicknesses listed are for

1. Design pressure=5Kg/cm²(g)
2. Dimensions are mentioned in Table
3. Material: Carbon Steel as per IS:2062

* Slipon Flange thickness listed are for pipe thickness mentioned in table.

In case of any change in Design pressure, Pipe ID & Thickness, Flange PCD & OD, Neck Thickness & dimensions and Material of Construction, Flange thickness to be worked out on case to case basis.

REV.	DATE	DESCRIPTION	ALTD	CHD	APPD
03	01.03.19	FLANGE DETAILS ADDED FOR 2600,2800 & 2900NB	AC	PM	SPV
02	02.05.11	FLANGE DETAILS ADDED FOR 2300,2500 & 2700NB	PM	SPV	SM
01	25.08.08	FLANGE DETAILS ADDED FOR 1000 & 2000NB	PM	SPV	SM



BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
PPE1, NOIDA

TITLE

SUGGESTIVE DIMENSIONAL DRAWING FOR
CARBON STEEL COUNTER FLANGE

DEPT CODE	NAME	SIGN	DATE
DRN	PM		25.06.07
DSGN	PM		25.06.07
CHD	SPV		25.06.07
APPD	SM		25.06.07

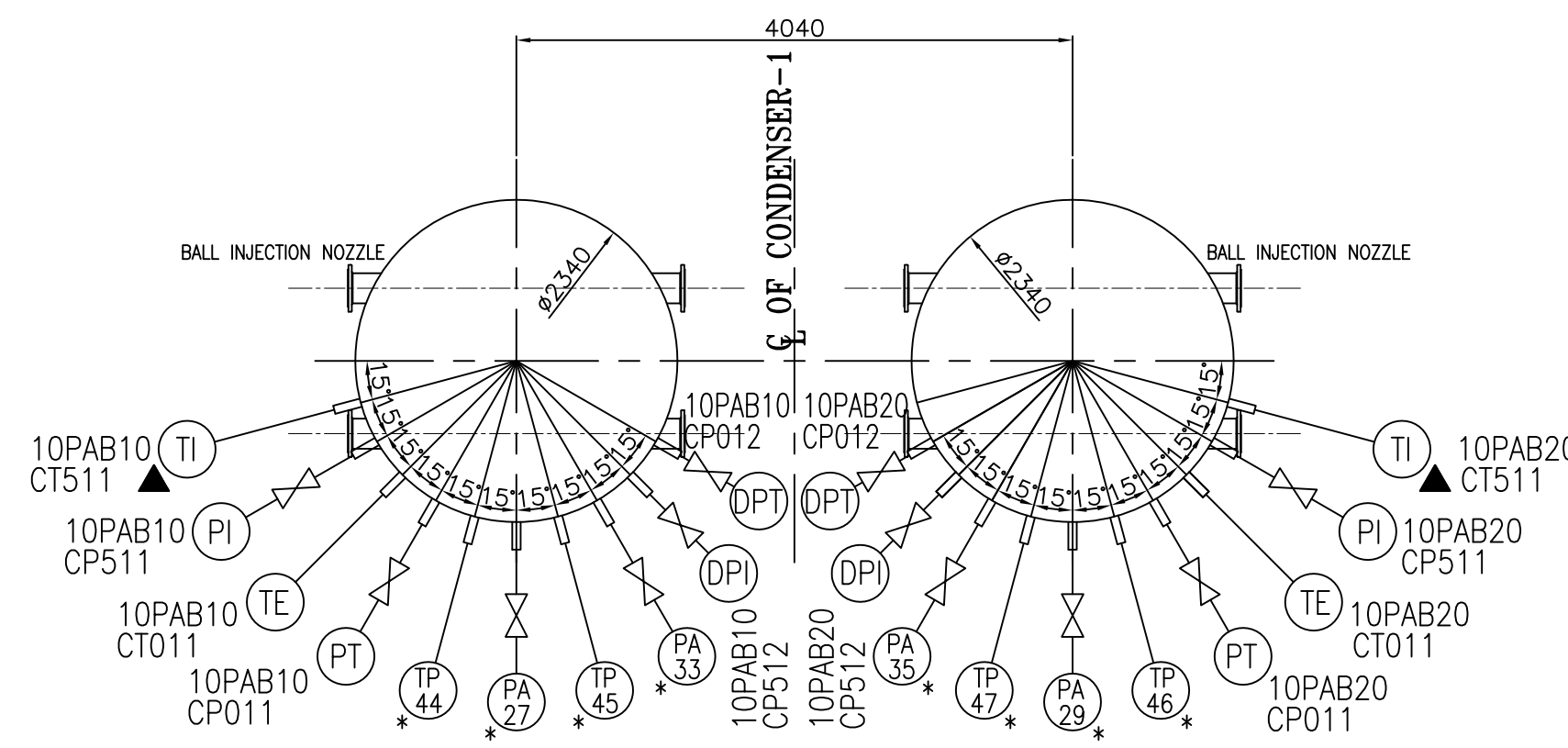
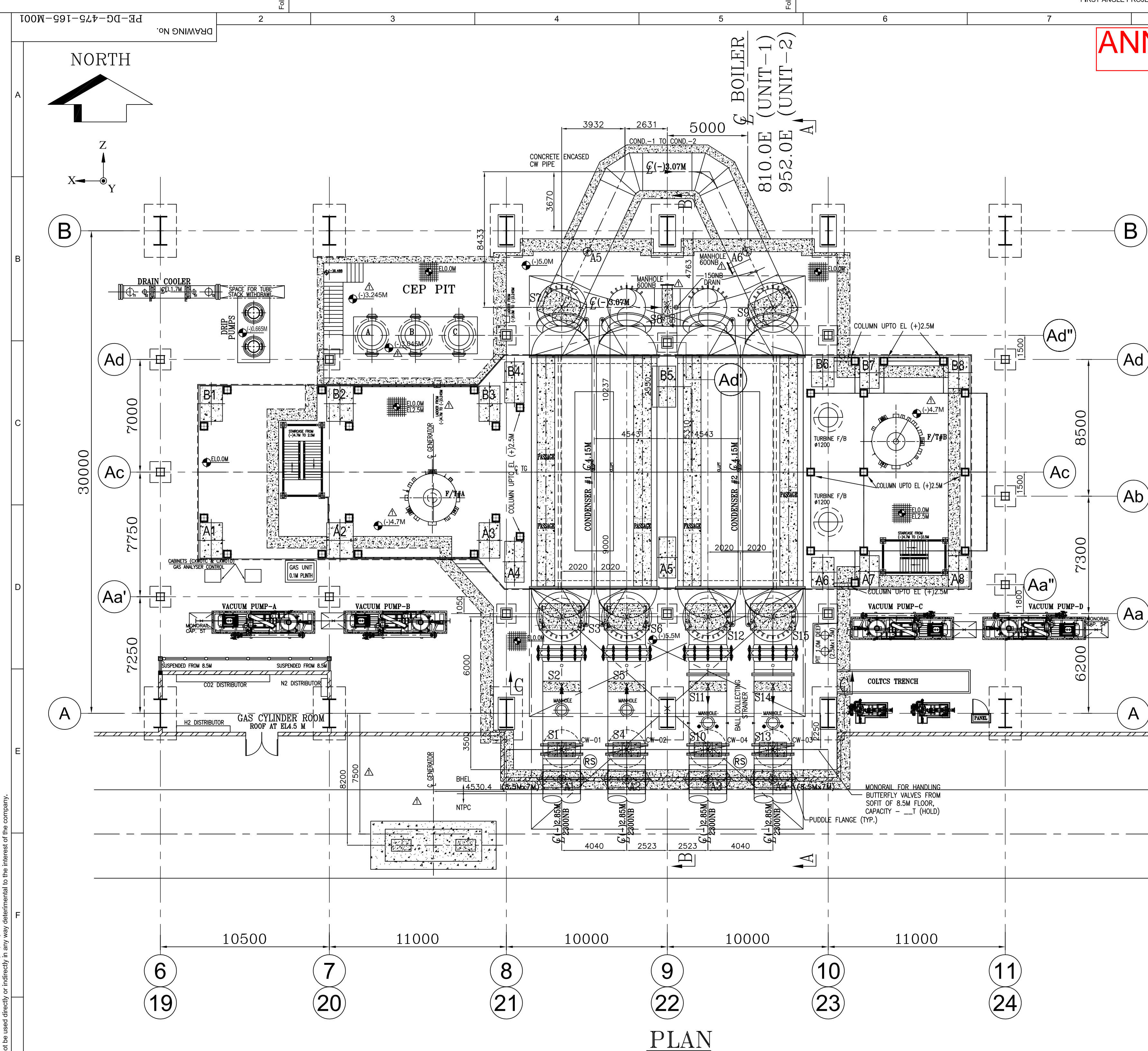
DRAWING NO.
PE-DG-999-141-M017

SHEET 01 OF 01 REV 03

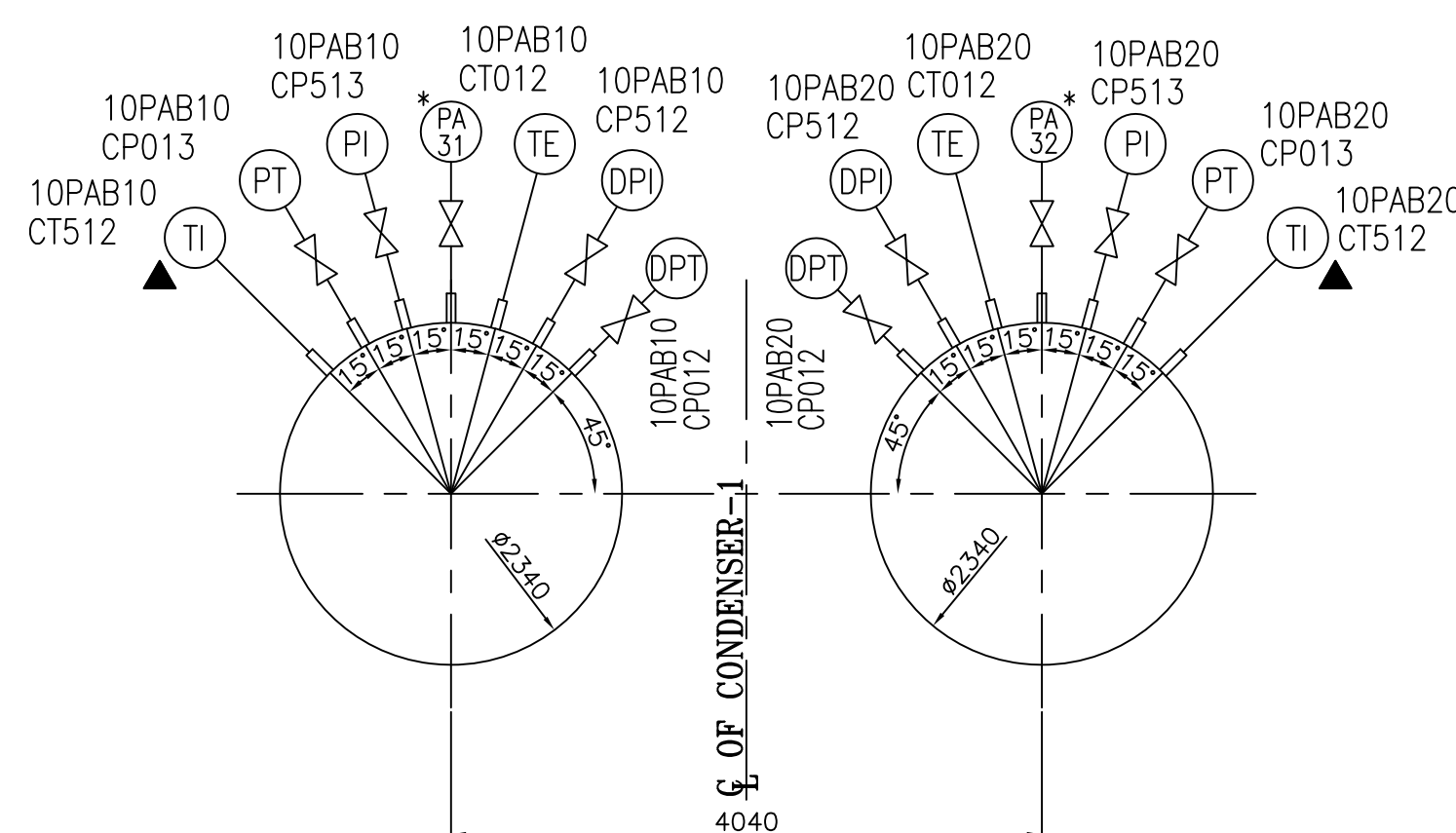
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STATUS -

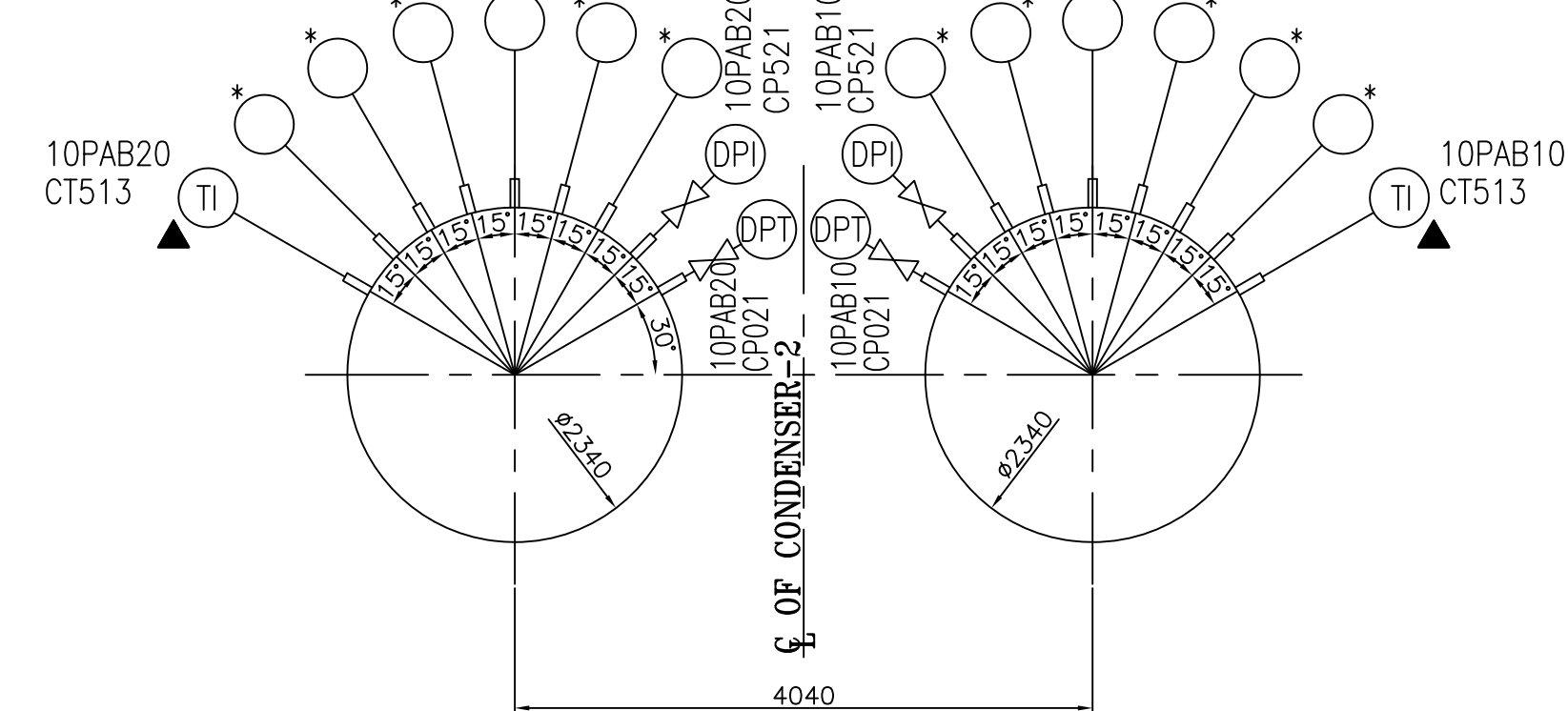
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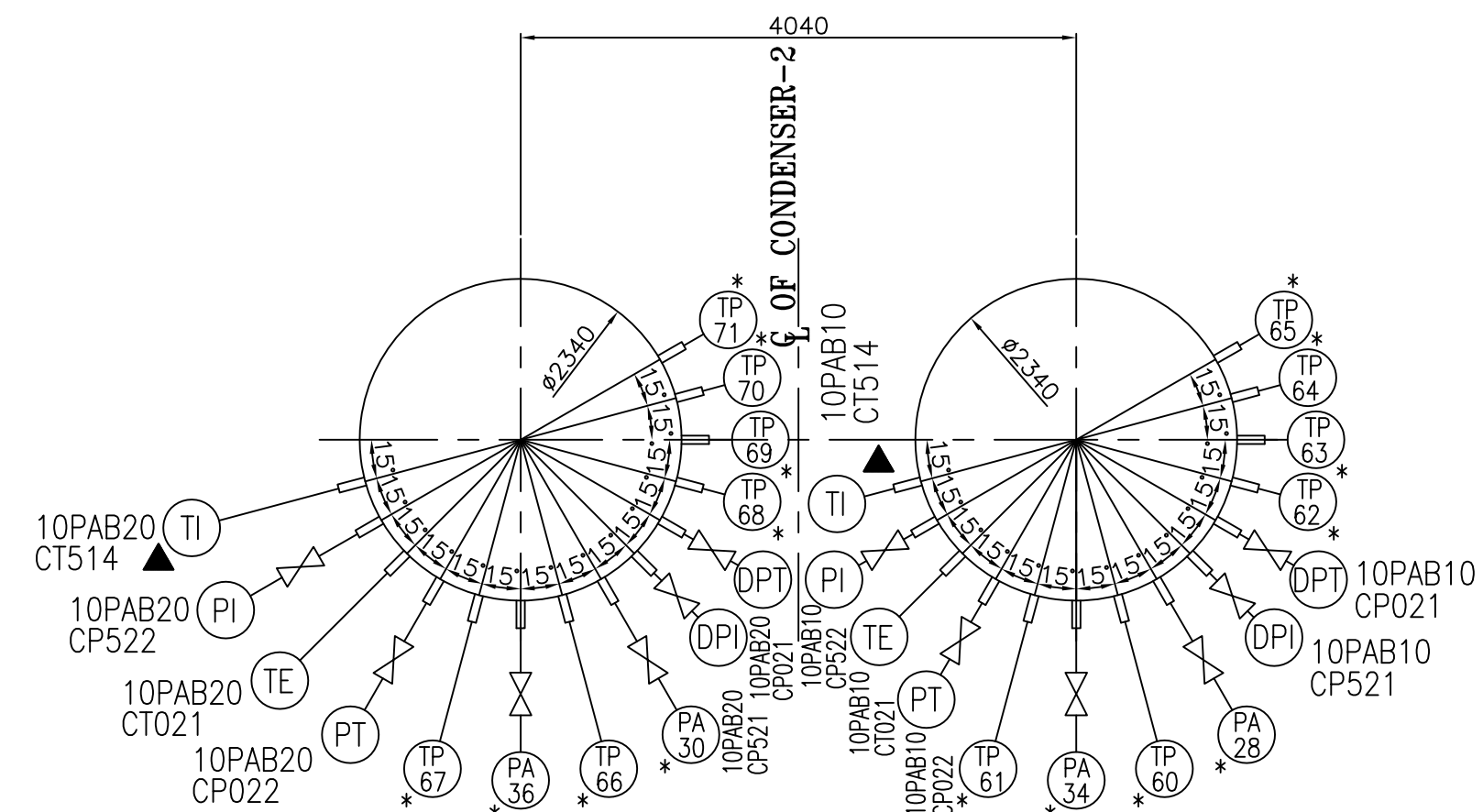
VIEW T1-T1
(DETAILS OF INSTRUMENT STUBS ON INLET OF CONDENSER-1)
AT EL(-)1.0M
(PG TEST STUBS ON HOLD)



VIEW T2-T2
(DETAILS OF INSTRUMENT STUBS ON OUTLET OF CONDENSER-1)
AT EL0.2M
(PG TEST STUBS ON HOLD)



VIEW T3-T3
(DETAILS OF INSTRUMENT STUBS ON INLET OF CONDENSER-2)
AT ELO.2M
(PG TEST STUBS ON HOLD)



VIEW T4-T4
(DETAILS OF INSTRUMENT STUBS ON OUTLET OF CONDENSER-2
AT EL(-)1.0M
(PG TEST STUBS ON HOLD))




REFERENCE DRAWING:—

- | | | |
|-----|---|----------------------------------|
| 1. | TO EQUIPMENT LAYOUT PLAN AT GROUND FLOOR | 9915-371-110-PEM-PMW-F-051 (PEM) |
| 2. | TO EQUIPMENT LAYOUT PLAN AT MEZZANINE FLOOR | 9915-371-110-PEM-PMW-F-052 (PEM) |
| 3. | P&ID - CW AND ACW SYSTEM | 9915-371-110-PEM-PMW-F-509 (PEM) |
| 4. | PG TEST INSTRUMENTATION SCHEME | (PEM) |
| 5. | CONDENSER GA | 9915-371-110-HWR-BW-B-022 (HWR) |
| 6. | GA OF COMPENSATING TYPE RE JOINT | (BPL) |
| 7. | ARRGT. OF 2300NB BUTTERFLY VALVE | (BPL) |
| 8. | GA OF BALL SEPARATOR | (PEM) |
| 9. | INSTALLATION PLAN - TUBE CLEANING SYSTEM | (PEM) |
| 10. | INSTRUMENT STUD DETAILS | (PEM) |

VALVE DETAILS (HOLD)						
SI. NO.	VALVE TAG NO.	SIZE (NB)	TYPE	END CONN.	LENGTH (MM)	SUPPLIED BY
1	CW-01	2300	BFV(MO)	F	—	BPIL ®
2	CW-02	2300	BFV(MO)	F	—	BPIL ®
3	CW-03	2300	BFV(MO)	F	—	BPIL ®
4	CW-04	2300	BFV(MO)	F	—	BPIL ®
5	CW-12	200	ARV	F	—	PEM
6	CW-14	200	ARV	F	—	PEM
7	CW-16	200	ARV	F	—	PEM
8	CW-18	200	ARV	F	—	PEM
9	CW-11	200	GV	F	—	TRY
10	CW-13	200	GV	F	—	TRY
11	CW-15	200	GV	F	—	TRY
12	CW-17	200	GV	F	—	TRY
13	CW-05/06	150	GV	BW	—	TRY
14	CW-07/08	150	GV	BW	—	TRY
15	CW-09/10	150	GV	BW	—	TRY

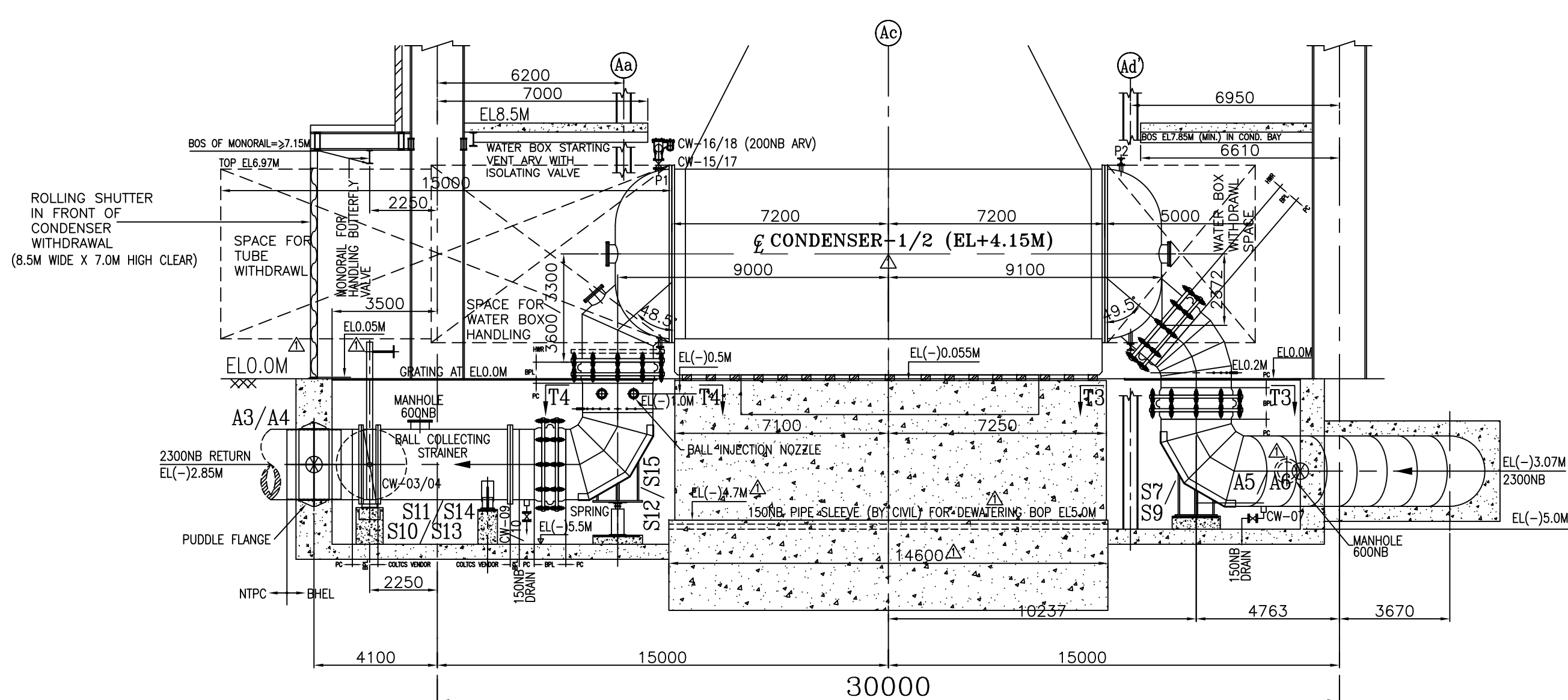
® WITH MATING FLANGE AND NECK PIECE

LEGEND:—

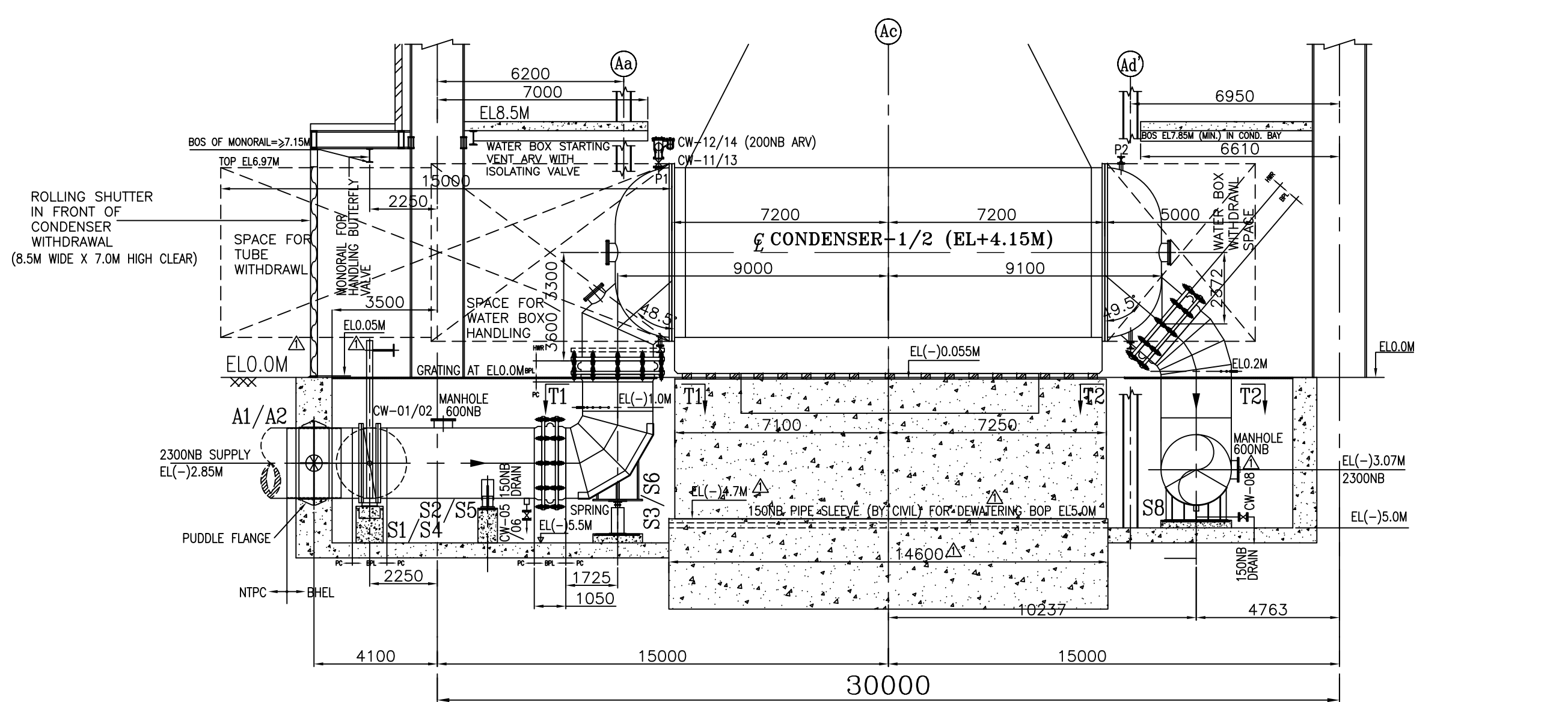
- | | | |
|---|---------------------------|-----------------------------|
|  | CHEQUERED PLATE FLOORING | 1. BUTTERFLY VALVES |
|  | REMOVABLE CHEQUERED PLATE | 2. PG TEST INSTRUMENTS |
|  | GRATED FLOORING | 3. BALL COLLECTING STRAINER |
| | | 4. AIR RELEASE VALVES |
| | | 5. GATE VALVES |

HOLD:-

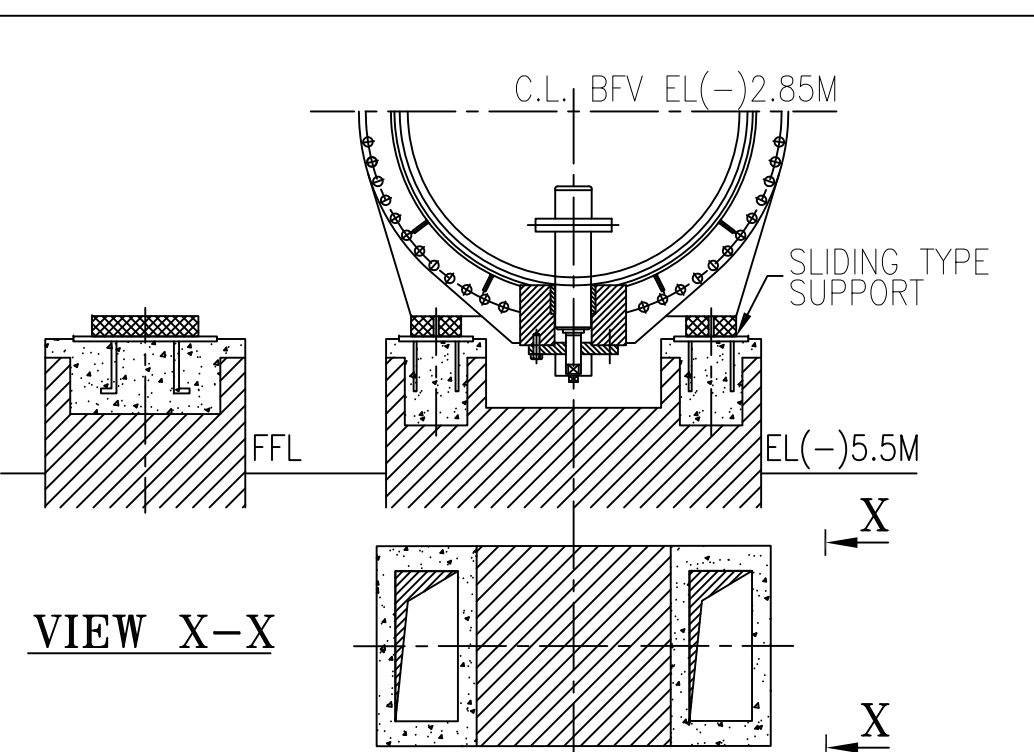
1. BUTTERFLY VALVES
2. PG TEST INSTRUMENTS
3. BALL COLLECTING STRAINER
4. AIR RELEASE VALVES
5. GATE VALVES



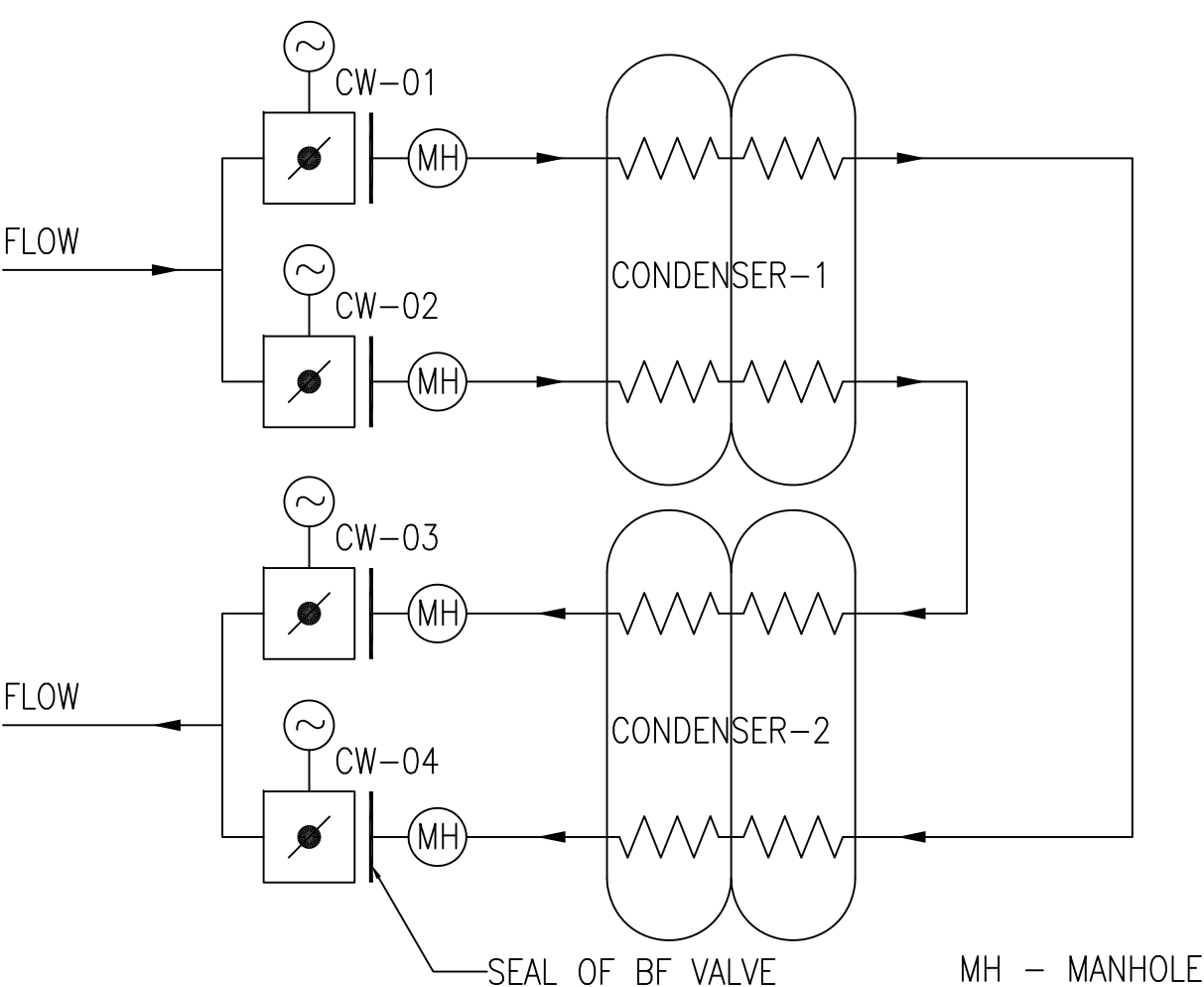
VIEW A-A (RETURN LINE)



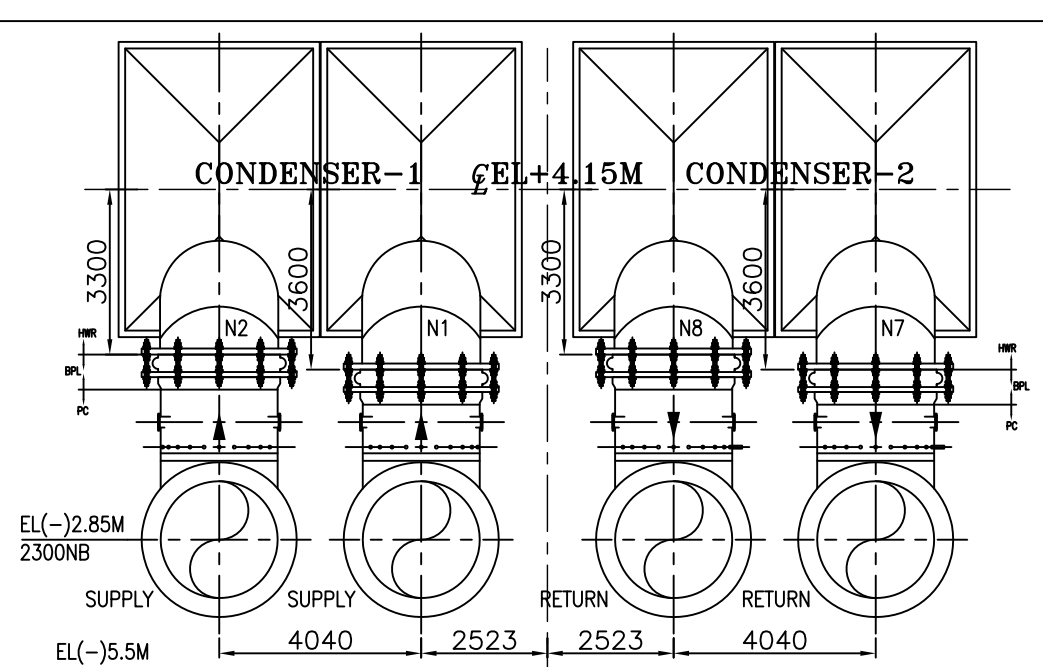
VIEW B-B (SUPPLY LINE)



DETAILS OF BOTTOM SUPPORTS
(S1, S4, S10 & S13) (HOLD)





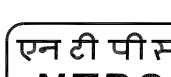

SCHEMATIC LOCATION OF
BUTTERFLY VALVES SEAL







VIEW C-C



- NOTES:—

1. ALL DIMENSIONS ARE IN MM'S AND LEVELS ARE IN METRES.
2. ALL ELEVATIONS INDICATED IN THE DRG. ARE W.R.T. POWER HOUSE GROUND FLOOR ELEVATION AS 0.00M. WHICH CORRESPONDS TO RL-194.5M.
3. DESIGN PRESSURE : 5.0 Kg/sq.cm (g) FOR CW SYSTEM
DESIGN PRESSURE : 7.5 Kg/sq.cm (g) FOR ACW SYSTEM
DESIGN ACW INLET TEMP. TO CONDENSER & VACUUM PUMP HEAT EXCH. = 33°C
DESIGN ACW INLET TEMP. TO PHE'S = 56°C
DESIGN MECHANICAL TEMPERATURE : 30°C
4. FOR MATERIALS OF CONSTRUCTION AND PAINTING/ PROTECTION OF PIPEWORK, KINDLY REFER P&ID – CW AND ACW SYSTEM.
5. ALL PRESSURE TAPPINGS & ROOT VALVES TO BE OF 15NB.
6. INSTRUMENTS MARKED (▲) THUS SHALL BE SUPPLIED ALONGWITH THE EQUIPMENTS.
7. ALL TEMPERATURE TRANSMITTERS FOR TEMPERATURE ELEMENTS AND OTHER REMOTE MEASURING INSTRUMENTS AS INDICATED IN THIS P&ID ARE IN BHEL SCOPE. THEY SHALL BE CONNECTED TO BOP--C&I--TDO--DOCMIS.
8. ALL 2300NB BENDS ARE OF MITRE TYPE WITH RADIUS 0.75D. 2300NB; OD 2340MMxTHK. 20MM.
9. INSTRUMENTS MARKED WITH * ARE FOR PERFORMANCE MEASUREMENT TEST.
10. COMPANION FLANGES FOR BUTTERFLY VALVES SUPPLIED BY BHEL/BPL ARE SUPPLIED ALONG WITH VALVES.
11. REFER COLTCS VENDOR DRAWING FOR COLTCS PIPING LAYOUT.
12. CW SYSTEM: 150NB SIZE DRAIN & VENT VALVES SHALL BE PROVIDED. ARVs OF SIZE 200NB SHALL BE PROVIDED.
13. FOOTINGS OF A--ROW COLUMNS 8/21, 9/22 & 10/23 TO BE KEPT BELOW CW PIT LEVEL SUCH THAT NO PART OF BASE PLATE PROJECTS ABOVE PIT SURFACE.
14. FOOTINGS OF 8/21d*, 10/23d* AND 9/22d* COLUMNS TO BE KEPT BELOW CONDENSER REAR SIDE PIT LEVEL SUCH THAT NO PART OF BASE PLATE PROJECTS ABOVE PIT SURFACE.
15. ORIENTATION OF BPF SHALL BE 

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CUSTOMER			<div></div> <div>THDC INDIA LIMITED (A Joint Venture of Govt. of India & Govt. of U.P.)</div> <div>2x660MW KHURJA SUPER THERMAL POWER PROJECT</div> <div>(TURBINE GENERATOR AND ASSOCIATED PACKAGES)</div>																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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CLAUSE NO.		TECHNICAL REQUIREMENTS			
<div>ANNEXURE IV</div>					
3.00.00	<div>CONDENSER ON LOAD TUBE CLEANING SYSTEM</div> <div><div>(a)</div><div>Sponge rubber ball type tube cleaning system designed for continuous & trouble free operation with provision of abrasive coated balls cleaning in case of hard deposits inside tubes.</div></div> <div><div>(b)</div><div>Suitably sized non clog type ball recirculation pump to inject the cleaning balls into respective CW inlet pipe.</div></div> <div><div>(c)</div><div>Suitable ball injection nozzles.</div></div> <div><div>(d)</div><div>Suitable ball collecting strainer to be provided at CW discharge pipe to collect the cleaning ball and the same will be drawn off to the suction of ball recirculation pump.</div></div>				
KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371		SUB-SECTION-A-3 TURBINE GENERATOR AND AUXILIARIES	
				PAGE 38 OF 92	

CLAUSE NO.	<div> TECHNICAL REQUIREMENTS </div>		
	<div><div>(e) Sufficient capacity ball collecting vessel to hold the full charge of balls</div><div>(f) Necessary piping, fittings and accessories for complete installation of the system.</div><div>(g) Automatic / manual ball sorter to sort out under size balls.</div><div>(h) The system should be complete with necessary instruments, protection and interlocks.</div><div>(i) Provision of manual and automatic back washing system with automatic collection of balls prior to back washing.</div><div>(j) Provision of ball monitoring system, which should at least consist of separate ball circulation monitor and ball oversize monitor.</div><div>(k) The no. of balls in circulation should be at least 10% of nos. of condenser tubes.</div><div>(l) Bidder should indicate the number of ball losses in 1000 hrs. of normal operation.</div><div>(m) Enough provision for homogeneous ball injection and even distribution of balls through out the condenser tubes.</div><div>(n) Provision to avoid any dead zone inside the water box.</div><div>(o) Bidder should ensure that there should not be crowding of balls at the inlet of ball collecting strainer at discharge pipe.</div><div>(p) Provision to prevent losses of ball during normal and abnormal condition including tripping of CW pump.</div><div>(q) Tender Drawing for COLTCS may also be read in conjunction with the specification.</div><div>(r) The ball recirculating pumps, collector, monitor etc. shall be skid mounted.</div></div>		
<div><div>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES</div></div>	<div><div>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371</div></div>	<div><div>SUB-SECTION-A-3 TURBINE GENERATOR AND AUXILIARIES</div></div>	<div><div>PAGE 39 OF 92</div></div>

CLAUSE NO.	<div> QUALITY ASSURANCE </div>
1.00.00	CONDENSER ON LOAD TUBE CLEANING SYSTEM/DEBRIS FILTER FOR MAIN TURBINE CONDENSER AND DRIVE TURBINE CONDENSER (IF OFFERED)
1.01.00	General Requirements Refer QA & I portion of General Technical conditions of technical specification.
1.01.01	Ball Recirculation Pump (a) All rotating parts shall be dynamically balanced. (b) Pump casing shall be subjected to hydraulic test at 1.5 times the shut off head or twice the maximum working pressure whichever is higher. (c) Complete pump assembly shall be subjected to shop performance test at supplier's works.
1.01.02	Ball Sorter / Fabricated Body (housing) (a) In the case of fabricated design, all butt welds shall be subjected to 10% radiographic/ultrasonic examination. All welds shall be examined by 10% magnetic particle testing method to ensure freedom from surface and sub-surface defects. (b) Body shall be subjected to hydraulic pressure test at 1.5 times the design pressure. (c) Performance test shall be carried out on ball sorter assembly.
1.01.03	Strainer (a) Strainer mesh shall be checked for chemical composition and mesh size. (b) Strainer body shall be subjected to hydraulic pressure test at 1.5 times the design pressure. (c) Strainer assembly shall be checked for its function.
1.01.04	The complete system and the individual equipment shall be subjected to performance testing at Site to demonstrate successful operation and performance to meet the design conditions. The tests shall also include hydraulic test, function test, check for interlocks and sequential operation. Site test shall also include test to establish pressure drop across the strainer section, proper functioning of DELTA-P system.
1.01.05	Piping and Fittings Piping and fabricated fittings shall be subjected to following NDT. (a) Butt welds of piping shall be subjected to 10% RT and 10% DP Test. Butt welds of Segmental flanges shall be checked by 100% RT and DPT.
<div><div><div>KHURJA SUPER THERMAL POWER PROJECT (2X660 MW) TURBINE GENERATOR AND ASSOCIATED PACKAGES</div></div><div><div>TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO.: THDC/RKSH/CC-9915-371</div></div><div><div>SUB-SECTION- :E-2 COLTCS</div></div><div><div>PAGE 1 OF 2</div></div></div>	

CLAUSE NO.	QUALITY ASSURANCE		
	<div>एनडीपीसी NTPC</div> <div></div>		
	<p>(b) Fillet welds with load transfer shall be subjected to 100% MPE/DPT and fillet welds without load transfer shall be subjected to 10% MPE/DPT.</p> <p>Wrought/ forged fittings shall be tested as per relevant code/ specification/ standard.</p>		
1.01.06	Coating / lining		
1.01.07	Coating shall be checked for DFT and adhesion. Further, Contractor shall furnish his practice for testing of coating to ensure the uniformity and freedom from pinholes.		
1.01.08	<p>Rubber lined items shall be hydraulically tested before rubber lining. All rubber lining is to be subjected to following tests as per IS-4682 part-I or acceptable equivalent:</p> <p>(a) Adhesion test</p> <p>(b) Check for resistance to bleeding</p> <p>(c) Measurement of thickness</p> <p>(d) Shore hardness test</p> <p>(e) Visual examination and spark test at 5 kv/mm of thickness.</p>		
1.01.09	VALVES Conventional gate/ globe/ check/ ball valves shall be tested as per relevant standard.		
1.02.00	ELECTRICAL AND CONTROL & INSTRUMENTATION: Refer Electrical and Control & Instrumentation Sections of QA&I specification. SITE TEST: Quality requirements for site activities shall be as a minimum, those specified for corresponding shop activities.		



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

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SUB-SECTION - IIA

STANDARD TECHNICAL SPECIFICATION (MECHANICAL)

STANDARD TECHNICAL SPECIFICATION FOR COLTCS

STANDARD QUALITY PLANS



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STANDARD TECHNICAL SPECIFICATION
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1.00.00 GENERAL

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

2.00.00 CODES AND STANDARDS

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

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

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

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

2.02.00 In case of any conflict between the above codes/standards and this specification, the later shall prevail and in case of any further conflict in the matter, the interpretation of the specification by the Engineer shall be final and binding.

3.00.00 DESIGN AND CONSTRUCTION

3.01.00 General Requirements

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

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

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

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



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3.02.00 DELETED

3.03.00 **Operational Requirements.**

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 **Ball Separator**

3.04.01 Ball separator body shall be of rigid construction and shall be designed and manufactured as per the applicable codes for pressure vessels. It shall house the ball separating screen / strainer and shall have flanged inlet, outlet, ball extraction opening and pressure measuring tappings etc. Body shall be designed and manufactured as per the applicable codes for pressure vessels and to take care of forces and moments as enclosed in the specification. However in no case thickness of housing/body shall be less than the connecting pipe thickness as specified in data sheet A

3.04.02 The ball separator shall be provided with manhole with bolted cover and sight glass to observe its internals.

3.04.03 If specified in Data Sheet -A, ball separator body shall be Epoxy lined.



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



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the cooling/lubricating/sealing water requirement.

- 3.05.09 All rotating components shall be statically and dynamically balanced.
- 3.05.10 The pump shall be designed such that pump impellers and other accessories of the pump, are not damaged due to flow reversal.
- 3.05.11 The pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the head Vs. flow characteristic curve over a range or 40% of rated flow to 120 -130 % of rated flow.
- 3.05.12 The pump shall preferably be non-overloading type. The total head Vs. capacity curve shall be continuously rising from the maximum flow point towards shut-off without any zone of instability.
- 3.05.13 The pump shall run smoothly without undue noise and vibration. Peak to peak vibration limits and noise level shall be within the acceptable values of applicable codes/standards.
- 3.05.14 The pump and motor shafts shall be connected through a pin and rubber bush flexible type of couplings. Suitable coupling guards shall be provided for the couplings.
- 3.05.15 The pump shall be capable of being started with discharge valve fully opened. Motor rating shall be adequate for this condition. The output KW rating of the pump drive motor shall not be less than the larger of the following :
- a) Maximum power input to the pump over the entire range for maximum flow to shut-off condition.
 - b) 125% of power input to the pump at duty point corresponding to 103% of the rated speed.
- 3.06.00 **Ball Collector**
- 3.06.01 The body of the ball collector shall be designed to withstand 2.0 times the operating pressure or 1.5 times the recirculating pump shut-off pressure, whichever is higher. The ball collector shall be designed and manufactured as per the applicable codes for pressure vessels.
- 3.06.02 Ball collector shall be provided with an inspection window/sight glass for visual inspection of the cleaning balls.
- 3.06.03 Ball collector shall be provided with suitable ports with covers for ball feeding and removal.
- 3.06.04 The ball collector shall be provided with vent and drain connections with isolating valves.
- 3.06.05 Provision shall be made in the ball collector for separating the undersized balls and ball collector shall have a separate chamber for collecting the undersized balls.



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

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

3.07.00 **Differential Pressure Measuring System.**

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

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

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

3.08.00 **Ball Monitoring System**

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

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

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

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

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



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

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

3.09.00 **Cleaning Balls**

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

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

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

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

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

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

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

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

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

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



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

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

3.11.00 **Actuators**

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

3.12.00 **Electric Motors**

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

3.13.00 **Instrumentation and Control System.**

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

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


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


3.14.00 **Other Accessories.**

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

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

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

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

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



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

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

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

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

5.08.00 **Dimensional Checks.**

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

5.09.00 **Hydrostatic Test**

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

5.10.00 **Leakage Test**

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

5.11.00 **Performance Test on Recirculating Pump**

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

5.12.00 **Functional Tests**

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

5.12.01 Smooth and free operation of all movable parts.

5.12.02 Interlock and sequential operation.

5.12.03 Satisfactory operations of ball monitoring system.



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

6.00.00 **TESTING AT SITE**

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

7.00.00 **QUALITY ASSURANCE & QUALITY PLAN**

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

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

8.00.00 **NAME PLATE AND TAG NUMBERS**

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

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

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


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

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

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

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



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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:-

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

1.01.03 Bar chart and inspection schedule.

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

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

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


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

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

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

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



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

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

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			QUALITY PLAN				SPEC. NO		PE-1S-417/435-165-N002		DATE:	
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ITEM: COLTCS			CW SYSTEM				SECTION:		SHEET 01 OF 12		DATE: 28.02.2020	
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	10	11		
1.0.0	Ball Separator				M	CN						
1.1.0	Raw Material											
[a]	Housing Shell, Nozzle flanges	Chemical properties & Physical MA Surface defects	MA	Chemical Analysis & Mechanical test Visual	One sample/cast 100%	Approved dig/Data sheet Approved dig/Data sheet	Approved dig/Data sheet Approved dig/Data sheet	Test Certificate / Lab test report	V	V		
	Sub Surface Defects	MA	Ultrasonic test	100%	ASME SA 435	ASME SA 435	Inspection report	V	P	V		
	Chemical properties & Physical MA Surface defects	MA	Chemical Analysis & Mechanical test Visual	One sample/heat 100%	Approved dig/Data sheet Approved dig/Data sheet	Approved dig/Data sheet Approved dig/Data sheet	Test Certificate / Lab test report	V	P	V		
	Leak Tightness	MA	Hydrostatic test	100%	Approved dig/Data sheet	Approved dig/Data sheet	Test Certificate	V	P	V		
	Chemical properties & Physical MA Heat treatment (Normalising)	MA	Chemical Analysis & Mechanical test Verification	One sample/cast 100%	Approved dig/Data sheet Approved dig/Data sheet	Approved dig/Data sheet Approved dig/Data sheet	Test Certificate	V	P	V		
	Surface defects	CR	Magnetic particle test	100%	Approved dig/Data sheet	Approved dig/Data sheet	Inspection report	V	P	V		
	Sub-surface defects	CR	Ultrasonic test	100%	ASME SA609 / SA 435	ASME SA609 Level II / SA 435 / SA 388	Inspection report	V	P	V		
	Chemical properties & Physical MA	MA	Chemical Analysis & Mechanical test	One sample/heat 100%	Approved dig/Data sheet	Approved dig/Data sheet	Test Certificate / Lab test report	V	P	V		

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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS

QUALITY PLAN

CUSTOMER: PROJECT: ITEM: COLTCS

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DATE: 28.02.2020

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DATE:

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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Surface defects on machined area	CR	Penetrant test	100%	ASME Sec. VIII Div. 1	ASME Sec. VIII Div. 1 Appendix 8	Inspection report	V	P	V	V	V	
		Sub-surface defects	CR	Ultrasonic test	100%	ASME SNT-45	ASME SNT-45	Inspection report	V	P	V	V	V	
		Chemical properties & Physical properties	MA	Chemical Analysis & Mechanical test	One sample / One heat	Approved dig/Data sheet	Approved dig/Data sheet	Test Certificate / Lab report	V	P	V	V	V	
		Corrosion Resistance	MA	IGC	One/Heat	ASTM A 923	ASTM A 923	Test Report/Lab test report	V	P	V	V	V	
		Surface Defects	MI	Visual	100%	Approved dig/Data sheet	Approved dig/Data sheet	Inspection report	V	P	V	V	V	
		Chemical properties & Physical properties	MA	Chemical Analysis & Mechanical test	One sample / One heat / One sample / One heat / One sample / One heat	Approved dig/Data sheet	Approved dig/Data sheet	Test Certificate / Lab report	V	P	V	V	V	
		Surface Defects	MI	Visual	100%	Approved dig/Data sheet	Approved dig/Data sheet	Inspection report	V	P	V	V	V	
		Leak Tightness	MA	Hydrostatic Test	100%	Approved dig/Data sheet	Approved dig/Data sheet	Test Certificate	V	P	V	V	V	
1.2.0	Improcess Quality Control													
1.2.1	Welding procedure specification	Correctness	CR	Security	100%	ASME Sec. IX	ASME Sec. IX	QW 482 of ASME Sec. IX	V	P	V	V	V	
1.2.2	Welding procedure qualification	Weld soundness	CR	Physical test	100%	ASME Sec. IX	ASME Sec. IX	QW 483 of ASME Sec. IX	V	P	V	V	V	
1.2.3	Welder performance qualification	Weld soundness	CR	Radiography	100%	ASME Sec. IX	ASME Sec. IX	QW 484 of ASME Sec. IX	V	P	V	V	V	
1.2.4	Fit-up of butt weld	Alignment and dimensions	MA	Template, visual	100%	Manufacturing Drawing	ASME Sec. VIII Div. 1	Log book	V	P	V	V	V	
1.2.5	Fit-up of shell flange and nozzle assembly to shell	Orientation, alignment and dimensions	MA	Template, visual	100%	Manufacturing Drawing	ASME Sec. VIII Div. 1	Log book	V	P	V	V	V	

ENGINEERING		BHEL		QUALITY		BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL	
Sign & Date	Name	Sign & Date	Name	Sign & Date	Name	Doc No.	Sign & Date	Name	Seal
Prepared by: <i>[Signature]</i>	Nishant Sekhar	Checked by: <i>[Signature]</i>	Ashish Panigrahi						
Reviewed by: <i>[Signature]</i>	Vishal Kumar	Reviewed by: <i>[Signature]</i>	R K Jaiswal						

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			QUALITY PLAN			SPEC. NO		PE-15-417/435-165-N002		DATE:	
CUSTOMER: -----			PROJECT: -----			OP NO.:		PE-OP-417-165-N002		DATE: 28.02.2020	
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1	2	3	4	5	6	7	8	9	11		
1.3.0	Rubber Lining for ball Separator Shell, V-piece & skid IC Pipe-(Applicable for Sea Water application)				M	C/N					
1.3.1	Rubber formulation	Tensile elongation and hardness	MA	Physical test	One per lot	Manufacturer's procedure	BS 6374/Equivalent	Manufacturer's test certificate	V	P	V
		Polymer Identification	MA	Flame test	One per lot	For Same Ebonite	For Same Ebonite	Inspection report	V	P	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				
1.3.2	Surface preparation of items to be lined	% Change in weight after 24 hrs immersion in sea water at 70 degrees	MA	Immersion test (bleeding test)	One per lot	ASTM D 471	+/- 1 %	Inspection report	V	P	V
		Free from rust, scale, dust and grease	MA	Visual	100%	SA 2.5	SA 2.5	Inspection report		P	-
1.3.3	Vulcanising	Temperature, Pressure and time	MA	Process monitoring	100%	Manufacturer's procedure	Manufacturer's procedure	Process Procedure		P	-
		a) Chip test	MA	Chip test	One per lot	Approved drawing BS 6374/Equivalent	BS BS 6374/Equivalent	Inspection report	V	P	V
1.3.4	Vulcanised rubber lined flanges	b) Adhesion, Visual defects, thickness and hardness	MA	Measurement, Visual inspection	100% visual	Approved drawing BS 6374/Equivalent	BS BS 6374/Equivalent	Inspection report	V	P	V
		c) Spark test for Pin holes at 3 kv/mm	MA	Spark test for Pin holes	100%	Approved drawing BS 6374/Equivalent	BS BS 6374/Equivalent	Inspection report	V	P	V

ENGINEERING		QUALITY		BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
Sign & Date	Name	Sign & Date	Name	Sign & Date	Doc No.	Sign & Date	Name	Seal	
Prepared by: <i>Arun Kumar</i>	Mishant Sekhar	Checked by: <i>Ashish Panigrahi</i>	Ashish Panigrahi			Prepared by:			
Reviewed by: <i>Geetha</i>	Vishal Kumar Yadav	Reviewed by:	R K Jaiswal			Reviewed by:			



MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS

QUALITY PLAN


CUSTOMER :
PROJECT :
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SYSTEM: CW SYSTEM

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DATE: 28.02.2020
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DATE: 28.02.2020
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Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Form of Record	Remarks
1	2	3	4	5	6	7	8	9	11
		Reduction Ratio			M	CIN			
		Angle of Rotation							
		Input Torque							
		Output Torque							
1.4.0	Complete Unit of Worm gear	Degree of protection	CR	Functional Test	100%	Approved Data Sheet	Approved Data Sheet	Test Certificate	
		Water & Dust ingress tests			Type test	Approved Data Sheet	Approved Data Sheet	Type test certificate	
		Routine Test	MA		Type test	Supplier catalogue	Supplier catalogue / Approved Data Sheet	Test Certificate	
		Make, Range, Model	MA			Supplier catalogue	Supplier catalogue / Approved Data Sheet		
		Assembly check alongwith ball valves	MA			Supplier catalogue	Supplier catalogue / Approved Data Sheet		
1.5.0	Actuators	Functional check alongwith settings/auxiliary contacts	MA	Visual	100%	Supplier catalogue	Supplier catalogue / Approved Data Sheet	Inspection Report	

ENGINEERING		QUALITY		BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL	
Sign & Date	Name	Sign & Date	Name	Sign & Date	Doc No.	Sign & Date	Seal
Prepared by: <i>[Signature]</i>	Meharant Sakhar	Checked by: <i>[Signature]</i>	Ashish Panigrahi				
Reviewed by: <i>[Signature]</i>	Vishal Kumar Yadav	Reviewed by: <i>[Signature]</i>	R K Jaiswal				

			MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			QUALITY PLAN				SPEC. NO		DATE:		
			CUSTOMER : PROJECT : ITEM: COLTOS			SYSTEM: CW SYSTEM			QP NO.:		PE-QP-417-165-N002		DATE: 28.02.2020	
									PO NO.:		DATE:			
									SECTION:		SHEET 06 OF 12			
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency			Remarks		
1					M	CN								
2.0.0	Complete Skid													
	Recticulating Skid with ball vessel	Completeness, Correctness, Orientation, Dimensions	MA	Visual & Measurement	100%	Approved Drawing	Approved Drawing	Inspection report	V	P	V	V		
2.1.0	Ball Vessel													
	Raw Material													
[e]	Housing Shell, Nozzle flanges and dish end	Chemical properties & Physical properties	MA	Chemical Analysis & Mechanical test	One sample/heat	Approved dryData sheet	Approved dryData sheet	Test Certificate / lab test report	V	P	V	V		
		Surface defects	MA	Visual	100%	Approved dryData sheet	Approved dryData sheet	Test Certificate/Inspection report	V	P	V	V		
		Sub-surface defects	MA	Ultrasonic test	100%	ASME SA 435	ASME SA 435	Inspection report	V	P	V	V	Plates > 20mm Thk only (UT - Full Volume)	
2.2.0	Improve Quality Control													
2.2.1	Welding procedure specification	Correctness	CR	Scrutiny	100%	ASME Sec.IX	ASME Sec.IX	QW 482 of ASME Sec.IX	V	P	V	V		
2.2.2	Welding procedure qualification	Weld soundness	CR	Physical test	100%	ASME Sec.IX	ASME Sec.IX	QW 483 of ASME Sec.IX	V	P	V	V	Welding procedure already approved b BH&EL/ROAG/DNV/UV shall be employed for this job.	
2.2.3	Welder performance qualification	Weld soundness	CR	Radiography	100%	ASME Sec.IX	ASME Sec.IX	QW 484 of ASME Sec.IX	V	P	V	V	Welders already qualified by BH&EL/ROAG/DNV/UV shall be employed for this job.	
2.2.4	Dished end for ball vessel	Dimensions	MA	Template	100%	Manufacturing Drawing	ASME Sec VIII Div.1	Inspection report	V	P	V	V		
		Surface defects	CR	Penetrant test	100%	ASME Sec VIII Div.1	ASME Sec VIII Div.1 Appendix 8	Inspection report	V	P	V	V		
ENGINEERING			QUALITY			BIDDER/ SUPPLIER			FOR CUSTOMER REVIEW & APPROVAL					
Sign & Date			Name			Sign & Date			Doc No:			Sign & Date		
Prepared by: <i>[Signature]</i>			Mishant Sakhar			QW 482 of ASME Sec.IX			Prepared by:					
Reviewed by: <i>[Signature]</i>			Vishal Kumar			R K Jaiswal			Reviewed by:					



MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS

QUALITY PLAN

CUSTOMER :
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1	2	3	4	5	6	7	8	9	M C N	11
2.2.5	Fit-up of butt weld	Alignment and dimensions	Major	Measurement	100%	Manufacturing Drawing	ASME Sec VIII Div. 1	Log book	V	BHEL to witness > 20mm thick butt joint.
2.2.6	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	V	
2.2.7	Weld quality for Pressure Parts									
	[a] Root run	Surface defects	MA	Penetrant test / Visual	100%	ASME Sec VIII Div. 1 Appendix 8	ASME Sec VIII Div. 1 Appendix 8	Operation Process Sheet	V	
		1. Surface defects	MA	Penetrant test	100%	ASME Sec VIII Div. 1 Appendix 8	ASME Sec VIII Div. 1 Appendix 8	Inspection report	V	
2.2.8	[a] Completed butt welds	2. Sub-surface defects	CR	Radiography test	10% of total weld length & 100% T joints	ASME Sec VIII Div. 1 Appendix 4 / UW 52	ASME Sec VIII Div. 1 Appendix 4 / UW 52	Radiographs and inspection report	V	RT films will be reviewed by BHEL.
	[b] Completed fillet welds	Surface defects	MA	Penetrant test	100%	ASME Sec VIII Div. 1 Appendix 8	ASME Sec VIII Div. 1 Appendix 8	Inspection report	V	
		1. Dimensions, Orientation	MA	Measurement	100%	Manufacturing Drawing	Manufacturing Drawing	Inspection report	V	
2.2.9	Fabricated Shell	2. Hydro test for Ball Vessel	CR	Hydrostatic Pr. @ 1.5 times design pr. (positive) (Duration 30 minutes)	100%	ASME Sec VIII Div. 1	No leakage	Inspection report	V	Hydrostatic test shall be conducted along with Recirculating sldd Assy for Ball Vessel.
	Picking and Passivation	Protection Layer	MA	Visual	100%	IS : 10117	IS : 10117	Log Book	V	
2.2.10		Chemical Physical properties	MA	Chemical & mechanical tests	One sample/heat	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / Lab test report / raw material flow sheet	V	
		Surface defects	MI	Visual	100%	Approved drg/ Data sheet	Approved drg/ Data sheet	Test Certificate/ Inspection report	V	
2.2.11	Ball Injection Pipe	Leak Tightness	MA	Hydrostatic test	100%	Approved drg/Data sheet	Approved drg/Data sheet	Test Certificate	V	

ENGINEERING			QUALITY			BIDDER/ SUPPLIER			FOR CUSTOMER REVIEW & APPROVAL		
Sign & Date	Name	Checked by	Sign & Date	Name	Seal	Doc No:	Sign & Date	Name	Seal		
Prepared by: <i>A. Anand Kumar</i>	Mishant Sekhar	Checked by: <i>A. Anand Kumar</i>	28.02.2020	Ashish Pangrhi							
Reviewed by: <i>Vishal Kumar</i>	Vishal Kumar	Reviewed by: <i>R. K. Jaiswal</i>	28.02.2020	R. K. Jaiswal							

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1	BALL RECIRCULATING PUMP				M	C/N				M	10	C	N		
2.3.0	Raw material control	Chemical/Physical properties	MA	Chemical & Physical analysis	One Sample/Cast Heat	Approved dry Data sheet	Approved dry/ Data sheet	Test Certificate	V	P	V	V			
2.3.1	Casing	Surface defects	MA	Visual	200%	Approved dry Data sheet	Approved dry/ Data sheet	Test Certificate	V	P	V	V			
2.3.2	Impeller, Sleeve	Physical and Chemical properties	MA	Physical and Chemical analysis	One Sample/Cast Heat	Approved dry Data sheet	Approved dry/ Data sheet	Test Certificate	V	P	V	V			
2.3.3	Shaft	Physical and Chemical properties	MA	Physical and Chemical analysis	One Sample/Cast Heat	Approved dry Data sheet	Approved dry/ Data sheet	Test Certificate	V	P	V	V			
2.3.4	In-process control	Sub-Surface defects	MA	Ultrasonic Test	100%	ASME SA 745	ASME SA 745	Test Certificate/ Inspection report	V	P	V	V	Only for shaft >= 50mm		
2.3.5	Casing	Leak tightness	CR	Hydro. test @ 1.5 times design pr. (positive) (Duration 30 minutes)	100%	Manufacturing Standard	No Leakage	Inspection report	V	P	V	V			
2.3.6	Shaft	Surface defects	CR	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	V	P	V	V			
2.3.7	Impeller	Residual static, dynamic imbalance	MA	Static/dynamic balancing	100%	ISO:1940	ISO:1940, Gr.6.3	Inspection report	V	P	V	V			
2.3.8	All components	Workmanship, finish and dimensions	MA	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. Pump efficiency / overall efficiency, Q Vs. Power, Vibration and Noise b) Dimensions, workmanship and finish c) Noise level Completeness, correctness, cleanliness	CR	Performance test	100%	Approved curve, approved data sheet, IS:5120	Approved data sheet	Inspection report, plotted curves	V	P	V	V			
				Measurement, visual	100%	Data sheet	Data sheet	Inspection report, plotted curves	V	P	V	V			
				Measurement	100%	--	85 db at 1 meter distance	Inspection report, plotted curves	V	P	V	V			
2.3.10	Complete pump	Completeness, correctness, cleanliness	MA	Visual examination	100%	Approved data sheet / Mfg. Dwg.	Approved data sheet / Mfg. Dwg.	Check list/ inspection report	V	P	V	V			

ENGINEERING		QUALITY		BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL	
Sign & Date	Name	Sign & Date	Name	Sign & Date	Doc No.	Sign & Date	Name
Prepared by: <i>[Signature]</i>	Nishant Sekhar	Checked by: <i>[Signature]</i>	Ashish Panigrahi	Seal			
Reviewed by: <i>[Signature]</i>	Vishal Kumar Yadav	Reviewed by: <i>[Signature]</i>	R K Jaiswal				



MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS

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Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Remarks
1									
2.4.0	Ball valves				M	C/N			
2.4.1	Materials								
	Body and Tail end pieces	Chemical/Physical properties	MA	Chemical & Physical analysis	One Sample/Cast heat	Approved dtg/ Data sheet	Approved dtg/ Data sheet	Test Certificate	V P V V
2.4.2	Ball	Chemical/Physical properties	MA	Chemical & Physical analysis	One Sample/Cast heat	Approved dtg/ Data sheet	Approved dtg/ Data sheet	Test Certificate	V P V V
2.4.3	Stem	Chemical/Physical properties	MA	Chemical & Physical analysis	One Sample/Cast heat	Approved dtg/ Data sheet	Approved dtg/ Data sheet	Test Certificate	V P V V
2.4.4	In-process inspection								
2.4.5	Machining of body, end, pieces, ball	Dimension	MA	Measurement	100%	Approved dtg/Data sheet	Approved dtg/Data sheet	Log book	V P V V
2.4.6	Ball	a) Surface defects b) Hardness	CR MA	Penetrant test Hardness testing	100% Random	ASME Sec.VIII Div.1 Appendix 8 Approved dtg/Data sheet	ASME Sec.VIII Div.1 Appendix 8 Approved dtg/Data sheet	Inspection report Inspection report	V P V V
2.4.7	Assembly	a) Dimensions b) Opening / Closing	MA MA	Measurement Operation	100% 100%	EN ISO 17292 As per approved data sheet	EN ISO 17292 As per approved data sheet	Test Certificate Inspection report	V P V V
2.4.8	Testing								
	(a) Body	Leakage	CR	Hydraulic test	100%	EN 12266-1&2/API 598 598/Aspd data sheet	EN 12266-1&2/API 598 598/Aspd Data sheet	Test Certificate	V P V V
	(b) Seat test	Leakage	CR	Hydraulic test	100%	EN 12266-1&2/API 598 598/Aspd data sheet	EN 12266-1&2/API 598 598/Aspd Data sheet	Test Certificate	V P V V
	(c) Seat	Leakage	CR	Air test	100%	EN 12266-1&2/API 598 598/Aspd data sheet	EN 12266-1&2/API 598 598/Aspd Data sheet	Test Certificate	V P V V

ENGINEERING		BHEL		QUALITY		BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
Sign & Date	Name	Sign & Date	Name	Sign & Date	Seal	Doc No:	Sign & Date	Name	Seal		
Prepared by: <i>Ashish Panigrahi</i>	Nishant Sekhar	Checked by: <i>Ashish Panigrahi</i>	Ashish Panigrahi								
Reviewed by: <i>Vishal Kumar Yadav</i>	Vishal Kumar Yadav	Reviewed by: <i>R K Jaiswal</i>	R K Jaiswal								




MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS


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1	2	3	4	5	6	7	8	9	10			11
3.1.0	V - Piece				M	C/N						
	Raw material inspection	Chemical & Physical properties	MA	Chemical & mechanical tests	One sample/heat	Approved drg/Data sheet	Approved drg/Data sheet	Test Certificate / lab report	V	P	V	
	In process inspection	a) Surface defects	MA	Visual	100%	Approved drg/ Data sheet	Approved drg/ Data sheet	Test Certificate / Inspection report	V	P	V	
		b) Sub-surface defects	CR	Radiography test	10% of total butt weld length	ASME Sec.VIII Div.1 Appendix 4	ASME Sec.VIII Div.1 Appendix 4	Inspection report	V	P	V	
		d) Hydro Static Test	CR	Hydrostatic test @ 1.5 times design pr. (positive) [Duration 30 minutes]	100%	ASME Sec.VIII Div.1	No leakage	Inspection report	V	P	V	

ENGINEERING			QUALITY			BIDDER/ SUPPLIER			FOR CUSTOMER REVIEW & APPROVAL		
Prepared by:	Sign & Date	Name	Sign & Date	Name	Seal	Doc No:	Sign & Date	Name	Seal		
Reviewed by:		Nishant Sekhar		Ashish Pangrani							
		Vishal Kumar		R K Jaiswal							

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS										QUALITY PLAN																			
										CUSTOMER: _____ PROJECT: _____ ITEM: COLTCS _____																			
										SYSTEM: _____										SPEC. NO. PE-TS-417/435-165-N002									
										CW SYSTEM										QP NO.: PE-QP-417-165-N002 PO NO.: _____ DATE: 28.02.2020									
BHEL										BIDDER/ SUPPLIER																			
ENGINEERING										QUALITY																			
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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS				QUALITY PLAN				SPEC. NO		DATE:	
				CUSTOMER :				PE-1S-417/435-165-N002		DATE: 28.02.2020	
				PROJECT :				PE-QP-417-165-N008		DATE: 28.02.2020	
				ITEM: COLTOS				SYSTEM: CW SYSTEM		SHEET 12 OF 12	
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency	Remarks	
1	Cleaning Balls										
5.0.0	Normal balls										
	Abrasive balls									Quantity and type of balls to be checked with details	
6.1.0	Internal Fasteners (Duplex Steel)	Chemical & Physical properties	MA	Chemical & Mechanical analysis	1 Per heat/TT Batch	Approved Data sheet	Approved Data Sheet	Test Certificate / Lab report	V	V	
	Visual workmanship finish	MA	Visual	Sample	1 Per heat/TT Batch	Approved Data sheet	Approved Data Sheet	Test Certificate / Lab report	V	V	
	Dimensions	MA	Measurement	Sample	Sample	Approved Data sheet	Approved Data Sheet	Inspection Report	V	V	
	Visual	MA	Visual	Sample	Sample	Approved Data sheet	Approved Data Sheet	Inspection Report	V	V	
6.2.0	Main Fasteners	Chemical & Physical properties	MA	Chemical & Physical test	1 sample per heat	Approved Data sheet	Approved Data Sheet	Test Certificate / Lab report	V	V	
	Dimensions	MA	Measurement	Sample	sample per heat	Approved Data sheet	Approved Data Sheet	Test Certificate / Lab report	V	V	
	Visual	MA	Visual	Sample	sample per heat	Approved Data sheet	Approved Data Sheet	Test Certificate / Lab report	V	V	
6.3.0	All Components / Equipments	Painting Dry film thickness and Visual	MA	Measurement	Random	Painting schedule	Painting schedule	Inspection report	V	V	
	Packing	MA	Measurement	100%	200%	Packing Procedure/ Technical Specification	Packing Procedure/ Technical Specification	Inspection report	V	V	

LEGENDS:

* RECORDS, IDENTIFIED WITH 'TICK' (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** M: SUPPLIER MANUFACTURER/ SUB-SUPPLIER, C: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, N: CUSTOMER.


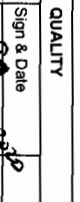
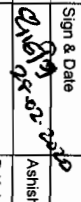
P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE


MA: MAJOR, MI: MINOR, CR: CRITICAL

NOTE:

1. Photographs of the wooden box (with LR No.) in which items are finally packed as per approved packing procedure is to be submitted to BHEL, (wherever applicable) before dispatch.


2. Clearance for dispatch of items will be given only after receipt of above photos

ENGINEERING		QUALITY		BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
Sign & Date	Name	Sign & Date	Name	Sign & Date	Doc No:	Sign & Date	Name	Seal	
Prepared by: 	Nishant Sekhar	Checked by: 	Ashish Panigrahi						
Reviewed by: Vishal Kumar Yadav		Reviewed by: 	R K Jaiswal						

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS		QUALITY PLAN					SPEC. NO.: PE-TS-020-100-M004			DATE: 24.01.2020		
			CUSTOMER :					QP NO.: PE-QP-020-100-M006			DATE: 27.01.2020		
			PROJECT:					PO NO.: LATER			DATE:		
			ITEM: GM BALL VALVES (SIZE 15 TO 50NB/ PN16), FSS/FCS BALL VALVES (SIZE 15 TO 50NB / CLASS 800) & CSS/CCS (SIZE 65 TO 200 NB/ CLASS 150)			SYSTEM: L.P. VALVES		SECTION: II			SHEET 1 OF 4		
SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY		REMARKS	
1	2	3	4	5	6	7	8	9	* D	**			
					M C/N					M	C	N	


1.0	MATERIALS												
1.1	BODY, END PIECES BALL, SPINDLE, GLAND, LEVER, FASTENERS	1. PHYSICAL, CHEMICAL PROPS.	MA	PHYSICAL, CHEM. TESTING	ONE PER BATCH/ LOT/ HEAT	APPD. DRG. / REL. STD.	APPD. DRG./ REL. STD.	MILL T.C.	√	P/W	V	-	CORRELATION REQD. FOR BODY & END PIECES W.R.T. HEAT Nos.
		2. HEAT TREATMENT	CR	REVIEW OF H.T. RECORDS	100%	-DO-	-DO-	H.T. INTERNAL INSPN. RECORDS	√	P/W	V	-	
		3. SURFACE DEFECTS	MA	VISUAL	100%	MSS-SP-55	FREE FROM DEFECTS	INSPN. REPORT	√	P/W	V	-	
1.2	BODY, END PIECES	1. SURFACE DEFECTS	CR	PENETRANT TEST	100%	ASTM E 165	ANSI B 16.34	TEST REPORT	√	P/W	V	-	APPLICABLE ONLY FOR SS CASTINGS.
1.3	GEAR BOX												
1.3.1	GEAR, WORM GEAR & SHAFT	1. PHYSICAL, CHEMICAL PROPS.	MA	PHYSICAL, CHEM. TESTING	ONE PER BATCH	REL. STD./ DATA SHEET/ MFG. DRG.	REL. STD./ DATA SHEET/ MFG. DRG.	T.C.	√	P/W	V	V	
		2. HARDNESS	MA	MEASUREMENT	100%	REL. STD./ DATA SHEET/ MFG. DRG.	REL. STD./ DATA SHEET/ MFG. DRG.	T.C.	√	P/W	V	V	
1.3.2	GEAR BOX ASSEMBLY	1. APPEARANCE	MA	VISUAL	100%	DRG./DATA SHEET	DRG./DATA SHEET	INSPN. REPORT	√	P/W	V	V	
		2. PERFORMANCE	MA	OPERATION TEST	100%	DRG./DATA SHEET	DRG./DATA SHEET	SUPPLIER T.C.	√	P/W	V	V	
		3. DIMENSIONS	MA	MEASUREMENT	100%	REL STD./ DATA SHEET/ MFG. DRG.	REL STD./ DATA SHEET/ MFG. DRG.	INSPN. REPORT	√	P/W	V	V	
1.3.3	DESIGN VERIFICATION OF GEAR BOX	1. TORQUE CAPABILITY	MA	TESTING (TORQUE AT TWICE OF RATED TORQUE OF GEAR BOX)	ONE/ TYPE/MODEL/ RATED TORQUE	APPROVED PROCEDURE	APPROVED PROCEDURE	T.C.	√	P/W	V	V	REFER NOTE No. 1

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:		Rahul Kadam	Checked by:		Krishna Kumar Yadav			Reviewed by:			
Reviewed by:		Sweta Singhal	Reviewed by:		Ritesh Kumar Jaiswal			Approved by:			

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS		QUALITY PLAN					SPEC. NO.: PE-TS-020-100-M004		DATE: 24.01.2020	
			CUSTOMER :					QP NO.: PE-QP-020-100-M006		DATE: 27.01.2020	
			PROJECT:					PO NO.: LATER		DATE:	
			ITEM: GM BALL VALVES (SIZE 15 TO 50NB/ PN16), FSS/FCS BALL VALVES (SIZE 15 TO 50NB / CLASS 800) & CSS/CCS (SIZE 65 TO 200 NB/ CLASS 150)			SYSTEM: L.P. VALVES		SECTION: II		SHEET 2 OF 4	
SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY		REMARKS
1	2	3	4	5	6	7	8	9	* D	** M C N	
					M C/N						


		2. GEAR BOX P.O.D. (LIFE CYCLE TEST)	MA	CYCLE TESTING	ONE/ TYPE/MODEL/ RATED TORQUE		APPROVED PROCEDURE	APPROVED PROCEDURE	T.C.	√	P/W	V	V	REFER NOTE No. 1
2.0	IN PROCESS INSPECTION													
2.1	MACHINING OF ALL COMPONENTS	1. DIMENSIONS	MA	MEASUREMENT	100%		MFG. DRG.	MFG. DRG.	LOG BOOK	-	P/W	-	-	
		2. SURFACE FINISH	MA	VISUAL	100%		MFG. DRG.	MFG. DRG.	LOG BOOK	-	P/W	-	-	
		3. HARDNESS (FOR BALL AND SPINDLE)	MA	HARDNESS TESTING	100%		APPD. DRG. / REL. STD.	APPD. DRG. / REL. STD.	T.C.	√	P/W	V	V	
		4. SURFACE DEFECTS	CR	PENETRANT TEST	100%		ASTM E 165	ANSI B16.34	T.C.	√	P/W	V	-	FOR BALL, SPINDLE SEATS & MACHINED SURFACES.
3.0	BEFORE GALVANISING - SHELL TEST FOR PRESSURE PARTS (FOR CS VALVES ONLY)													
3.1	BODY, END PIECES (PRESSURE PARTS)	LEAK TIGHTNESS	CR	HYDRAULIC TEST	100%		APPD. DRG.	NO LEAKAGE	T.C.	√	P/W	V	-	
4.0	HOT DIP GALVANIZING OF CARBON STEEL BODY, END PIECES AND ALL OTHER CARBON STEEL VALVE PARTS	1. FREEDOM FROM SURFACE DEFECTS	MA	VISUAL	100%		IS:2629	IS:2629	INSPN REPORT	√	P/W	V	-	
		2. UNIFORMITY IN THICKNESS	MA	THICKNESS	VALVE BODY AT RANDOM		IS:2629	IS:2629	INSPN REPORT	√	P/W	V	V	THICKNESS 50 MICRONS (MIN.) TO BE CHECKED WITH ELCOMETER ##
		3. ADHESION	MA	KNIFE TEST	-DO-		IS:2629	IS:2629	INSPN REPORT	√	P/W	V	V	
5.0	ASSEMBLY OF ALL VALVE													
5.1	BALL AND SEAT	MIRROR FINISH (BALL)	CR	BUFFING/ GRINDING/ MACHINING	100%		THE SURFACE SHALL BE SMOOTH AND SHALL HAVE UNIFORM CONTACT WITH SOFT SEAT		LOG BOOK	√	P/W	V	V	
6.0	FINAL TESTING													
6.1	ASSEMBLY	1. DIMENSIONS	MA	MEASUREMENT	100%	10% #	APPD. DRG.	APPD. DRG.	INSPN. REPORT	√	P/W	W	W	

BHEL					BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY		Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name			Sign & Date	Name	Seal
Prepared by:		Rahul Kadam	Checked by:		Krishna Kumar Yadav		Reviewed by:			
Reviewed by:		Sweta Singhal	Reviewed by:		Ritesh Kumar Jaiswal		Approved by:			

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS		QUALITY PLAN						SPEC. NO.: PE-TS-020-100-M004			DATE: 24.01.2020		
			CUSTOMER :						QP NO.: PE-QP-020-100-M006			DATE: 27.01.2020		
			PROJECT:						PO NO.: LATER			DATE:		
			ITEM: GM BALL VALVES (SIZE 15 TO 50NB/ PN16), FSS/FCS BALL VALVES (SIZE 15 TO 50NB / CLASS 800) & CSS/CCS (SIZE 65 TO 200 NB/ CLASS 150)				SYSTEM: L.P. VALVES		SECTION: II			SHEET 3 OF 4		
SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	* D	**				
					M					C/N	M	C		N

		2. OPENING/ CLOSING	MA	OPERATION	100%	10% #	SMOOTH OPERATION OF VALVE	SMOOTH OPERATION OF VALVE	-DO-	√	P/W	W	W	
			MA	TORQUE TESTING	100%	10% #	TORQUE CALCULATIONS	TORQUE WITHIN CALCULATED VALUE	-DO-	√	P/W	W	W	For 200NB size valve
		3. APPEARANCE: WORKMANSHIP, ORIENTATION, MARKING, TAG No.	MA	VISUAL	100%	10% #	APPD. DRG.	APPD. DRG.	INSPN. REPORT	√	P/W	W	W	
6.2	BODY	1. LEAK TIGHTNESS	CR	HYDRAULIC TEST	100%	10% #	APPD. DRG.	NO LEAKAGE	T.C.	√	P/W	W	W	
6.3	SEAT	1. LEAK TIGHTNESS	CR	-DO-	100%	10% #	-DO-	-DO-	-DO-	√	P/W	W	W	
		2. LEAK TIGHTNESS	CR	PNEUMATIC TEST	100%	10% #	-DO-	REL. STD.	-DO-	√	P/W	W	W	
6.4	COMMISSIONING SPARES	WORKMANSHIP & SUITABILITY	MA	VISUAL	100%	100%	-DO-	APPD. DRG.	INSPN. REPORT	√	P/W	W	-	
7.0	PACKING IN WOODEN CASES AND MARKING	SOUNDNESS OF PACKING	MA	VISUAL	100%		APPD. DRG.	APPD. DRG.	SOFT COPY OF PHOTOGRAPHS	-	P	V	-	<p>Vendor to provide the following to BHEL-PEM for verification:</p> <p>a) Photographs of valves duly placed inside the wooden box just before final packing.</p> <p>b) Photographs of the wooden box in which valves have been finally packed just before dispatch.</p> <p>Clearance for dispatch</p>

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:		Rahul Kadam	Checked by:		Krishna Kumar Yadav			Reviewed by:			
Reviewed by:		Sweta Singhal	Reviewed by:		Ritesh Kumar Jaiswal			Approved by:			

	MANUFACTURER/BIDDER/VENDOR NAME & ADDRESS		QUALITY PLAN					SPEC. NO.: PE-TS-020-100-M004		DATE: 24.01.2020		
			CUSTOMER :					QP NO.: PE-QP-020-100-M006		DATE: 27.01.2020		
			PROJECT:					PO NO.: LATER		DATE:		
			ITEM: GM BALL VALVES (SIZE 15 TO 50NB/ PN16), FSS/FCS BALL VALVES (SIZE 15 TO 50NB / CLASS 800) & CSS/CCS (SIZE 65 TO 200 NB/ CLASS 150)			SYSTEM: L.P. VALVES		SECTION: II		SHEET 4 OF 4		
SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY		REMARKS	
1	2	3	4	5	6	7	8	9	* D	**		
					M					C/N	M	
												of valves will be given only after receipt of the photos of valves in satisfactory condition as mentioned above.

NOTE:

- REVIEW/ VERIFICATION OF TEST REPORT/CERTIFICATE, IN CASE THESE TESTS HAVE BEEN CARRIED OUT EARLIER (WITHIN THE LAST 5 YEARS FROM PLACEMENT OF PROJECT SPECIFIC PO, BASED ON FRAMEWORK AGREEMENT) ON THE IDENTICAL MODEL/TYPE/RATING OF GEAR BOX, AT AN INDEPENDENT LABORATORY OR WITNESSED BY REPUTED CUSTOMER LIKE NTPC ETC. OR THIRD PARTY INSPECTION AGENCY LIKE LLOYDS, TUV, DNV ETC. IF THE ABOVE TEST REPORTS/CERTIFICATES ARE NOT AVAILABLE OR NOT FOUND SATISFACTORY BY BHEL/CUSTOMER, THEN THE REQUIRED TYPE TESTS TO BE CARRIED OUT BY THE VENDOR ON GEAR BOX WITHOUT ANY COMMERCIAL IMPLICATIONS AT HIS OWN COST & WITNESSED BY BHEL/CUSTOMER.
- BHEL RESERVES THE RIGHT FOR CONDUCTING REPEAT TEST, IF REQUIRED.

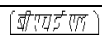
The extent of check to be witnessed is 10% or min. 2nos. at random by BHEL/CUSTOMER & 100% by vendor for each size, type & rating of valve for project specific PO quantity.

Minimum thickness of galvanizing may vary based on project specific requirement, which shall be informed project wise.

LEGENDS:


*RECORDS, INDENTIFIED WITH "TICK"(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
 ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, C: MAIN SUPPLIER (BHEL)/ THIRD PARTY INSPECTION AGENCY, N: CUSTOMER,
 P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE
 MA: MAJOR, MI: MINOR, CR: CRITICAL

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:		Rahul Kadam	Checked by:		Krishna Kumar Yadav			Reviewed by:			
Reviewed by:		Sweta Singhal	Reviewed by:		Ritesh Kumar Jaiswal			Approved by:			

	QUALITY PLAN			CUSTOMER:			PROJECT:			SPEC. NO :PE-TS-415-100-M008		
				BIDDER/VENDOR:			QAP NO.PE-QP-415-100-M020		REV.00 DTD. 22.12.2018		SPEC. TITLE TWO WAY BUTTERFLY VALVE	
	SHEET 1 OF 5			SYSTEM WATER SYSTEM LP VALVES			ITEM: BUTTERFLY VALVES			SECTION II		
S.N O.	COMPONENT/ OPERATION	CHARACTERISTICS CHECKED	CATE GORY	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V			REMARKS


1.	MATERIALS											
1.1	BODY, DISC, SHAFT	1 MECH./CHEM PROPERTIES	MA	CHEM & PHYS. TESTS	ONE/ HEAT/ BATCH	APPD DRG/ TECH SPEC	APPD DRG/ TECH SPEC	TEST CERT.	3/2	2	1	- CORRELATION REQUIRED FOR BODY DISC - FOR CI ONLY MECH. PROPERTIES
		2.DIMENSIONS	MA	MEASURE- MENT UT(**)	100%	TECH. SPEC	TECH SPEC	LOG BOOK	2	2	1	
		3. SUB-SURFACE DEFECTS OF SHAFT	CR		100%	ASTM A388	ASTM A388	TEST CERT.	3/2	2	1	DIA 40 MM & GREATER
		4. CASTINGS SURFACE DEFECTS	CR	1) VISUAL	100%	MSS SP55	MSS SP55	--DO--	3/2	2	1	
				2) MPI	100%	ASTM E-709/165	NO DEFECTS	--DO--	3/2	2	1	
				3) DPT	100%	ASTM E165	-DO-	-DO-	3/2	2	1	
				4) RT	100%	ASM E B16.34	ASM E B16.34	-DO-	3/2	2	1	- RT ON SS VALVES (FILM REVIEW BY BHEL)
		5. HEAT TREATMENT	MA	REVIEW OF HT RECORD	100%	TECH. SPEC	REL. MATL. STD	MATL. T.C	3/2	2	1	- SOLUTION ANNEALING FOR OTHER MATL. AS PER REL. SPEC
1.2	SOFT SEAT CLAMPING RING & SOFT SEAT S.S. MATING SEAT	1)CHEM., PHYS PROPS	MA	CHEM. PHYS TESTS	1/HEAT	TEST SPEC/ APPD DATA SHEET	TECH SPEC/ APPD DATA SHEET	LAB REPORT	3/2	2	1	
		2) INTERNAL DEFECTS	MA	UT TEST(**)	100%	ASTM A388	ASTM B16.34 APPENDIX-IV	TEST CERT	3/3	2	1	FOR S.S MATING SEAT THICKNESS 25MM & ABOVE
		3) VISUAL INSPN	MA	VISUAL	100%	TECH. SPEC	NO DEFECTS	TEST CERT.	3/2	2	1	
		4)CHEMICAL TESTING OF BODY SEAT RING, MATING SEAT (SS)	CR	IGC TEST	1/HEAT/BA TCH	ASTM A262	ASTM A262 PRACTICE 'E'	TEST REPORT	3/2	2	1	
1.3	SOFT SEAT	1. VISUAL INSPN	MA	VISUAL	100%	TECH. SPEC/	TECH. SPEC/	LOG BOOK	3/2	2	1	

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				BIDDER/VENDOR:			QAP NO.PE-QP-415-100-M020		REV.00 DTD. 22.12.2018		SPEC. TITLE TWO WAY BUTTERFLY VALVE	
	SHEET 2 OF 5			SYSTEM WATER SYSTEM LP VALVES			ITEM: BUTTERFLY VALVES			SECTION II		
S.N O.	COMPONENT/ OPERATION	CHARACTERISTICS CHECKED	CATE GORY	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V		REMARKS	


		2.DIMENSIONS	MA	MEASURE- MENT	100%	APPD DRG TECH. SPEC	APPD DRG TECH SPEC	LOG BOOK	2	2	1	
		3. TENSILE STRENGTH	MA	TESTING	1. SAMPLE / BATCH	IS:3400(PART-1)	120Kg/CM ² (MIN)	I.R	3/2	3/2	1	
		4.ELONGATION	MA	TESTING	-DO-	IS:3400(PART-1)	250%(min)	I.R	3/2	3/2	1	
		5. HARDNESS	MA	TESTING	-DO-	MFG. STD.	70 ⁰ ±5 ⁰ (Shore-A)	I.R	3/2	3/2	1	
		6. BLEED RESISTANCE	MA	TESTING	-DO-	SAMPLE TO BE KEPT IN 33% HCL, DM WATER, 48% NaOH FOR 72 HRS	NO DISCOLOU- RATION, WEIGHT GAIN ± 0% TO +2%	T.C	3/2	3/2	1	
		7. OZONE RESISTANCE	MA	TESTING	1/ BATCH	ASTM-D-1149	NO CRACKS AT 50 pphm Ozone	TEST CERT	3/2	3/2	1	
		8. AGEING TEST	MA	TESTING	1/ BATCH	ASTMD-573	No deterioration	TEST CERT	3/2	3/2	1	
		9. HYDRAILIC STABILITY TEST AFTER AGING	MA	TESTING	1/BATCH	TECH SPEC./ AWWA C504	TECH SPEC./ AWWA C504	TEST CERT.	3/2	2	1	
1.4	FASTENERS	1. VERIFICATION OF MAKE, GRADE	MI	VISUAL	100%	TECH. SPEC/ DATA SHEET	TECH. SPEC/ DATA SHEET	INSPN REPORT	3	3/2	1	
		2. DIMENSIONS	MA MA	MEASURE- MENT	SAMPL- ING PLAN	RELV STD.	RELV STD.	INSP REPORT	3	3/2	1	
1.5	GEAR BOX	1. CHEM. COMP. & PHYS PROPERTIES	MA	CHEM & PHYS TEST	1/ BATCH	RELV STD/ DATA SHT/ MFG DRG	RELV STD/ DATA SHT/ MFG DRG	TEST CERT	3/2	2	1	
	GEAR, WORM , BUSH & SHAFT	2. DIMENSIONS	MA	MEASURE- MENT	100%	RELV STD/ DATA SHT/ MFG DRG	RELV STD/ DATA SHT/ MFG DRG	INSP REPORT	2	2	1	
		3. HARDNESS(GEAR & WORM)	MA	MEASURE- MENT	100%	RELV STD/ DATA SHT/ MFG DRG	RELV STD/ DATA SHT/ MFG DRG	TEST CERT	3/2	2	1	
		4. <u>DESIGN VERIFICATION</u>										
		a) TORQUE CAPABILITY	MA	TESTING (TORQUE AT TWICE OF RATED TORQUE OF GEAR BOX)	ONE/ TYPE/SIZE/ RATED TORQUE	AWWA C504 CL 4.2.8	AWWA C504 CL 4.2.8	TEST CERT.	3/2	1	-	REFER NOTE

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S.N O.	COMPONENT/ OPERATION	CHARACTERISTICS CHECKED	CATE GORY	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V		REMARKS


		b) GEAR BOX P.O.D. (LIFE CYCLE TEST)	MA	(CYCLE TESTING)	ONE/ TYPE/SIZE/ RATED TORQUE	APPROVED PROCEDURE/ AWWA C504 CL 4.5.8.5.9	APPROVED PROCEDURE/ AWWA C504 CL 4.5.8.5.9	TEST CERT.	2	1*		REFER NOTE
1.6	ELECTRICAL ACTUATORS	1. TORQUE TESTING & SETTING OF TORQUE SWITCH	MA	{MECH., ELEC. TESTS	100%	TECH. SPEC./ APPD. DRG./ DATA SHEET/ IS:9334	APPD. DRG./ DATA SHEET/ IS:9334	INSPN. REPORT	3	2	1	
		2. TRAVEL/STROKE 3. TRAVEL TIME 4. OPERATION OF LIMIT SWITCH 5. MANUAL OPERATION THROUGH HAND WHEEL 6. OPERATION TEST WITH POWER SUPPLY VARIATION ENERGISES TO OPEN/CLOSE 7. IR,HV,IR 8.DEGREE OF PROTECTION	MA MA MA MA MA MA MA MA	{ { { { { { { { WATER, DUST TEST								
		9. DESIGN VERIFICATION	MA	TYPE TEST	ONE/MODEL / TYPE/ SIZE /RATING	TECH. SPEC./ APPD. DRG./ DATA SHEET/ IS:9334 AWWA C540/	APPD. DRG./ DATA SHEET/ IS:9334 AWWA C540	3RD PARTY TEST CERT. TEST CERT	3 3/2	- 2	2,1 1`	
2.0	INPROCESS CONTROL											
2.1	BODY, DISC, SHAFT, SOFT SEAT MATING SEAT	1 DIMENSIONS	MA	MEASURE- MENT	100%-	MFG DRG	MFG DRG	LOG BOOK	2	2	1	
		2. SURFACE DEFECTS	CR	VISUAL	100%	FINISH	NO VISUAL DEFECTS	INSP REPORT	2	2	1	
		3. SURFACE DEFECTS	CR	DP/ MPI	100%	ASTM E165	NO SURFACE DEFECTS	INSP REPORT	3/2	2	1	MACHINED AREAS
3.0	TESTING											
3.1	PROOF OF	1. DISC STRENGTH	MA	HYDRO TEST	ONE/ TYPE/	AWWA C504	AWWA C504	TEST CERT.	3/2	1*	--	Refer note

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	SHEET 4 OF 5			SYSTEM WATER SYSTEM LP VALVES			ITEM: BUTTERFLY VALVES			SECTION II		
S.N O.	COMPONENT/ OPERATION	CHARACTERISTICS CHECKED	CATE GORY	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V		REMARKS	

3.2	DESIGN TESTS VALVE LEAK TIGHTNESS TEST	TEST 2. LIFE CYCLE TESTING	MA	HYDRO TEST	SIZE/ CLASS	CL 5.1.4	CL 5.1.4	TEST CERT.	3/2	1*	--	Refer note
		1. SHELL TEST	MA	HYDRO TEST	ONE/TYPE/ CLASS / SIZE GROUP 100%	APPROVED PROCEDURE/ AWWA C504 CL 5.1.4 APPD. DRGS/ RELV STD	APPROVED PROCEDURE AWWA C504 CL 5.1.4 NO LEAKAGE	TEST CERT	2	1	--	Refer note
		2. SEAT LEAKAGE	MA	HYDRO TEST/ AIR TEST (IF AIR TEST SPECIFIED IN APPD DRG)	100%	APPD. DRGS/ RELV STD	NO LEAKAGE	TEST CERT	2	1	--	
3.3	FUNCTIONAL TEST OF ACTUATOR WITH VALVE	1. SETTING OF LIMIT, ,TORQUE SWITCHES & OPERATION	MA	TESTING	100%	TECH SPEC/ APPD.DRG/ APPD DATA SHEET/IS:9334	TECH SPEC/ APPD.DRG/ APPD DATA SHEET/IS:9334	TEST CERT.	3/2	1		
		2. OPERATION TEST WITH POWER SUPPLY ENERGISED,OPEN/ CLOSE & CURRENT DRAWN	MA	TESTING	100%	TECH SPEC/ APPD.DRG/ APPD DATA SHEET/IS:9334	TECH SPEC/ APPD.DRG/ APPD DATA SHEET/IS:9334	TEST CERT.	3/2	1		
3.4	PERFORMANCE TEST	1.VALVE & ACTUATOR PERFORMANCE	MA	**	100%	TECH SPEC/ RELV STD	SMOOTH OPERATION	TEST CERT	2	1		**OPERATING THREE TIMES FROM THE FULLY CLOSED TO THE FULLY OPENED AND THE REVERSE UNDER DESIGN CONDITION, MANUALLY AS WELL AS THROUGH OPERATOR.
4.0 4.1	COMPLETE ASSEMBLY FINAL INSPECTION	1. OVERALL L DIMENSION	MA	MEAS.	100%	APPD DRG		INSPN REPORT	2	1		
		2. CLEANLINESS	MA	VISUAL	100%	APPD DRG/ TECH SPEC		INSPN REPORT	2	2	1	
		3. NAMEPLATE WITH VALVE TAG NOS.	MA	VISUAL	100%	APPD DRG/ TECH SPEC		INSPN REPORT	3/2	2	1	

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	QUALITY PLAN		CUSTOMER:			PROJECT:			SPEC. NO :PE-TS-415-100-M008		
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	SHEET 5 OF 5		SYSTEM WATER SYSTEM LP VALVES			ITEM: BUTTERFLY VALVES			SECTION II		
S.N O.	COMPONENT/ OPERATION	CHARACTERISTICS CHECKED	CATE GORY	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V		REMARKS

5.0	PAINTING	AS PER BHEL TECH. SPEC	MA	VISUAL	100%	AS PER TECH. SPEC.	COMPLAINE REPORTS & PHOTOGRAP H	3/2	2	1	FOR CI VALVES ONLY
6.0	PACKING	SOUNDNESS	MI	VISUAL	100%	AS PER TECH SPECIFICATION	INSP REPORT	2	2	1	PHOTOGRAPHS OF WOODEN CASES HAVING DULY PACKED VALVES TO BE FURNISHED TO BHEL-PEM FOR VERIFICATION TO OBTAIN MDCC

NOTE: REVIEW/ VERIFICATION OF INSPECTION REPORTS / TEST CERTIFICATES, IN CASE THESE TESTS CARRIED OUT EARLIER ON THE IDENTICAL MODEL/TYPE SIZE/CLASS RATING/ SIZE GROUP OF TESTED VALVES, GEAR BOX, ACTUATOR AND WITNESS BY REPUTED CUSTOMER LIKE NTPC OR THIRD PARTY INSPECTION AGENCY LIKE LLOYDS, TUV , DNV ETC. If the same above TCs are not available then the required type tests to be carried out by the bidder on identical valves, electric actuators, gear box without any commercial implications/ at their own cost AND the POD tests shall be witnessed by BHEL/ customer.

ABBREVIATIONS: CHP=CUSTOMER HOLD POINT CR= CRITICAL ACTIVITY MA= MAJOR ACTIVITY PT= DYE PENETRATION TEST P=PERFORMED BY V=VERIFIED BY W= WITNESSED BY (customer at random)
1= BHEL/TPI 2= VENDOR 3= SUB VENDOR I R= INSPECTION REPORT TC= TEST CERTIFICATE,UT=Ultrasonic test,
LPI=liquid penetrant inspection, MPI=magnetic particle inspection.

() NORMAL BEAM PROBE OF 20/10MM DIA & 2/2.5 MHz SHALL BE USED. USING THIS PROBE THE BACK WALL ECHO SHALL BE SET AT 100% FULL SCREEN HEIGHT (FSH) IN SOUND AREA. AT THIS SENSITIVITY LEVEL THE ITEM SHALL BE SCANNED & ANY DEFECT ECHO MORE THAN 20% FSH IS NOT ACCEPTABLE. ALSO ANYWHERE COMPLETE LOSS OF BACK WALL ECHO IS NOT ACCEPTABLE**

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TITLE:
**TECHNICAL SPECIFICATION
COLTCS**
STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-475-165-N002**
SECTION: **II**
SUB-SECTION: **IIB**
REV. NO. **00** DATE 20.01.2021
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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<p>4.9.1 Motors provided for similar drives shall be interchangeable.</p> <p>4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.</p> <p>4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.</p> <p>4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.</p> <p>4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.</p> <p>4.9.6 Name plate with all particulars as per IS: 325 shall be provided</p> <p>4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.</p> <p>5.0 INSPECTION AND TESTING</p> <p>5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.</p> <p>5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.</p> <p>5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.</p> <p>5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.</p> <p>6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT</p> <p>a) OGA drawing showing the position of terminal boxes, earthing connections etc.</p> <p>b) Arrangement drawing of terminal boxes.</p> <p>c) Characteristic curves: (To be given for motor above 55 kW unless otherwise specified in Data Sheet).</p> <p>i) Current vs. time at rated voltage and minimum starting voltage.</p> <p>ii) Speed vs. time at rated voltage and minimum starting voltage.</p> <p>iii) Torque vs. speed at rated voltage and minimum voltage. For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.</p> <p>iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.</p>		


	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS		STANDARD QUALITY PLAN		SPEC. NO :		DATE:
			CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02		DATE: 17.04.2020
			PROJECT:		PO NO.:		DATE:
			ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II		SHEET 1 of 2

S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY				REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	C/ N					D	M	C	N
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	-	MFG. SPEC.	MFG. SPEC.	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	VISUAL	100%	-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	LOG BOOK		P	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MFG.SPEC./	MFG.SPEC.	LOG BOOK		P	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	-	MFG. SPEC/ APPROVED DATASHEET	MFG. SPEC/ APPROVED DATASHEET	LOG BOOK	✓	P	V	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST	MA	VISUAL	100%	-	IS-325 / IS-12615/ APPROVED DATA SHEET	IS-325 / IS-12615/ APPROVED DATA SHEET	TEST/ INSPN. REPORT	✓	P	V*	-	* NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	-	APPROVED DRG/ DATA SHEET	APPROVED DRG/ DATA SHEET	TEST/ INSPN. REPORT	✓	P	V*	-	* NOTE -1 & NOTE-2

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ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		RITESH KUMAR JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
		CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
		PROJECT:		PO NO.:	DATE:
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II	SHEET 2 of 2

		3.NAMEPLATE DETAILS	MA	VISUAL	100%	-	IS-325 / IS-12615 / APPROVED DATA SHEET	SAME AS COL. 7	TEST/ INSPN. REPORT	✓	P	V	-	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MFG. STANDARD / (#)	AS PER MFG. STANDARD / (#).	INSPC. REPORT	✓	P	W	-	(#) REFER NOTE-8

NOTES:

1. Routine tests on 100% motors shall be done by the vendor. However, BHEL/ Customer shall witness routine tests on random samples. The sampling plan shall be mutually agreed upon.
2. For exhaust/ventilation fan motors of rating up to 1.5 KW, only routine test certificates shall be furnished for scrutiny.
3. In case test certificates for these tests on similar type, size and design of motor from independent laboratory are available, the same is valid for 5 years.
4. BHEL reserves the right to perform repeat test, if required.
5. After packing and prior to issue MDCC, photographs of items to be despatched shall be sent to BHEL for review.
6. In case of any changes in QP commented by customer at contract stage, same shall be carried out by bidder without any implication to BHEL/ Customer.
7. Project specific QP to be developed based on customer requirement.
8. For export job, BHEL technical specification for seaworthy packing to be followed.
9. Packing shall be suitable for storage at site in tropical climate conditions.
10. Latest revision/ year of issue of all the standards (IS/ ASME/ IEC etc.) indicated in QP shall be referred.

LEGENDS:

*RECORDS, IDENTIFIED WITH "TICK"(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,


** **M:** SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **B:** MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C:** CUSTOMER,

P: PERFORM, **W:** WITNESS, **V:** VERIFICATION, AS APPROPRIATE

MA: MAJOR, **MI:** MINOR, **CR:** CRITICAL

D: DOCUMENTATION

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Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI			Reviewed by:			
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		RITESH KUMAR JAISWAL			Approved by:			


	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO. :		DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	SECTION: II	SHEET 1 OF 9

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL													
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	-		FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	LOG BOOK		P	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	SAMPLE	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TEST REPORT		P/V	-		
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%	-		FREE FROM CRACKS, UN-EVENNESS ETC.	TEST REPORT		P	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TC		P/V	-	-	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%	-	MANUFACTURER'S DRG./SPEC	FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK		P/V	-		
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TC		P/V	-		HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG.	MANUFACTURER'S DRG.	LOG BOOK		P/V	-		
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	LOG BOOK		P/V	-		

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Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

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Sign & Date	
Seal	

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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :		DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	SECTION: II	

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S DRG./ STD.	TC		P/V	-		
		3. DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S DRG.	LOG BOOK		P/V	-		
		4.INTERNAL FLAWS	CR	ULTRASONIC TEST	100%	-	ASTM-A388	MANUFACTURER'S STD.	INSPECTION REPORT	✓	P/W	V	-	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNec-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	100%	-	MANUFACTURER'S DRG./STD.	MANUFACTURER'S DRG./STD.	INSPECTION REPORT		P/V	-	-	
		2. PHYSICAL COND.	MA	VISUAL	100%	-	MANUFACTURER'S DRG./STD.	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	INSPECTION REPORT		P/V	-	-	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG./ STD	MANUFACTURER'S DRG. / STD.	INSPECTION REPORT		P/V	-	-	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-	MANUFACTURER'S DRG./ STD	MANUFACTURER'S DRG. / STD.	TEST REPORT		P/V	-	-	

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Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :		DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	SECTION: II	

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	-	NO VISUAL DEFECTS	TEST REPORT		P/V	-	-	
		2.DIMENSION/BORE DIA, WALL THICKNESS, BDV AS RECEIVED, BDV AFTER FOLDING AT 180°	MA	TEST	SAMPLE	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK AND OR SUPPLIER'S TC		P/V	-	-	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK		P	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG. .	MANUFACTURER'S DRG.	LOG BOOK		P/V	-	-	
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	SAMPLE	-	MANUFACTURER'S DRG./ STD.	MANUFACTURER'S DRG./ STD.	TC		P/V	-	-	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		*P/V	-	-	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY
		2.ELECT. PROP. & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S / SPEC.	TC & VENDOR'S TEST REPORTS		P/V	-	-	

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Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.:		DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	SECTION: II	SHEET 4 OF 9

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	SAMPLES	-	MANUFACTURER'S DRG / SPEC.	MANUFACTURER'S / SPEC.	LOG BOOK		P/V	-	-	
		1.MAKE & TYPE	MA	VISUAL	100%	-	MANUFACTURER'S DRG./ APPROVED DATASHEET	MANUFACTURER'S DRG./ APPROVED DATASHEET			P/V	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	APPROVED DATASHEET	APPROVED DATASHEET/ BEARING MANUF'S CATALOGUES	LOG BOOK		P/V	-	-	
		3.SURFACE FINISH	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P/V	-	-	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	SAMPLE	-	MANUFACTURER'S STD./ APPROVED DATASHEET	MANUFACTURER'S STD./ APPROVED DATASHEET	LOG BOOK		P/V	-	-	
		4.HV/IR	MA	-DO-	100%	-	MANUFACTURER'S STD./ APPROVED DATASHEET	MANUFACTURER'S STD./ APPROVED DATASHEET	LOG BOOK		P/V	-	-	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	-	MANUFACTURER'S DRG/SPECS	MANUFACTURER'S DRG/ SPECS.	LOG BOOK		P	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	

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Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :		DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	SECTION: II	SHEET 5 OF 9

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
2.0	IN PROCESS													
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-	MANUFACTURER'S DRG	GOOD FINISH	LOG BOOK		P/W	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-	-DO-	GOOD FINISH	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	100%	-	MANUFACTURER'S STD./ ASTM-E165	MANUFACTURER'S STD./ APPROVED DATASHEET.	LOG BOOK	✓	P	V	-	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		3.SHADE	MA	VISUAL	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	

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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS

STANDARD QUALITY PLAN

CUSTOMER :

PROJECT:

ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))

SYSTEM:

SPEC. NO :

QP NO.: PE-QP-999-Q-007, REV-04

PO NO.:

SECTION: II

DATE:17.04.2020

SHEET 6 OF 9

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	.	**			
					M	C/N					D	M	C	N
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK		P	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK		P	-	-	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		2.CLEANLINESS	CR	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	100%	-	IS-325//IS-12615//IEC-60034 PART-1	IS-325//IS-12615//IEC-60034 PART-1	TEST/INSPC. REPORT	✓	P	V	-	
		4.RESISTANCE	CR	ELECT. TEST	100%	-	IS-325//IS-12615//IEC-60034 PART-1	IS-325//IS-12615//IEC-60034 PART-1	TEST/INSPC. REPORT	✓	P	V	-	
		5.INTERTURN INSULATION	CR	ELECT. TEST	100%	-	IS-325//IS-12615//IEC-60034 PART-1	IS-325//IS-12615//IEC-60034 PART-1	TEST/INSPC. REPORT		P	-	-	
2.6	IMPREGNATION	1.VISCOSITY	MA	PHY. TEST	AT STARTING	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		3.NO. OF DIPS	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK	✓	P	V	-	THREE DIPS TO BE GIVEN

BHEL

ENGINEERING

QUALITY


	Sign & Date	Name		Sign & Date	Name
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Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.:		DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	SECTION: II	SHEET 7 OF 9

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION 1.COMPACTNESS & CLEANLINESS	MA MA	PROCESS CHECK VISUAL	CONTINUOUS 100%	- -	MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD	LOG BOOK LOG BOOK	✓ 	P P	V -	- -	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS 2.SOUNDNESS	CR CR	VISUAL MALLETT TEST & UT	100% 100%	- -	MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD MANUFACTURER'S STANDARD	LOG BOOK TEST/INSPC. REPORT	 ✓	P P	- V	- -	
2.9	COMPLETE ROTOR ASSEMBLY	3.HV 1.RESIDUAL UNBALANCE	MA CR	ELECT. TEST DYN. BALANCE	100% 100%	- -	MANUFACTURER'S STANDARD MANUFACTURER'S SPEC./ ISO 1940	MANUFACTURER'S STANDARD MANUFACTURER'S DWG.	TEST/INSPC. REPORT LOG BOOK	✓ 	P P	V -	- -	
2.10	ASSEMBLY	2.SOUNDNESS OF DIE CASTING 1.ALIGNMENT 2.WORKMANSHIP 3.AXIAL PLAY 4.DIMENSIONS 5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE 6. RTD, BTD & SPACE HEATER MOUNTING.	CR MA MA MA MA MA	ELECT. (GROWLER TEST) MEAS. VISUAL MEAS. MEAS. VISUAL	100% 100% 100% 100% 100%	- - - - -	MANUFACTURER'S SPEC. MANUFACTURER'S SPEC. MANUFACTURER'S SPEC. MANUFACTURER'S DRG./ MANUFACTURER'S SPEC. MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC. MANUFACTURER'S SPEC. MANUFACTURER'S SPEC. MANUFACTURER'S DRG./ MANUFACTURER'S SPEC. MANUFACTURER'S SPEC.	TEST/INSPC. REPORT LOG BOOK LOG BOOK LOG BOOK LOG BOOK	✓ ✓ 	P P P P P	V - - V -	- - - - -	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:		PRAVEEN DUTTA	Reviewed by:		R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			


	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :		DATE:17.04.2020
		CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:		SECTION: II

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	.	**			
					M	C/N				D	M	C	N	
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS	MA	ELECT.TEST	1/TYPE/SIZE	1/TYPE/SIZE	IS-325//IS-12615/APPROVED DATASHEET	IS-325//IS-12615/APPROVED DATASHEET	TEST REPORT	✓	P	W*	-	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST	MA	ELECT.TEST	100%	-	IS-325//IS-12615/APPROVED DATASHEET	IS-325//IS-12615/APPROVED DATASHEET	TEST REPORT	✓	P	√ [§]	-	§ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	ELECT.TEST	100%	-	IS: 12075 / IEC 60034-14 & IS-12065	IS: 12075 / IEC 60034-14 & IS-12065	TEST REPORT	✓	P	√ [§]	-	§ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET &	TEST/INSPC. REPORT	✓	P	W	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	-	IEC 60034-5//IS-12615	APPROVED DATASHEET	TC	✓	P	V	-	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	ELECT. & MECH. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1//IS: 12802	IS-325//IS-12615/IEC-60034 PART-1//IS: 12802	TC	✓	P	√ [§]	-	§ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	ELECT. & MECH. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1	IS-325//IS-12615/IEC-60034 PART-1	TC	✓	P	√ [§]	-	§ NOTE - 2
		8. NAME PLATE DETAILS	MA	VISUAL	100%	-	IS-325//IS-12615& DATA SHEET	IS-325//IS-12615 & DATA SHEET	TEST/INSPC. REPORT	✓	P	√ [§]	-	§ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	-	IS 2148 / IEC 60079-1	IS 2148 / IEC 60079-1	TC	✓	P	V	-	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	SAMPLE	APPROVED DATASHEET	APPROVED DATASHEET	TC	✓	P	W [§]	-	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY § NOTE - 2

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	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :		DATE:17.04.2020
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		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	SECTION: II	SHEET 9 OF 9

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	.	**			
					M	C/N					D	M	C	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MANUFACT. STANDARD / (#)	AS PER MANUFACT. STANDARD / (#)	INSPC. REPORT	✓	P	W	-	(#): REFER NOTE-8

NOTES:

- 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.
- 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL/CUSTOMER SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.
- 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THE SAME IS VALID FOR 5 YEARS.
- 4 BHEL RESERVES THE RIGHT TO PERFORM REPEAT TEST, IF REQUIRED.
- 5 AFTER PACKING AND PRIOR TO ISSUE MDCC, PHOTOGRAPHS OF ITEMS TO BE DESPATCHED SHALL BE SENT TO BHEL PURCHASE GROUP FOR REVIEW.
- 6 IN CASE , ANY CHANGES IN QP COMMENTED BY CUSTOMER AT CONTRACT STAGE SHALL BE CARRIED OUT BY BIDDER WITHOUT ANY IMPLICATION TO BHEL/ CUSTOMER.
- 7 PROJECT SPECIFIC QP TO BE DEVELOPED BASED ON CUSTOMER REQUIREMENT.
- 8 FOR EXPORT JOB, BHEL TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING TO BE FOLLOWED.
- 9 PACKING SHALL BE SUITABLE FOR STORAGE AT SITE IN TROPICAL CLIMATE CONDITIONS.
- 10 LATEST REVISION/ YEAR OF ISSUE OF ALL THE STANDARDS (IS/ ASME/ IEC ETC.) INDICATED IN QP SHALL BE REFERRED.

LEGENDS:

*RECORDS, IDENTIFIED WITH "TICK"(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.
**** M:** SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **B:** MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C:** CUSTOMER,
P: PERFORM, **W:** WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI:** MINOR, **CR:** CRITICAL
D: DOCUMENT

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

S. NO.	LIST OF MOTORS	
1	NON FLAME PROOF	ABB
2		BHARAT BIJLEE LTD.
3		CROMPTON GREAVES
4		GE-POWER
5		KIRLOSKAR ELECTRIC CO LTD.
6		LAXMI HYDRAULICS PVT. LTD
7		MARATHON
8		NGEF
9		RAJINDRA ELECT INDUSTRIES
10		SIEMENS
11	FLAME PROOF	RAJINDRA ELECT INDUSTRIES

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



TITLE:

**TECHNICAL SPECIFICATION
COLTCS**

STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-475-165-N002**

SECTION: **II**


SUB-SECTION: **IIC**

REV. NO. **00** DATE 20.01.2021

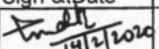
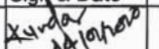
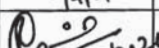
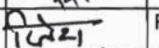
SHEET **1** OF **1**

SUB-SECTION - IIC

STANDARD TECHNICAL SPECIFICATION (C &I)


		MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			STANDARD QUALITY PLAN			SPEC. NO :		DATE:		
					CUSTOMER :			QP NO.: PE-QP-999-145-1056		DATE: 07.02.2020		
					PROJECT:			PO NO.: --		DATE: --		
					ITEM: LOCAL CONTROL PANEL			SYSTEM: C&I		SECTION: C		SHEET 1 OF 9

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	** M C N			REMARKS
1	2	3	4	5	M	C/N	7	8	9		M	C	N	
1.0	RAW MATERIAL Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	√	P/W	V		
		2. Bend Test	CR	Mech. test	Sample	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	√	P/W	V		
		3. Surface finish	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	---		
		4. Waviness	MA	Visual	100%	10%	Manufacturing Standard	No Waviness	Inspection Report	√	P/W	---		
		5. Thickness	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	V		
		6. Mill marking	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V		
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	Sample	IS:2062	IS:2062	Test Certificate	√	P/W	---		
		2. Surface Defects	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	---		
		3. Straightness	MA	Measurement	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	---		
		4. Mill marking	MA	Visual	100%	10%	IS:2062	IS:2062	Inspection Report	√	P/W	V		

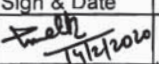
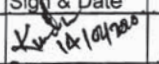
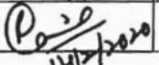
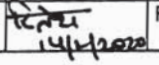
BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		CHETAN MALIK	Checked by:		KUNDAN PRASAD
Reviewed by:		RK RAINA	Reviewed by:		RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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		MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS				STANDARD QUALITY PLAN				SPEC. NO :		DATE:	
						CUSTOMER :				QP NO.: PE-QP-999-145-1056		DATE: 07.02.2020	
		PROJECT:				PO NO.: --		DATE: --					
		ITEM: LOCAL CONTROL PANEL				SYSTEM: C&I		SECTION: C		SHEET 2 OF 9			

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	**			REMARKS
1	2	3	4	5	M	C/N	7	8	9		M	C	N	
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	√	P/W			
		2. IR and HV	MA	Electrical	100%	10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	√	P/W			
		3. Conductor a) Resistance b) Size c) Sheet colour	MA MA MA	Electrical Measurement Visual	100% 100% 100%	10% 10% 10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	√	P/W			
		4. Type / Routine Test Certificates	MA	Verification	100%	10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	√	P/W			
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays	1. Verification at make and Type	CR	Visual	Sample	Sample	Approved Drg/Datasheet	Approved Drg/Datasheet	Test Certificate	√	P/W			
		2. Verification of Test Certificates	CR	Scrutiny of Type / Routine T.Cs. Electrical	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	√	P/W			
		3. Operation / Functional check	CR		Sample 100% @	Sample 10% @	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	√	P/W			+ for relay & contactors only

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						CUSTOMER :				QP NO.: PE-QP-999-145-1056		DATE: 07.02.2020	
		PROJECT:				PO NO.: --		DATE: --					
		ITEM: LOCAL CONTROL PANEL				SYSTEM: C&I		SECTION: C		SHEET 3 OF 9			

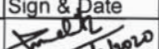
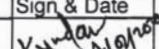
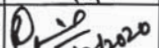
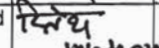
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	**			REMARKS
1	2	3	4	5	M	C/N	7	8	9	D	M	C	N	
	Timers, Space Heaters, Thermostat, Indicating meters etc.	4. I.R.	MA	Electrical	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	√	P/W			@ for all components except relays & contactors.
		5. H.V.	MA	Electrical	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	√	P/W			
		6. Calibration	MA	Electrical	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	√	P/W	V		
		7. Pick up / Drop off Voltage	MA	Electrical	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	√	P/W			
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make	MA	Visual	Sample	Sample	Manufacturing Standard	Manufacturing Standard	Test Certificate	√	P/W			
		2. Surface defects	MA	Visual	Sample	Sample	Manufacturing Standard	Manufacturing Standard	Test Certificate	√	P/W			
		3. IR / HV on Terminal Blocks	MA	Electrical	Sample	Sample	Manufacturing Standard	Manufacturing Standard	Test Certificate	√	P/W			
IN PROCESS INSPECTION														

BHEL					
ENGINEERING			QUALITY		
Prepared by:	Sign & Date	Name	Checked by:	Sign & Date	Name
	<i>[Signature]</i>	CHETAN MALIK		<i>[Signature]</i>	KUNDAN PRASAD
Reviewed by:	Sign & Date	Name	Reviewed by:	Sign & Date	Name
	<i>[Signature]</i>	RK RAINA		<i>[Signature]</i>	RK JAISWAL

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				CUSTOMER :				QP NO.: PE-QP-999-145-1056		DATE: 07.02.2020				
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				ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I		SECTION: C		SHEET 4 OF 9				
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	**			REMARKS
1	2	3	4	5	M	C/N	7	8	9	D	M	C	N	
6.0	Blanking / Bending / Forming	1. Dimensions	MI	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		2. Surface defects after bending	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W			
7.0	Nibbling / Punching	1. Cutout Sizes	MI	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		2. Deburring	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
8.0	ASSEMBLY Frame Assembly & Sheet fixing	1. Dimensions	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		2. Alignment	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		3. Welding Quality	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		4. Surface defects	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			

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						ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I		SECTION: C		SHEET 5 OF 9	
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**		
					M	C/N				D	M	C	N
9.0	Pre-treatment and Painting	1. Pretreatment Process	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V	
		2. Process parameters like bath temp. concentration etc.	MA	Measurement	Periodic	Periodic	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V	
		3. Dipping / Removal Time	MA	Measurement	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V	
		4. Surface quality after every dip	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V	
		5. Primer after phosphating	MA	Visual, Thickness	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V	
		6. Putty Application & Rubbing after primer	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V	
		7. Paint first coat	MA	Visual, Thickness	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V	

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Reviewed by:	Sign & Date	Name	Reviewed by:	Sign & Date	Name
	<i>[Signature]</i>	RK RAINA		<i>[Signature]</i>	RK JAISWAL

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		PROJECT:				PO NO.: --		DATE: --					
		ITEM: LOCAL CONTROL PANEL				SYSTEM: C&I		SECTION: C		SHEET 6 OF 9			

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY	REMARKS	
1	2	3	4	5	6		7	8	9			
					M	C/N						
		8. Putty Application and Rubbing after first coat of paint	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	✓	P/W	V
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	✓	P/W	V
10.	Panel Wiring	1. Wiring Layout	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W	
		2. Wiring Termination (Crimped Lugs)	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W	
		3. Ferrule numbers	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W	
		4. Colour of wiring	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W	V
		5. Size of Conductor	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W	V
11.	Component Mounting	1. Correct components	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W	
		2. Fixing	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	✓	P/W	


BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	<i>[Signature]</i>	CHETAN MALIK	Checked by:	<i>[Signature]</i>	KUNDAN PRASAD
Reviewed by:	<i>[Signature]</i>	RK RAINA	Reviewed by:	<i>[Signature]</i>	RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

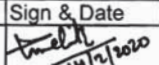
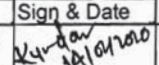
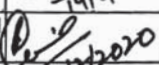
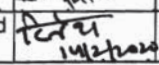
FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

		MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS				STANDARD QUALITY PLAN				SPEC. NO :		DATE:	
						CUSTOMER :				QP NO.: PE-QP-999-145-1056		DATE: 07.02.2020	
						PROJECT:				PO NO.: --		DATE: --	
						ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I		SECTION: C		SHEET 7 OF 9	
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**		
					M	C/N				D	M	C	N
12.	FINAL TESTING Final Inspection	1. Workmanship	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	W	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%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W	
		3. Components identification Marking / Name plates	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W	
		5. Dimensions	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W	At Random by BHEL, based on 100 % internal test reports by Mfr.
		6. Door functioning	MA	Functional	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W	
		7. Paint Shade	CR	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W	

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
Prepared by:	Sign & Date	Name	Checked by:	Sign & Date	Name	Seal		Reviewed by:	Sign & Date	Name	Seal
Reviewed by:			Reviewed by:					Approved by:			
	<i>[Signature]</i> 14/2/2020	CHETAN MALIK		<i>[Signature]</i> 14/2/2020	KUNDAN PRASAD						
	<i>[Signature]</i> 14/2/2020	RK RAINA		<i>[Signature]</i> 14/2/2020	RK JAISWAL						


		MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS			STANDARD QUALITY PLAN			SPEC. NO :		DATE:		
					CUSTOMER :			QP NO.: PE-QP-999-145-1056		DATE: 07.02.2020		
					PROJECT:			PO NO.: --		DATE: --		
					ITEM: LOCAL CONTROL PANEL			SYSTEM: C&I		SECTION: C		SHEET 8 OF 9

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
		8. Paint Thickness	CR	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		9. Workmanship of Gaskets	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	W		
		10. Wiring Layout	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		11. Wire Termination	MA	Pulling manually	Sample	Sample	----	Firm termination	Inspection Report	√	P/W	W		
		12. Continuity	MA	Electrical	100%	10%	----	Continuity OK	Inspection Report	√	P/W	W		
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	Sample	Approved Drg/Datasheet Relevant IS-13947 Part-1, IS-2148.	Approved Drg/Datasheet Relevant IS-13947 Part-1, IS-2148.	Type Test Certificate	√	P/W	V		
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	10%	Approved Drg/Datasheet Relevant IS.	Approved Drg/Datasheet Relevant IS.	Inspection Report	√	P/W	W		

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		CHETAN MALIK	Checked by:		KUNDAN PRASAD
Reviewed by:		RK RAINA	Reviewed by:		RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

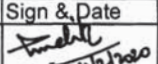
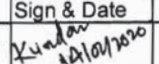
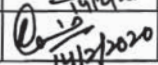
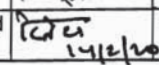
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						CUSTOMER :				QP NO.: PE-QP-999-145-1056		DATE: 07.02.2020		
						PROJECT:				PO NO.: --		DATE: --		
						ITEM: LOCAL CONTROL PANEL		SYSTEM: C&I		SECTION: C		SHEET 9 OF 9		
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANC E NORMS	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6		7	8	9	* D	**			
					M	C/N					M	C	N	
15	FUNCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		2. Instrument Calibration	CR	Electrical	10%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		3. Temperature rise	CR	Electrical	100%	10%	Approved Drg/Datasheet Relevant IS.	Approved Drg/Datasheet Relevant IS.	Inspection Report	√	P/W	W		

NOTES:

- Customer's specification for painting shall be included in the technical specification. In the absence of Customer's spec. for painting, vendor to obtain BHEL's approval on their painting specification / procedure.
- Copies of all TC's (Test Certificates) for components shall be submitted to BHEL for verification and acceptance.
- BHEL reserves the right to conduct repeat tests, if required.

LEGENDS:

*RECORDS, IDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION, D: DOCUMENTATION,
 ** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, C: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, N: CUSTOMER,
 P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE
 MA: MAJOR, MI: MINOR, CR: CRITICAL

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:		CHETAN MALIK	Checked by:		KUNDAN PRASAD						
Reviewed by:		RK RAINA	Reviewed by:		RK JAISWAL						

	2X660 MW KHURJA STPP-TG PKG	
	TECHNICAL SPECIFICATION (C&I) FOR CONDENSER ON LOAD TUBE CLEANING SYSTEM	
<div>SUB VENDOR LIST</div>		

Sl No	Package Name	Supplier Name	Supplier Communication Address
1	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com
2	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode : 382729 Email : sales@precisionmass.com
3	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
4	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode : 560022 Email : info@hgurusouth.com
5	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net
6	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,
7	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, Sarani, Kolkata Phone- +91 33 2548 7220 Pincode : 700074 Email : parthabosebpi@gmail.com; bopspanda@vsnl.net
8	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in
9	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in
10	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbnl@vsnl.com
11	TRANSMITTERS	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com
12	TRANSMITTERS	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
13	TRANSMITTERS	ABB INDIA LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com
14	TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : udav.shankar@in.yokogawa.com.
15	TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone- 9352009000, Pincode : 305002, Email : info@tipl.com,
16	TRANSMITTERS	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39, ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD PUNE, Phone- 912041030100 Pincode : 411009 Email : newdelhi@sbem.co.in
17	TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola District Centre, New Delhi, Phone- 9717593001, Pincode : 110025, Email : prakash.vaghela@in.endress.com,
18	TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com.
19	TRANSMITTERS	Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@miinet.com
20	TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com
21	TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	Mr. Amit Paithankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI Phone- 9619121500 Pincode : 400051 Email : vikramrai.singh@emerson.com
22	TRANSMITTERS	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com
23	TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@delbbv.rpams.ems.vsnl.net.in
24	TRANSMITTERS	Honeywell Automation India Limited	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : raiesh.chaudhary@honeywell.com
25	JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net
26	JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com

27	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari Phone- 02637 265140,265003 Pincode : 396424 Email : flexpro@flexproltd.com
28	JUNCTION BOX	Shrenik & Company,	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com
29	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	JIGNESH MAHENDRA AJMERA DENA BANK BLDG.,SHREE NAGESH INDL. ESTATE,STATION ROAD, MUMBAI Phone- 022 67973578 Pincode : 400 088 Email : aimera@aimera.net, imaimera@yahoo.com
30	INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91- 9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
31	INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
32	INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
33	INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
34	INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
35	INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
36	INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91- 9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
37	INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
38	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com
39	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai Phone- +91-250-2392246 Pincode : 401210 Email : arya@aryaengg.com
40	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai Phone- 91-9324383121 Pincode : 400008 Email : shahanawaz.khan@perfectinstrumentation.com
41	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com
42	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91- 9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
43	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com
44	INSTRUMENT FITTINGS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,
45	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
46	INSTRUMENT FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
47	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laxmipura, Nandasan Phone- 02764-267036/37 Pincode : 382705 Email : marketing@com-fit.com

	2X660 MW KHURJA STPP-TG PKG	
	TECHNICAL SPECIFICATION (C&I) FOR CONDENSER ON LOAD TUBE CLEANING SYSTEM	
<div>KKS NUMBERING PHILOSOPHY</div>		



DOCUMENT TITLE

KKS NUMBERING PHILOSOPHY

KKS NUMBERING PHILOSOPHY

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

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

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

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

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

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

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

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

- 1) Self-Cleaning Strainer System: PCA,PCB

ANNEXURE-2**Standard Equipment Codes:**


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

Standard Apparatus Codes:

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

Standard Measuring Circuits Codes:

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

<div></div>	<div>DOCUMENT TITLE</div> <div>KKS NUMBERING PHILOSOPHY</div>																																		
CM		Humidity																																	
CQ		Analysis (SWAS)																																	
CS		Speed, Velocity, Frequency																																	
CT		Temperature																																	
CY		Vibration, Expansion																																	
<div>ANNEXURE-3</div> <div>Numerical Keys</div> <div>A) Numerical Keys at System Code Level</div> <div><div>i)</div><div>Use 10, 20, 30... To distinguish between main systems having same Alpha Codes. Examples:</div><div><div>a)</div><div>Main Steam (Left) and Main Steam (Right)</div><div>b)</div><div>BFP – A/B/C</div><div>c)</div><div>ID Fan – A/B, FD Fan A/B, AH – A/B</div></div><div>ii)</div><div>For branch off from main system path having code say 10, keep the same alpha code and use 11, 12, 13 etc. Similarly for other branch off from main system path having code say 20, keep the same alpha code and use 21, 22, 23 etc and shall carry on further in the same way.</div><div>iii)</div><div>If the branch off from main system / sub system path is used for some other system, where different alpha codes can be applied, then in that case the said branch line will be designated by the alpha codes of the system to which it is providing the input.</div></div> <div>B) Numerical keys at Equipment Code level:</div> <div>There are three numerical keys available for each type of equipment code. Following has been agreed upon considering present practice, better flexibility and ease in sorting.</div> <div><div>i)</div><div>Valves and Dampers</div><div>---</div><div>Equipment Code – AA</div></div> <table><tr><td></td><td></td><td><div>N1</div></td><td><div>N2 N3</div></td></tr><tr><td>Motorised (on/off duty)</td><td>-</td><td>0</td><td>01 to 50</td></tr><tr><td>Motorised (inching duty)</td><td>-</td><td>0</td><td>51 to 99</td></tr><tr><td>Pneumatic (Control)</td><td>-</td><td>1</td><td>01 to 50</td></tr><tr><td>Motorised (thyrestor Control)</td><td>-</td><td>1</td><td>51 to 99</td></tr><tr><td>Sol. Operated</td><td>-</td><td>2</td><td>01 to 99</td></tr><tr><td>(Open / Close duty (Valves, NRVs, Gate)</td><td></td><td></td><td></td></tr><tr><td>Hydraulic</td><td>-</td><td>3</td><td>01 to 99</td></tr></table>						<div>N1</div>	<div>N2 N3</div>	Motorised (on/off duty)	-	0	01 to 50	Motorised (inching duty)	-	0	51 to 99	Pneumatic (Control)	-	1	01 to 50	Motorised (thyrestor Control)	-	1	51 to 99	Sol. Operated	-	2	01 to 99	(Open / Close duty (Valves, NRVs, Gate)				Hydraulic	-	3	01 to 99
		<div>N1</div>	<div>N2 N3</div>																																
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Sol. Operated	-	2	01 to 99																																
(Open / Close duty (Valves, NRVs, Gate)																																			
Hydraulic	-	3	01 to 99																																



DOCUMENT TITLE

KKS NUMBERING PHILOSOPHY

NRV (Without actuation)	-	4	01 to 99
Manual	-	5	01 to 99
Manual	-	6	01 to 99
Relief & Safety Valves	-	7	01 to 99
Reserve	-	8	01 to 99
Reserve	-	9	01 to 99

ii) Field Instruments

Field Transmitters & Analog Signals	-	0	01 to 99
Field Switches & Binary Signals	-	1	00 to 99
PG Test Point	-	4	00 to 99
Gauges	-	5	00 to 99
Automatic Turbine Tester (ATT)-HWR	-	2	00 to 99
(Reserved for protection Signals used by Hardwar)			

Example of Numerical Key Usage:

In line with the philosophy adopted for Valves / Dampers /instruments etc. pumps and fans in the main systems (having different system code) can be numbered as AP/N100 and as AP/N101, 102, Where system code is same.



TITLE:
**TECHNICAL SPECIFICATION
COLTCS**
STANDARD TECHNICAL REQUIREMENTS

SPEC. NO.: **PE-TS-475-165-N002**
SECTION: **III**
SUB-SECTION:
REV. NO. **00** DATE 20.01.2021
SHEET **1** OF **1**

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER



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


SPEC. NO. PE-TS- 475-165-N002

SECTION: III

Sheet 1 of 1 Date- 20.01.2021

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


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

	TITLE : COMPLIANCE CERTIFICATE FOR COLTCS	SPEC. NO.	PE-TS-475-165-N002
	PROJECTS: 2X660 MW KHURJA TG PKG	DATE:	20.01.2021
		SHEET	1 OF 2

COMPLIANCE CERTIFICATE


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


- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions with regard to same.
- b) There are no other deviations w.r.t. specification other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ Customer/Customer's Consultant approval and customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. Charges for 3rd party inspection (TUV/ equivalent) for imported components wherever required shall be included by bidder in the base price itself.
- d) Any drawing/ document/ data-sheet/ calculation/ Quality plan/ Instrumentation etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ Customer/Customer's Consultant approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification. For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.
- f) The commissioning spares including balls shall be supplied on 'As Required Basis' and to be supplied at the time of commissioning of COLTCS system & prices for same included in the base price itself.
Prices for special tools & tackles, if any, shall also be included in the base price.
Recommended spares for 3 years shall be quoted separately with price indicated separately.
- g) Charges for Installation Checks, Commissioning of equipments, Trial runs and Performance Testing at site shall be included by bidder as per the price format.
- h) The main flanges for Ball separator shall be suitable for the forces and moments as per the specification.
- j) Injection nozzles – 2/4 numbers of stubs of 100 NB or size as informed by bidder shall be provided by BHEL. The injection nozzles, counter flanges for the stubs along with nuts, bolts and gaskets shall be supplied by the bidder.
- k) Number of balls (Normal as well as abrasive) for COLTCS shall be as specified i.e Number of balls per charge shall be @ 10% of no. of tubes per condenser section.
- l) The hydrostatic test pressure shall be 1.5 times the design pressure.
- m) All sub - vendors shall be subject to BHEL/ Customer/Customer's Consultant approval in the event of order.
- n) The Performance guarantees of equipments shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Customer/Customer's Consultant.
- o) The orientation of piping around COLTCS shall be finalised during detailed Engg.


	TITLE : COMPLIANCE CERTIFICATE FOR COLTCS	SPEC. NO.	PE-TS-475-165-N002
	PROJECTS: 2X660 MW KHURJA TG PKG	DATE:	20.01.2021
		SHEET	2 OF 2


p) Electrical/ C&I :


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


	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)		SPECIFICATION NO. PE-TS-999-165-N001				
			VOLUME		III	PART A	
			SHEET		1	OF	13
INSTRUCTION TO BIDDER							
1. This data sheet shall be read in conjunction with Specification No. PE-TS-475-165-N002. 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		M ³ /hr				
	a) Normal						
	b) Maximum allowable						
2.6	Flow rate through ball collector		M ³ /hr				
	a) Normal						
	b) Maximum allowable						
Name of Bidder/ Vendor							
Revision Number		0	1	2	3	4	
Signature of Bidder/ Vendor Authorised Representative							
Date :							


	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)		SPECIFICATION NO. PE-TS-999-165-N001				
			VOLUME III PART A				
			SHEET 2 OF 13				
INSTRUCTION TO BIDDER		1. This data sheet shall be read in conjunction with Specification No. PE-TS-475-165-N002. 2. Items which deviate from Specification shall be marked with an asterisk (*)					
SL.NO.	PARTICULARS	ITEM		UNIT			
3.0	Guaranteed Performance						
3.1	Whether condenser back pressure/ overall heat transfer coefficient is guaranteed that it will be permanently maintained as long as the tube cleaning system is in operation.			YES/NO			
3.2	Pressure drop across the ball separator (i.e., between inlet and outlet connections) :						
	a) Normal flow condition						
	b) Maximum allowable flow condition						
3.3	Power consumption by ball recirculating pump during :		KW				
	a) Normal operation						
	b) Ball collection operation						
	c) Ball sorting operation						
3.4	Quantity of cleaning balls required per set for an operating period of one year		Nos.				
4.0	Operation :						
	Whether tube cleaning system is designed for the following operation modes :						
4.1	Automatic start-up initiated by push button.			YES/NO			
4.2	Automatic shut-down with ball collection effected by :						
	a) Push button			YES/NO			
	b) Adjustable timer			YES/NO			
	Ball monitoring system			YES/NO			
Name of Bidder/ Vendor							
Revision Number		0	1	2	3	4	
Signature of Bidder/ Vendor Authorised Representative							
Date :							


	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)		SPECIFICATION NO. PE-TS-999-165-N001			
			VOLUME III PART A			
			SHEET 3 OF 13			
INSTRUCTION TO BIDDER						
1. This data sheet shall be read in conjunction with Specification No. PE-TS-475-165-N002. 2. Items which deviate from Specification shall be marked with an asterisk (*)						
SL.NO.	PARTICULARS	ITEM		UNIT		
4.3	Automatic backwashing of ball separator with ball collection effected by :					
	a) Differential pressure measuring system			YES/ NO		
	b) Adjustable timer			YES/ NO		
	c) Push button			YES/ NO		
4.4	Automatic emergency backwashing of ball separator effected by differential pressure measuring system.			YES/ NO		
4.5	Automatic flushing of differential pressure measuring system.			YES/NO		
4.6	Automatic ball sorting initiated by push button.			YES/NO		
4.7	Whether provision for manual operation of the complete tube cleaning system is made in case of control system failure.			YES/NO		
5.0	Ball Separator :					
5.1	Make					
5.2	Nos. provided per set		Nos.			
5.3	Code/ Standard					
5.4	Body outer diameter		mm			
5.5	Body thickness		mm			
5.6	Manhole type & size		mm			
5.7	Whether sight glass is provided					
5.8	No. of screens/ strainers provided per each ball separator		Nos.			
5.9	Type of arrangement provided to prevent lodging of the debris at the entrance of ball extraction pipes.					
Name of Bidder/ Vendor						
Revision Number		0	1	2	3	4
Signature of Bidder/ Vendor Authorised Representative						
Date :						


	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)		SPECIFICATION NO. PE-TS-999-165-N001				
			VOLUME III PART A				
			SHEET 4 OF 13				
INSTRUCTION TO BIDDER		1. This data sheet shall be read in conjunction with Specification No. PE-TS-475-165-N002. 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		Mos.				
6.2	Design discharge flow		M ³ /hr				
6.4	Design discharge pressure		Bar				
6.5	Design pump Speed		RPM				
6.6	Design pump efficiency		%				
6.7	Seal for the pump						
6.8	Materials :						
	a) Casing						
	b) Impeller						
	c) Shaft						
7.0	Ball Collector :						
7.1	Nos. provided per set		Nos.				
Name of Bidder/ Vendor							
Revision Number		0	1	2	3	4	
Signature of Bidder/ Vendor Authorised Representative							
Date :							


	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)		SPECIFICATION NO. PE-TS-999-165-N001				
			VOLUME III PART A				
			SHEET 5 OF 13				
INSTRUCTION TO BIDDER		1. This data sheet shall be read in conjunction with Specification No. PE-TS-475-165-N002. 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			Nos.			
	g) Contact rating						
	h) Enclosure						
	i) Mounting						
8.2	Whether differential Pressure gauge is provided for manual observation.						
8.3	Diffrential Pressure Gauge :						
	a) Type						
	b) Make and Model						
	c) Range						
Name of Bidder/ Vendor							
Revision Number		0	1	2	3	4	
Signature of Bidder/ Vendor Authorised Representative							
Date :							


	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)		SPECIFICATION NO. PE-TS-999-165-N001				
			VOLUME III PART A				
			SHEET 6 OF 13				
INSTRUCTION TO BIDDER		1. This data sheet shall be read in conjunction with Specification No. PE-TS-475-165-N002. 2. Items which deviate from Specification shall be marked with an asterisk (*)					
SL.NO.	PARTICULARS	ITEM			UNIT		
	d) Accuracy e) Material of sensing element f) No. of contacts g) Dial size h) Enclosure i) Mounting		Nos.				
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 a) 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.				YES/ NO		
Name of Bidder/ Vendor							
Revision Number		0	1	2	3	4	
Signature of Bidder/ Vendor Authorised Representative							
Date :							


	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)		SPECIFICATION NO. PE-TS-999-165-N001				
			VOLUME III		PART A		
			SHEET 7 OF 13				
INSTRUCTION TO BIDDER		1. This data sheet shall be read in conjunction with Specification No. PE-TS-475-165-N002. 2. Items which deviate from Specification shall be marked with an asterisk (*)					
SL.NO.	PARTICULARS	ITEM			UNIT		
10.4	Whether electronic processor of the ball monitoring system is provided with the following a) Indicators for ♦ Required basic ball charge ♦ Recirculating Ball quantity ♦ Oversized ball quantity b) Time counters for ♦ Total cleaning system operating hours ♦ Cleaning system operating hours with sufficient number of oversized balls c) Recorder for ball consumption				YES/ NO YES/ NO YES/ NO YES/ NO. YES/NO YES/NO		
10.5	Whether provision for Self-testing and Self Calibration are made				YES/NO		
11.0	Cleaning Balls :						
11.1	Type						
11.2	Size		mm				
11.3	Specific gravity						
11.4	Material						
11.5	Hardness						
11.6	Total Ball recirculation quantity per set		Nos.				
11.7	abrasive coated ball recirculation quantity per set - (if any)		No.s				
12.0	Piping :						
12.1	Ball Extraction Piping						
Name of Bidder/ Vendor							
Revision Number		0	1	2	3	4	
Signature of Bidder/ Vendor Authorised Representative							
Date :							


	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)		SPECIFICATION NO. PE-TS-999-165-N001			
			VOLUME III		PART A	
			SHEET 8		OF 13	
INSTRUCTION TO BIDDER						
1. This data sheet shall be read in conjunction with Specification No. PE-TS-475-165-N002. 2. Items which deviate from Specification shall be marked with an asterisk (*)						
SL.NO.	PARTICULARS	ITEM		UNIT		
12.2	a) OD x thicknes b) Material c) Length of piping being supplied Ball Transport Piping		mm x mm M			
12.3	a) OD x thicknes b) Material c) Length of piping being supplied Differential pressure measuring system flushing piping.		mm x mm M			
12.4	a) OD x thicknes b) Material c) Length of piping being supplied Any other		mm x mm M			
13.0	Valves (Indicate Type of Valves)					
13.1	Sizes		: mm			
13.2	Nos. provided per set		Nos.			
13.3	Materials					
14.0	a) Body b) Disc/ Trim c) Shaft Distributors					
14.1	Nos. provided per set		Nos.			
14.2	Materials : a) Body b) Sight glass c) Sight glass flanges d) Internal parts					
Name of Bidder/ Vendor						
Revision Number		0	1	2	3	4
Signature of Bidder/ Vendor Authorised Representative						
Date :						

	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)		SPECIFICATION NO. PE-TS-999-165-N001				
			VOLUME III		PART A		
			SHEET 9		OF 13		
INSTRUCTION TO BIDDER		1. This data sheet shall be read in conjunction with Specification No. PE-TS-475-165-N002. 2. Items which deviate from Specification shall be marked with an asterisk (*)					
SL.NO.	PARTICULARS	ITEM		UNIT			
14.3	Lining material (if applicable)						
15.0	Injection Nozzles :						
15.1	Nos. provided per each CW inlet pipe		Nos.				
15.2	Size of the stubs to be provided in CW inlet pipe for installing the injection nozzles.		mm				
15.3	Material						
15.4	Lining material (if applicable)						
16.0	Actuators :						
16.1	Actuators for ball separator :						
	a) Nos. provided per ball separator		No.s				
	b) Type & make						
	c) Motor rating		KW				
16.2	Actuators for ball collector						
	a) Nos. provided per ball collector		No.s				
	b) Type & make						
	c) Motor rating		KW				
16.3	Actuators for Valves:						
	a) Nos. provided per set		No.s				
	b) Type & motor						
	c) Motor rating		KW				
16.4	Any other						
Name of Bidder/ Vendor							
Revision Number		0	1	2	3	4	
Signature of Bidder/ Vendor Authorised Representative							
Date :							

	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)		SPECIFICATION NO. PE-TS-999-165-N001			
			VOLUME III PART A			
			SHEET 10 OF 13			
INSTRUCTION TO BIDDER						
1. This data sheet shall be read in conjunction with Specification No. PE-TS-475-165-N002. 2. Items which deviate from Specification shall be marked with an asterisk (*)						
SL.NO.	ITEM					UNIT
PARTICULARS						
17.0	Electric Drive Motors					
17.1	Drive motor for recirculating pump :					
	a) Type and make					
	b) Rating					KW
17.2	Drive motor for differential pressure measuring system flushing pump (if applicable)					
	a) Type and make					
	b) Rating					KW
17.3	Any other.					
18.0	Control Panel					
18.1	Type					
18.2	Model & Manufacturer					
18.3	Operating Voltage/ frequency					V/ Hz
18.4	Control Voltage/ frequency					V/ Hz
18.5	Materials of housing and door					
18.6	Protections/ interlocks provided for :					
18.7	Class of Protection					
18.8	Control Hardware					
18.8	Alarms/ Annunciations provided for :					
18.9	Indicators provided for :					
18.10	Whether interconnecting control and power cabling between the control panel and various drive is included in the offer.					
19.0	Pressure gauges :					
19.1	Manufacturer & Type, Model					
Name of Bidder/ Vendor						
Revision Number		0	1	2	3	4
Signature of Bidder/ Vendor Authorised Representative						
Date :						

	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)		SPECIFICATION NO. PE-TS-999-165-N001			
			VOLUME III PART A			
			SHEET 11 OF 13			
INSTRUCTION TO BIDDER						
1. This data sheet shall be read in conjunction with Specification No. PE-TS-475-165-N002. 2. Items which deviate from Specification shall be marked with an asterisk (*)						
SL.NO.	ITEM			UNIT		
PARTICULARS						
19.2	Nos. provided per set	Nos.				
19.3	Location					
19.4	Dial size	mm				
19.5	Range & Accuracy					
19.6	Materials of construction :					
	a) Sensing element					
	b) Movement					
	c) Casing					
19.7	Enclosure					
19.8	Mounting					
20.0	Counter Flanges :					
20.1	Whether counter flanges complete with gaskets, bolts and nuts etc. for all terminal points are included in the offer.			YES/ NO		
20.2	Type					
20.3	Rating					
20.4	Materials					
	a) Flanges					
	b) Bolts and Nuts					
	c) Gaskets					
20.5	Code/ Standard					
21.0	Whether lifting arrangement is provided for various equipments.			YES/ NO.		
22.0	Whether ball recirculating pump, ball collector with interconnecting piping and valves are mounted on a single frame.			YES/ NO		
23.0	Whether supports (wherever necessary) complete with foundation plates, bolts, nuts, inserts etc. are included in the offer.			YES/ NO		
Name of Bidder/ Vendor						
Revision Number	0	1	2	3	4	
Signature of Bidder/ Vendor Authorised Representative						
Date :						

	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)		SPECIFICATION NO. PE-TS-999-165-N001			
			VOLUME III PART A			
			SHEET 12 OF 13			
INSTRUCTION TO BIDDER						
1. This data sheet shall be read in conjunction with Specification No. PE-TS-475-165-N002. 2. Items which deviate from Specification shall be marked with an asterisk (*)						
SL.NO.	ITEM		UNIT			
PARTICULARS						
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)				
	<ul style="list-style-type: none"> ◆ 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					
	c) Finish					
25.2	Internal Surfaces :					
	a) Surface Preparation					
	b) Primer					
	c) Finish					
26.0	Weights :					
26.1	Empty Weight	Kg.				
	a) Ball Separator					
Name of Bidder/ Vendor						
Revision Number	0	1	2	3	4	
Signature of Bidder/ Vendor Authorised Representative						
Date :						

	Title DATA SHEET - B CONDENSER ON LOAD TUBE CLEANING SYSTEM (SPONGE RUBBER BALL TYPE)		SPECIFICATION NO. PE-TS-999-165-N001			
			VOLUME III PART A			
			SHEET 13 OF 13			
INSTRUCTION TO BIDDER						
1. This data sheet shall be read in conjunction with Specification No. PE-TS-475-165-N002. 2. Items which deviate from Specification shall be marked with an asterisk (*)						
SL.NO.	PARTICULARS	ITEM		UNIT		
	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:\MSE\ASH\DS-COTCS.RTF						
Name of Bidder/ Vendor						
Revision Number	0	1	2	3	4	
Signature of Bidder/ Vendor Authorised Representative						
Date :						

ANNEXURE III

[illegible]

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

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

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

(A) SYSTEM VOLTAGE CODES:

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

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

(B) CABLE VOLTAGE CODES:

A = 11KV (Power cables)

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

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

(C) CABLE CODES

PVC Copper

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

PVC Aluminium

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


XLPE Copper

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

XLPE Aluminium

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

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

	TITLE LV MOTOR DATA SHEET - C	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE
		SHEET 1 OF 2

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

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE LV MOTOR DATA SHEET - C	SPECIFICATION NO.
		VOLUME II B
		SECTION D
		REV NO. 00 DATE
		SHEET 2 OF 2

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

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			