TSGENCO

5X800 MW YADADRI TPP

TANGEDCO

2X660 MW UDANGUDI STPP STG I

TECHNICAL SPECIFICATION

FOR DEBRIS FILTER (DF)

Specification No. : PE-TS- 417/435-165-N003 (REV. 00)

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

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SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

1.0 GENERAL

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

The DEBRIS FILTER (DF) 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.

COLTCS for Clarified water Application:

I. 5X 800 MW YADRADI TPS Flow = 42000 M³/hr Size= 2700 NB

COLTCS for Sea water Application:

II. 2X660 UDANGUDDI STPP Flow = 40675 M³/hr Size =2600 NB

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

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

1.3 The bids 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 :

2.1 Debris Filter (DF) :

The debris filter (DF) is intended to prevent accumulation of debris in CW Pipe before entering into the condenser. 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.

3.0 SCOPE OF SUPPLY UNDER THE SPECIFICATION IN THE BIDDER'S SCOPE FOR DEBRIS FILTER.

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

3.2 SCOPE OF SUPPLY IN THE BIDDER'S SCOPE FOR DEBRIS FILTER:

3.2.1 Each set of Debris Filter shall comprise as following:

a) Flushing pump with drive Motor (if required) - 1 No.

b) 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.

c) For Sea Water :- Complete Pipe work, including interconnection/debris discharge piping, intermediate flanges/counter flanges for pipes, bends, fittings, distributors, nozzles and support installation materials shall be in Purchaser's scope. **However, equipments & 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.

d) Filter body/ housing Vent and drain connections along with their isolating valves.

e) Maximum Length of Debris Filter, complete with scope of bolts, nuts and gaskets shall be as per Datasheet-A. Thickness of body flange shall be as per Drg no PE-DG-999-141-MO17 enclosed at enclosures at Annexure-II of Datasheet-A.:

f) Differential pressure measuring system for debris filter. DP measuring system shall comprise of **3 Nos. DPT + 1 No. DPG (For 5X800 MW YADADRI TPP)** and **2 Nos. DPT + 1 No. DPG (For 2X660 MW UDANGUDI STPP)** for each DF and shall be with Remote seal arrangement. Stubs for DPT and DPG shall be independent.

g) The Electrical & C&I items/ accessories as specified in succeeding clause/ respective sections herein.

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

i) Local Control cum Starter Panel (Switch Gear Panel) shall be as follows:

(i) Each set of Debris Filter shall be supplied with its own local control cum starter panel (Switch Gear Panel) and its MIMIC and annunciator for its operation. Extent of MIMICs and annunciators shall be decided during detailed engg.

For 2 Debris Filters of each unit, BHEL shall provide 2 Working and 2 standby feeders, i.e. 1 Working and 1 standby feeders for each Debris Filter. Each Switch

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

j) Control cables between field instruments and Switch gear panel.

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

l) Set of commissioning spares, on "As required basis".

m) Set of mandatory spares as indicated in Data Sheet A.

n) 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

o) Finish paints for touch up painting of equipment after erection at site, in sealed containers.

p) Set of special tools and tackles if required for maintenance and erection of the equipment supplied.

q) 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.

r) Panels & Instruments: Scope and Type as specified in C&I section wherever required.

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

4.0 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 Debris Filter:

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

The trial run & PG Test of equipment shall be generally conducted immediately after commissioning. These activities for different units shall be timed separately.

- **For drawings/documents approval**
  In the event of order all drawings / documents in soft as well as hard copy shall be submitted as per Cl. No. 10.0.

  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/ trail run/PG Test:**

  Bidder to include cost of two site visits for four days each for installation check, commissioning, trial run and PG testing for one unit i.e 2 nos of DF .

  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.

5.0 EXCLUSIONS:

The following are excluded from the bidder's scope.

5.1 Civil foundation works required for installation

5.2 Erection of Equipment at site.

6.0 DESIGN CONSTRUCTION:

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

6.1 The typical flow diagram applicable for the project specified herein for Debris Filter is enclosed (Annexure-I of Datasheet-A) with scope demarcation for bidder's compliance.

6.2 Location of Debris Filter shall be Approx. 15M Outside TG Hall 'A' Row in Transformer Yard. Final Layout drawing shall be provided during Detailed Engineering.

6.3 Thickness of body flange and counter flange of Debris Filter shall be as per Drg no PE-DG-999-141-MO17 enclosed at enclosures at Annexure-III of Datasheet-A.

6.4 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.

6.5 Housing/ body of Debris Filter 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 Debris Filter.

6.6 For Non-Sea Water Application, provision to be given for Cathodic Protection. For Sea Water Application, Cathodic Protection for DF along with Sacrificial Anode shall be provided by the bidder in the equipment.

6.7 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.

7.0 Performance Guarantee for Debris Filters.

Performance Guarantee Parameters shall be as under:

- Max. Pressure drop in Debris Filter in clean condition (Test to be conducted

along with commissioning) – not exceeding value as per S.No. 3.1 (a) of Datasheet A (Sub-Section ID). The Bids shall be technically rejected for pressure drop quoted higher than the indicated value in the referred Clause.

Any deviation to above pressure drop will not be accepted.

In case the successful bidder fails to demonstrate above parameter, he shall carry out modifications at his own cost, to purchaser's approval.
In case bidder fails to demonstrate above parameter to purchaser's satisfaction even after modification carried by him at site, the purchaser has the right to reject the equipment out rightly and bidder is liable to resupply the equipment meeting the contractual performance parameters within time period mutually agreed upon without any cost implication to BHEL/Customer.

8.0 SPARES :

8.1 Mandatory Spares

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

9.0 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.

10.0 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:

- Technical Data Sheets, P&ID, Installation Plan.
- GA drawings, Details of Flushing Skid (if any) and C& I Document (Part-I & II) of DF as applicable.
- Quality Plan.
- O & M Manual.

c. Drawings submission schedule after the award of contract shall be as below:

PACKAGE	BHEL DRG NO	DRG TITLE	Drg Sch for Vendors
DEBRIS	Primary Documents -		

FILTER	PE-V3-XXX-165-N001	P&ID - OF DF SYSTEM	R-0 within 20 days (for all except Installation plan, for Installation Plan 30 Days) from LOI/PO & subsequent revisions within 10 days of comments received from BHEL.
	PE-V3-XXX-165-N002	TECHNICAL DATA SHEET-DF	
	PE-V3- XXX-165-N003	INSTALLATION PLAN- DF	
	PE-V3- XXX-165-N004	GENERAL ARRANGEMENT OF DF	
	PE-V3- XXX-165-N006	C&I Part-I, PANEL-TDS, I/O LIST, CABLE SCH AND CONTROL PHILOSPHY FOR DF	
	PE-V3- XXX-165-N008	QP-DF	
	PE-V3- XXX-165-N005	GA OF FLUSHING PUMP & FOUNDATION DETAILS OF FLUSHING PUMP AND SADDLE SUPPORT (If Applicable)	R-0 within 20 days from Cat-I(or)II approval of TDS & subsequent revisions within 10 days of comments received from BHEL
	PE-V3- XXX-165-N007	GA & WIRING DIAGRAM OF PANEL-DF	R-0 within 30 days from Cat-I(or)II approval of C&I Part-I document & subsequent revisions within 10 days of comments received from BHEL.
	Secondary Documents -		
	PE-V3- XXX-165-N009	O&M MANUAL-DF	Within 30 days from MDCC

11.0 The makes of various bought out items shall be subjected to purchaser's (BHEL & Customer) approval in the event of order.

12.0 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.***

13.0 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.
  - Debris Filter body/ housing (as applicable).
  - Flushing Skid (if any).
  - Other equipment considered necessary for Layout/ Civil.

- Electrical Load Data.
- Schedule of Deviation.

The bidder to note that load requirement furnished and finalized 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.

14.0 Debris Filter 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.

14.1 Preparation for Packing:

- After hydro testing, operation, all fluids e.g. water etc., shall be completely drained from all DF'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 DF shall be placed on a strong wooden base & bolted to the wooden base using the foundation holes for further transportation up to site.

14.2 Protection of parts:

- DF Shell shall be packed in properly in high grade bubble plastic wrap for transportation, and long storage at site.
- Actuators shall be packed in separate wooden box of proper sizes.
- DF items (EXCEPT DF Shell) 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 Debris Filter shall be closed properly by suitably covering to prevent foreign material entering in Debris Filter.

- 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.

14.3 Preservation

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

14.4 Photographs

Bidder to take photographs of all parts like Debris Filter Shell, Screen, pumps (if any), piping, valves, instruments, actuators, panel (inside & outside) and sent to engineering deptt along with all inspection reports before final dispatch.

SUB-SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

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

PACKAGES: DEBRIS FILTER (DF)

SCOPE OF VENDOR: SUPPLY

PROJECT:

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC Starter cum control panel (if applicable)	BHEL Vendor	BHEL BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	 BHEL 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: DEBRIS FILTER (DF)

SCOPE OF VENDOR: SUPPLY

PROJECT:

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	BHEL	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	BHEL	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Equipment layout drawings	Vendor	-	For preparation of cabling layout drawings by BHEL, vendor shall furnish Electrical equipment layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling,
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipment/ items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of Junction Box arises on account of Power Cable size mis-match due to vendor engineering at later stage, vendor shall supply the Junction Box for suitable termination.

DATA SHEET - FOR LV MOTORS			
SL NO.	DESCRIPTION	PROJECTS	
		5X800 MW YADADRI TPP	2X660 MW UDANGUDI STPP STG I
A	**General**		
1	Manufacturer & country of origin	DURING DETAILED ENGINEERING	DURING DETAILED ENGINEERING
2	Motor type	Squirrel cage induction AC motors	Squirrel cage induction AC motors
3	Efficiency class	IE3	For all LT motors, it shall be IE3 class as per IS 12615 except for VFD controlled LT motors, it shall be IE2 class as per IS 12615
4	Type of starting	DOL	DOL
5	Maximum acceptable kW rating of LV motor	Less than 175 kW	>0.2 kW and up to 200 kW. LT motors rated up to 125 kW shall be controlled through MPCB/MCCB and contactor. LT motors rated more than 125 kW shall be controlled through air circuit breaker.
6	Rating up to which Single phase motors permitted.	0.2 kW	up to 0.2 Kw
7	Installation (Indoors/ Outdoors)	indoor/outdoor	indoor/outdoor
8	Degree Of Protection	IP55	IP 55
9	Name of the equipment driven by motor & Quantity	DURING DETAILED ENGINEERING	DURING DETAILED ENGINEERING
10	Maximum Power requirement of driven equipment	DURING DETAILED ENGINEERING	DURING DETAILED ENGINEERING
11	Rated speed of Driven Equipment	As per system requirement	As per system requirement
12	Design ambient temperature (Degree Celcius)	50 deg C	50 deg C
B	**Design and Performance Data**		
1	Frame size & type designation	DURING DETAILED ENGINEERING	DURING DETAILED ENGINEERING
2	Type of duty	As per system requirement	AS PER REQUIREMENT
3	Rated Voltage	240/415 V	240/415 V
4	Rated Frequency	50 Hz	50 Hz
5	System fault level at rated voltage	50 kA for 1 sec.	50 kA for 1 sec.
6	LV System grounding	solidly grounded	solidly grounded
7	Permissible variation for		
a	Voltage	±10%	±10%
b	Frequency	+3% to -5%	+3% to -5%
c	Combined voltage & frequency	10%	10%

8	Rated output at design ambient temp (by resistance method)	As per system requirement	As per system requirement
9	Synchronous speed & Rated slip	As per system requirement	As per system requirement
10	Minimum permissible starting voltage	80% of rated voltage	80% of rated voltage During fast changeover of power supply source, vector difference between the motor residual voltage and the incoming supply voltage shall be about 150% of the rated voltage and the motors shall withstand voltage stress and torque stress developed during that time, which may last for a period of one (1) second. c) The motor shall be capable of operating at full load at a supply voltage of 75% of the rated voltage for 5 minutes.
11	TYPE OF STARTER PROVIDED IN MCC	As per system requirement	As per system requirement
12	Starting time in sec with mechanism coupled		
a	At rated voltage	As per system requirement	As per system requirement
b	At min starting voltage		
13	Locked rotor current as percentage of FLC (including IS tolerance)	As per IS 12615/IEC 60034	For energy efficient LT motors, locked rotor current shall be as per IS: 12615. Locked rotor current of the VFD controlled AC motors shall be limited to 300% of the full load current, and is subject to IS tolerance
14	Torque		
a	Starting	As per system requirement	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque. • Pull out torque at rated voltage shall not be less than 205% of full load torque. • Motors subjected to reverse rotation shall be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125% of rated speed in reverse direction.
b	Maximum		
15	Permissible temp rise at rated output over ambient temp & method	All motors shall have class F insulation but limited to class B temperature rise	Winding shall be class F insulation with temperature limited to class B

16	Noise level in (dB)	The noise level shall not exceed 85db (A) at 1.5 meters from the motor.	Motors shall be selected with low noise levels in accordance with IS 12065.
17	Amplitude of vibration	maximum double amplitude vibrations upto 1500 rpm shall be 40 microns and 15 microns upto 3000 rpm	The peak amplitude of the vibration shall also be within the specified limits of IS: 12075.
18	Efficiency & P.F. at rated voltage & frequency		
a	At 100% load	Efficiency as per IS 12615, IEC: 60034-30 (Latest revision), P.F. as per requirement.	Efficiency as per IS 12615, IEC: 60034-30 (Latest revision), P.F. as per requirement.
b	At 75% load		
c	At starting	Efficiency as per IS 12615, IEC: 60034-30 (Latest revision), P.F Minimum 0.2.	Efficiency as per IS 12615, IEC: 60034-30 (Latest revision), P.F in line with starting requirement as per IS.
C	**Constructional Features**		
1	Method of connection of motor driven equipment	As per system requirement	As per system requirement
2	Applicable Standard	as per relevant standard	as per relevant standard
3	DOP of Enclosure	IP55	IP55
4	Method of cooling	The motor shall be self-ventilated type, either totally enclosed fan cooled IC 411(TEFC), totally enclosed tube ventilated IC 511(TETV) or closed air circuit air- cooled IC 611(CACA).	LT motors shall be totally enclosed fan cooled (TEFC), type IC411. The cooling shall be effected by self-driven bi-directional centrifugal fan protected by fan cover. The Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.
5	Class of insulation	All motors shall have class F insulation but limited to class B temperature rise	All motors shall have class F insulation but limited to class B temperature rise
6	Main terminal box		
a	Type	Refer Specific technical requirement for motors	
b	Power Cable details (Conductor, size, armour/unarmour)	1.1 kV XLPE armour cable, size shall be provided during detailed engineering	1.1 kV XLPE armour cable, size shall be provided during detailed engineering
c	Cable Gland & lugs details (Size, type & material)	Refer Specific technical requirement for motors	The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer. The terminal box shall have a separate grounding terminal.

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

SL.NO.	PARAMETERS	5X800 MW YADADRI TPP	2X660 MW UDANGUDI STPP STG I
1	**CODE ANS STANDARDS**	IS-325, IS-12615, IEC-60034	IS-325, IS-12615, IEC-60034
2	**SERVICE CONDITIONS**	Hot, Humid and Tropical Atmosphere highly polluted.	Motors shall be suitable for installation in hot, humid and tropical atmosphere and polluted at places with coal ash and or fly ash
3	**TYPE AND RATING**	General purpose, Constant speed, Squirrel cage, Three/Single phase, Induction type, Continuous duty, motor name-plate rating at 50°C shall have at least 15% margin	All AC motors shall be squirrel cage three phase/single phase induction motors. All the motor shall be designed for bi-directional rotation. All the motors shall be rated for S1 duty for continuous operation. Motors of crane and hoist application shall be intermittent duty. Whenever the basis for motor rating are not specified in the corresponding mechanical specification section maximum continuous motor rating shall be atleast 10% above the maximum load derived of the driven equipment under entire operating range including voltage & frequency variation.
4	**EFFICIENCY CLASS**	IE3 (As per latest BIS notification)	For all LT motors, it shall be IE3 class as per IS 12615 except for VFD controlled LT motors, it shall be IE2 class as per IS 12615
5	**RUNNING REQUIREMENT**	a) Motor shall run continuously at rated output over the entire range of 415V±10% voltage and 50Hz+3% to -5% frequency variations. b) The motor shall be capable of operating satisfactorily at full load for 5 minutes without injurious heating with 75% rated voltage at motor terminals. c) The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.	A The motor shall be capable of operating at full load at a supply voltage of 75% of the rated voltage for 5 minutes. B) The motors shall be suitable for bus transfer schemes provided on the 11 kV/6.6 kV/415 V systems without any injurious effect on its life. C) During fast changeover of power supply source, vector difference between the motor residual voltage and the incoming supply voltage shall be about 150% of the rated voltageand the motors shall withstand voltage stress and torque stress developed during that time, which may last for a period of one (1) second.
6	**STARTING CURRENT**	a) Motor shall be designed for direct online starting at full voltage. Breakaway starting current as percentage of full load current for various motor rating shall not exceed 600% subject to IS tolerance of plus 20%. b) The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage. c) Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminals. d) Two hot starts in succession with motor initially at normal running temperature. e) The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage.	• For energy efficient LT motors, locked rotor current shall be as per IS: 12615. • Locked rotor current of the VFD controlled AC motors shall be limited to 300% of the full load current, and is subject to IS tolerance. Motors subjected to reverse rotation shall be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125% of rated speed in reverse direction. Continuous duty motors shall be suitable for the following starting requirements under the specified conditions of load, torque and inertia. • No. of consecutive hot starts shall be 2 (with initial temperature of the motor at full load operating level). • No. of consecutive cold starts shall be 3 (with initial temperature of the motor at ambient temperature).

SL.NO.	PARAMETERS	5X800 MW YADADRI TPP	2X660 MW UDANGUDI STPP STG I
7	**LOCKED ROTOR WITHSTAND TIME**	a) Under hot condition at 110% rated voltage shall be more than motor starting time by at least 3 seconds for motors up to 20 seconds starting time and by 5 seconds for motor with more than 20 seconds starting time at minimum permissible voltage of 80% rated voltage.	• For the LT motors having starting time up to 20 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 seconds more than the starting time. • For the motors having starting time more than 20 seconds and up to 45 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 seconds more than the starting time. • For motors having starting time more than 45 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time. • Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met. • When a speed switch is mounted on the motor shaft, the same shall remain closed for speeds lower than 20% and open for speeds above 20% of the rated speed. The speed switch shall be capable of withstanding 120% over speed in either direction of rotation.
8	**ENCLOSURE**	All motor enclosures for outdoor, semi-outdoor & indoor application shall conform to the degree of protection IP-55. Motor for outdoor or semi-outdoor service shall be of weather-proof construction with canopy.	a) Motors shall have IP 55 degree of protection. b) For hazardous location, the enclosure of motors shall following have flame proof construction conforming to applicable standard. • Fuel oil area Group – IIB • Hydrogen generation plant area : Group – IIC)
9	**COOLING**	The motor shall be self ventilated type, either totally enclosed fan cooled IC 411(TEFC), totally enclosed tube ventilated IC 511(TETV) or closed air circuit air- cooled IC 611(CACA).	LT motors shall be totally enclosed fan cooled (TEFC), type IC411. The cooling shall be effected by self-driven bi-directional centrifugal fan protected by fan cover. • The Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC.
10	**WINDING AND INSULATION**	a) All insulated winding shall be of copper. b) Class F insulation but limited to class B temperature rise.	Winding shall be class F insulation with temperature limited to class B. Insulation shall be Non-hygroscopic, oil resistant, and flame resistant. Winding, fittings and hardware shall be corrosion resistant. Winding shall be tropicalized and suitably varnished, baked and treated for operating satisfactorily in humid and corrosive atmosphere.
11	**TROPICAL PROTECTION**	a) All motors shall have fungus protection involving special treatment of insulation and metal against fungus, insects and corrosion. b) All fittings and hardwares shall be corrosion resistant.	Motors shall be suitable for installation in hot, humid and tropical atmosphere and polluted at places with coal ash and or fly ash.

SL.NO.	PARAMETERS	5X800 MW YADADRI TPP	2X660 MW UDANGUDI STPP STG I
12	**BEARINGS**	a) Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be rated for minimum service life of 40,000Hrs. b) Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. c) Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area. d) Grease lubricated bearings shall be pre-lubricated and shall have provisions for in-service positive lubrication with drains to guard against over lubrication. e) Bearings shall be insulated as required to prevent shaft current and resultant bearing damage.	• Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area. • Sleeve bearings shall be split type, ring oiled with permanently aligned, close running shaft sleeves. Grease lubricated bearings shall be pre-lubricated and shall have provisions for inservice positive lubrication with grease nipple and relief holes. For sleeve bearings, the bearing housing shall be preferably in end shield itself. • Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. However, if anti-friction bearings can take vertical thrust, thrust and guide bearings are not required. • Lubricant shall not deteriorate under all service conditions. The lubricants shall be limited to normally available types. For motors rated 30 kW and above re-lubrication facility shall be provided. • For motor with forced lubrication, a shaft driven oil pump shall be provided along with an electrical auxiliary pump. Alternatively, two motor driven pumps may be provided, one working and one standby. All necessary auxiliaries and accessories shall be provided to complete the system. A pressure gauge and pressure switch for low oil pressure warning and to start the standby oil pump automatically shall also be provided. A motor driven jacking oil pump may be provided, for heavy shaft loads. • Flow switches shall be provided for monitoring oil flow of forced lubrication bearings, if used. Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10 A at 230 V AC. • For bearing temperature measurement, duplex RTDs shall be provided for each bearing and shall be wired up to the terminal box. • Each bearing shall be provided with dial type thermometer. • For all VFD operated motors shall have insulated bearings to prevent flow of shaft currents. • All the motors rated <15 kW shall be provided with sealed ZZ bearings. • Lub oil pressure transmitters shall be provided to DCS for remote monitoring. Lub oil pressure very low trip to HT equipment shall be 2 out of 3 logic.

SL.NO.	PARAMETERS	5X800 MW YADADRI TPP	2X660 MW UDANGUDI STPP STG I
13	**MOTOR TERMINAL BOX**	(a) Motor terminal box shall be detachable type and located in accordance with Indian Standards clearing the motor base- plate/ foundation. (b) Terminal box shall be capable of being turned 360 Deg. in steps of 90 degree for LV motors unless otherwise approved. (c) The terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor. (d) Terminals shall be stud or lead wire type, substantially constructed and thoroughly insulated from the frame (e) The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor. (f) The terminal box shall be capable of withstanding maximum system fault current for a duration of 0.25 sec. (g) Motor terminal box shall be furnished with suitable cable lugs and double compression brass glands to match with cable used. (h) Degree of protection for terminal boxes shall be IP 55 as per IS 4691. (i) unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end. (j) Connections shall be such that when the supply leads R, Y & B are connected to motor terminals 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.	• Separate terminal boxes of IP 55 degree of protection shall be provided for stator leads. For single core cables, gland plate shall be non-magnetic material. Terminal box of LT motors shall be capable of being turned 360° in steps of 90°. The terminal boxes shall be split type with removable cover with access to connections. • Terminals for motors shall be stud type, thoroughly insulated from the frame. The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor. • The terminal box shall be capable of withstanding maximum system fault current for 0.2 sec for all breaker operated motors and shall be provided with explosion vent. • For contactor operated LT motors, the terminal box shall be capable of withstanding the fault current for 0.2 sec minimum and operating time of MPCB/MCCB. • Removable gland plates of thickness not less than 2.5 mm sheet steel or 3 mm aluminium (for single core cables) shall be provided for cable boxes. • Cable spreader box shall be provided for larger cable sizes. • Separate terminal box for space heaters shall be provided. • A separate terminal box of IP 55 degree of protection shall be provided for temperature detectors. • All the accessory terminal boxes shall be located on the same side of the main (power) terminal box. • For LT motors, terminal box shall be located on top, unless otherwise specified.
14	**MINIMUM PHASE TO PHASE & PHASE TO EARTH CLEARANCE FOR 415V**	25 mm	As per relevant standard

SL.NO.	PARAMETERS	5X800 MW YADADRI TPP	2X660 MW UDANGUDI STPP STG I
15	**GROUNDING**	(a) The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer to accommodate Flat ground conductor (shall be finalsied during deatil engineering). (b) The cable terminal box shall have a separate grounding pad.	The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer. The terminal box shall have a separate grounding terminal.
	GROUNDING CONDUCTORS	Shall be finalsied during deatil engineering	Shall be finalsied during deatil engineering
16	**RATING PLATE**	In addition to the minimum information required by IS, the following information shall be shown on motor rating plate : a) Temperature rise in Deg.C under rated condition and method of measurement. b) Degree of protection. c) Bearing identification no. and recommended lubricant.	Motor shall have stainless steel nameplate(s) showing diagram of connections, all particulars as per IS: 325 / IS: 12615 and shall also have 'BEE' marking. In addition to the minimum information required by IEC/IS, the following information shall be shown on motor rating plate: - Temperature rise in ºC under rated condition and method of measurement. - Degree of protection. - Bearing identification no. and recommended lubricant. - Location of insulated bearings.
17	**DRAIN PLUG**	Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.	-
18	**LIFTING PROVISIONS**	Motor weighing 20 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.	-
19	**PAINTING**	Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions subject to Customer's approval during detailed engineering.	Painting shall be carried out by an approved process. Pretreatment shall conform to applicable standard. The equipment shall be subject to a coat of red oxide primer paint. All inside and outside surface shall be painted with epoxy based paint. The final thickness of paint film on steel shall not be less than 100 microns. Finish shade shall be 631 of IS: 5 (smoke grey).

SL.NO.	PARAMETERS	5X800 MW YADADRI TPP	2X660 MW UDANGUDI STPP STG I
20	**TESTS**	All motors shall be subjected to Type tests & routine tests as per IS: 325 and approved quality plan.	Equipment offered shall be of type tested and proven type. Type test certificates for test conducted earlier on similar rating shall be furnished for the motors rated 30 kW and above. The following type tests shall be conducted on LT motors. • Measurement of resistance of windings of stator and wound rotor. • No load test at rated voltage to determine input current power and speed • Full load test to determine efficiency power factor and slip. • Temperature rise test. • Momentary excess torque test. • High voltage test. • Test for vibration severity of motor. • Test for noise levels of motor • Test for degree of protection • Over speed test. The following routine tests shall be carried out for the motors as per applicable standards. • IR of Winding before and after HV tests • HV test on main winding space heater, RTD, BTD • Resistance measurement • No load run test Major Electrical • Phase sequence and direction of rotation • Vibration check Major Electrical • Reduced voltage running test • Locked rotor test at reduced voltage • Record of RTD & BTD resistance at the end of no load test • Test on space heater & RTD • Visual Control of terminal box and verification of construction with respect to short tested terminal box
21	**DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT**	DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT a) OGA drawing showing the position of terminal boxes, earthing connections etc. b) Arrangement drawing of terminal boxes.	DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT a) OGA drawing showing the position of terminal boxes, earthing connections etc. b) Arrangement drawing of terminal boxes.
22	**MINIMUM STARTING VOLTAGE FOR MOTOR**	-	80% of rated voltage
23	**SHORT TIME RATING FOR TERMINAL BOXEX**	-	Fault withstand rating of motor terminal box (Breaker operated): 415 V system : 50/65 kA for 0.2 second

SUB-SECTION – IC

SPECIFIC TECHNICAL REQUIREMENTS (C &I)

SCOPE MATRIX - DEBRIS FILTER (DF)		
S.No.	PROJECT	5X800 MW YADADRI TPP
1	SYSTEM APPLICABLE: DEBRIS FILTER (DF)	Y
2	SYSTEM CONFIGURATION: UNITISED OR COMMON OR AS APPLICABLE	UNITISED
3	CONTROL SYSTEM	REFER NOTE-1
4	LOCATION OF CONTROL SYSTEM	
5	CONTROL SYSTEM SCOPE (BIDDER/BHEL/ CUSTOMER)	
6	CONTROL FROM PB's 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 LCP (Y/N)	Y; REFER NOTE-5
9	ACTUATOR WITH INTEGRAL STARTER (Y/N)	Y
10	DPG/ DPT PER DEBRIS FILTER (DF) *	DIFFERENTIAL PRESSURE TRANSMITTER = 3 nos. (Across each strainer) DIFFERENTIAL PRESSURE GAUGE = 1 no. (Across each strainer)
11	SEA WATER APPLICATION	N
12	DETAILED CUSTOMER SPECIFICATION	ANNEXURE-I

	NOTES:
1	Type of control system shall be DDCMIS (Station C&I) based, located in Central Control Room in BHEL scope. Field instrumentation for the package is in bidder's scope.
2	Local control cum starter panel for DEBRIS FILTER (DF) is in bidder's scope of supply. Items not specifically mentioned and required for the completeness of the system shall be supplied by bidder.
3	Push buttons and indication lamps for open/close and Start/stop of drives/equipments for DEBRIS FILTER (DF) 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 starter panel for DEBRIS FILTER (DF). Nos. shall be decided during detailed engineering.
4	No. of facia shall be decided during detailed engineering.
5	Colored MIMICS on Local control cum starter panel to be provided as per system flow diagram for both streams of Debris Filter.
6	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.
7	Bidder to terminate all instrumentation and control elements in the local control cum starter panel for further cabling to DDCMIS. Complete cable schedule (in BHEL excel format provided in electrical portion of the specification) and cable interconnection details from field to Local control cum Starter panel and ,Local control cum Starter panel to DDCMIS shall be provided by bidder.
8	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. Cable schedule (in BHEL excel format provided in electrical portion of the specification) & cable interconnection details from field to Local control cum Starter panel and, Local control cum starter panel to DDCMIS.
9	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.
10	LIR (Instrument Rack) to be provided for mounting the instruments in the field.
11	Cable for local wiring, between field instruments to Starter panel shall be screened with 1.5 mm2 minimum and shall be in bidder's scope. Refer 'electrical scope sheet between BHEL and bidder' attached in electrical specification for cable scope.
12	Mandatory spare list shall be referred in 'List of mandatory spares' attached elsewhere in the specification and shall be supplied by bidder.
13	*Instruments, root valves, impulse pipe shall be suitable for sea water application having corrossion resistance where media is sea water. All the transmitters and gauges shall have remote seal type having 15m capillary length.
14	The Vendor list/ sub-vendor list shall be subject to BHEL/Customer approval during contract stage.
15	The specifications for instruments mentioned in the specification are minimum requirements. The detailed specifications shall be finalized during detail engineering.
16	No deviations with respect to technical specification shall be acceptable.
17	Local control cum starter panel can be common for two streams of Debris Filter (left and right) for One Unit.

C&I DELIVERABLES LIST FOR DEBRIS FILTER			
Sl.No.	**DRAWING NO.**	**DRAWING/DOCUMENT TITLE**	**CATEGORY**
INSTRUMENTATION			
1	PE-V9-XXX-165-I901C	INSTRUMENT DATA SHEETS	A
2	PE-V9-XXX-165-I902C	BOQ	I
3	PE-V9-XXX-165-I903C	INSTRUMENT QP / CHECK LIST	A
LOCAL CONTROL CUM STARTER PANEL			
1	PE-V9-XXX-165-I950C	LOCAL CONTROL CUM STARTER PANEL DATA SHEET	A
2	PE-V9-XXX-165-I951C	WIRING DIAGRAM	A
3	PE-V9-XXX-165-I952C	PANEL EXTERNAL & INTERNAL GA DRAWING & TERMINATION DETAILS (INCLUDING FOUNDATION DETAILS & FLOOR CUT-OUT)	A
4	PE-V9-XXX-165-I953C	RECOMMENDED CONTROL LOGICS / CONTROL PHILOSOPHY	A
5	PE-V9-XXX-165-I954C	LIST OF HARDWIRED SIGNAL EXCHANGE WITH DDCMIS	A
6	PE-V9-XXX-165-I955C	BILL OF MATERIAL	I
7	PE-V9-XXX-165-I956C	LOCAL CONTROL PANEL QUALITY PLAN	A
8	PE-V9-XXX-165-I957C	INPUT/OUTPUT LIST; DRIVE LIST	I
9	PE-V9-XXX-165-I958C	RELAY BASED PANEL O & M MANUAL	I
10	PE-V9-XXX-165-I959C	Cable schedule & cable interconnection details from field to Local control cum Starter panel and, Local control cum starter panel to DDCMIS.	I

XXX-PROJECT NO.

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR DEBRIS FILTERS

1.1 The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. The Vendor list/ sub-vendor list shall be subject to BHEL / Customer approval during contract stage. No commercial implication in this regard shall be acceptable.

1.2 These requirements are to be read in conjunction with detailed Technical specification enclosed in the specification. In case of any conflict and repetition of clauses in the specification, the more stringent requirement as per interpretation of Customer shall prevail without any commercial implication. No deviations shall be acceptable.

1.3 Drawings/Documents and data to be furnished after award of the contract as per deliverables list attached elsewhere in the specification.

1.4 All local gauges as well as transmitters and sensors for parameters like pressure, temperature, flow etc. as required for the safe and efficient operation and maintenance under the scope of specification shall be provided. The necessary root valves, impulse piping, drain cock, gauge-zeroing cocks, valve manifolds, instrument racks and all the other accessories required for mounting / erection of these local instruments, transmitters and sensors shall be supplied by bidder even if not specifically asked for. Also the proposal shall include the necessary cables, flexible conduits, instrument racks, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg / Cm2.

1.5 All local gauges, transmitters and sensors shall be mounted on suitable en closures, Instrument racks (LIR) in bidder's scope subject to Customer's approval.

1.6 Type of control system shall be DDCMIS (Station C&I) based, located in Central Control Room in BHEL scope. Field instrumentation for the package is in bidder's scope.

1.7 The local control cum starter panel in bidder's scope shall be NEMA 4X. Suitable canopy on top shall be provided for the panel.

1.8 Push buttons and indication lamps for Open/Close and Start/Stop of drives/equipment's shall be provided on the starter panel. Remote and local indication, indicating lamps / LED cluster for instruments/drives/equipment's status and critical alarms shall be provided on the starter panel. Nos. shall be decided during detailed engineering.

1.9 Colored MIMICS on the panel is to be provided as per system flow diagram. No. of facia on Starter panel shall be decided during detailed engineering.

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR DEBRIS FILTERS

1.10 Bidder to terminate all instrumentation and control elements in the control panel for further cabling to DDCMIS by BHEL.

1.11 All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. The enclosures of all electronic instruments shall conform to IP-65 unless otherwise specified (Explosion proof for NEC article 500, class 1, Division 1 area & flame proof) and an anticorrosive paint shall be applied to the field mounted enclosures / instruments. All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland. Gaskets, Fasteners, Counter and mating flange shall also be included wherever required with the field instruments.

1.12 Sea or saline water media is applicable for Udangudi . The minimum requirement for sea water or saline water media is as below:

a. Instruments shall be suitable for sea or saline water application. MOC of impulse tubing and impulse pipe shall be CPVC (3/8") Sch 80 or better, Industrial grade up to manifold. MOC of impulse tubing, fittings (from manifold to instrument) and manifold shall be Super Duplex stainless steel.
b. MOC of all wetted parts, fittings, sampling pipes, tubes, fittings, diaphragm and all types of erection hardware of instrument/drives/equipment, shall be Duplex stainless steel or better suitable for sea or saline water application.

1.13 Epoxy coated painting is required for all I & C equipment.

1.14 All valve actuator shall be provided with conventional actuators with integral starter for ON/OFF valves. Non-contact type electronic 2-wire position transmitters shall be provided for all inching type motorized valves and dampers. The detailed specification of actuator is given elsewhere in the specification.

1.15 Differential pressure indicators & Differential pressure Transmitters across Debris filters shall be provided with independent impulse & isolation valves. Remote & Local indication DP transmitters & gauges across Debris filters shall be provided.

1.16 All the transmitters and gauges shall have remote seal type having 15m capillary length minimum.

1.17 All the instruments/equipment's/electrical items shall be provided & designed with maximum star rating as available in line with energy conservation policies notified by BEE, GOI at the time of supply.

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR DEBRIS FILTERS

1.18 All primary instruments shall be with protection class of IP 65 or better.

1.19 Transmitter should not be mounted directly on the manifold, Manifold shall be non-integral and standalone type.

1.20 LVDT type instrument is not acceptable.

1.21 All limit switch shall be conforming to IEC-60947-5-1.

1.22 Each switching element including the limit and torque switches of valve actuators shall be provided with minimum two SPDT OR DPDT contacts each for close, open and adjustable.

1.23 All transmitters shall be smart and electronic type, microprocessor based and HART compatible. All instruments should be supplied with valid calibration and test certificates provided by OEM.

1.24 The system shall be provided with annunciation system. It shall be an integral part of the control system. All the field contact shall be acquired through control system. The annunciation sequence/ logic shall conform to ISA sequence ISA-2A. The window lamps for the system shall be driven through output modules of the control system.

1.25 For plug in type instruments, the plug & sockets shall be polarized to prevent wrong connections and have facility for secure coupling in plug-in position to prevent loose connections.

1.26 Signal/Electrical connection shall be screwed connection with double compression type Nickel-plated brass cable glands.

1.27 All the field instruments shall also be provided with SS tag nameplate.

1.28 Cable scope shall be referred in Electrical scope sheet attached in the Electrical portion of the specification.

1.29 Push buttons and indication lamps for Open/Close and Start/Stop of drives/equipment's shall be provided on the starter panel in Bidder's scope. Remote and local indication, indicating lamps / LED cluster for instruments/drives/equipment's status and critical alarms shall be provided on the starter panel. Nos. shall be decided during detailed engineering.

1.30 Mandatory spare list shall be referred in 'List of mandatory spares' attached elsewhere in the specification and shall be supplied by bidder.

1.31 Power Supply Requirement:
415 V, 3 phase AC power supply shall be provided by Customer for the local control cum starter panel at a single point. Further any electrical distribution shall be in bidder's scope. Any other voltage requirement to be

arranged/derived by bidder by providing suitable control transformer. Starter panel in bidder's scope shall have provision for redundant feeder with fast automatic changeover.

1.32 Bidder shall provide an unlimited warranty on all equipment and software for three years after the start of the warranty period, i.e. after satisfactory completion of initial operations. This warranty shall include repair, replace ment or correction of identified software or hardware discrepancies at no cost to owner.

1.33 Bidder to delegate /depute their persons/experts as per Customer's require ment.

1.34 Bidder must offer general tools and tackles and special calibration instrume nts required during start-up, trial run, operation and maintenance of the sy stem.

1.35 The technical requirements for instruments/ equipment's/panels mentioned in the specification are minimum requirements. Items not specifically mentioned and required for the completeness of the system shall be supplied by bidder.

2.0 **Requirements for flanged remote seal diaphragm:**

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

FORM NO. PEM-6666-0

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR FOR DEBRIS FILTER	SPECIFICATION NO.: PE-DG-XXX-145-I902
		VOLUME II B
		SECTION D
		REV. NO. 00 DATE: 26.04.2018
		SHEET 1 OF 4

Data Sheet A & B

		DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL*	* PROJECT		
	OFFER REFERENCE		
	* TAG NO. SERVICE		
	* DUTY	■ ON / OFF ■ INCHING	
	* LINE SIZE (inlet/outlet): MATERIAL		
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY	
	* OPENING / CLOSING TIME		
	* WORKING PRESSURE		
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%	
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY	
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY	
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY	
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, IP:68	
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL	
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.	
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.	
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. **FOR INCHING SERVICE - 150 STARTS/HR MINIMUM & FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM.**	
HANDWHEEL	* REQUIRED	■ YES ☐ NO	
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED	
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.		
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY	
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY	
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT-INCLUSIVE OF **I.S.** TOLERANCE	
	ACTUATOR APPLICABLE WIRING DIAGRAM	☐ ENCLOSED (BIDDER TO CONFIRM) A: ☐ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ☐ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram	
	COLOUR SHADE	☐ BLUE (RAL 5012) ☐	
	PAINT TYPE **(## Refer Notes)**	☐ ENAMEL ■ EPOXY ☐	
	SHAFT RPM	BIDDER TO SPECIFY	
	OLR SET VALUE	BIDDER TO SPECIFY	
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY	
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY	
	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC	
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V	

BHEL	**SPECIFICATION FOR MOTORISED VALVE ACTUATOR FOR DEBRIS FILTER**	SPECIFICATION NO.: PE-DG-XXX-145-I902 VOLUME II B SECTION D REV. NO. 00 DATE: 26.04.2018 SHEET 2 OF 4

Data Sheet A & B

		DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
	@ ENCLOSURE CLASS OF MOTOR	■ IP 68 ☐ FLAME PROOF	
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B	
	@ WINDING TEMP PROTECTION	■ THERMOSTAT (3 Nos.,1 IN EACH PHASE) ☐ ----------	
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED	
INTEGRAL STARTER	INTEGRAL STARTER	■ REQUIRED ☐ NOT REQUIRED	
	TYPE OF SWITCHING DEVICE	■ CONTACTORS ☐ THYRISTORS	
	TYPE	■ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)	
	STEP DOWN CONT. TRANSFORMER	■ REQUIRED	
	OPEN / CLOSE PB	■ REQUIRED ☐ NOT REQUIRED	
	STOP PB	■ REQUIRED ☐ NOT REQUIRED	
	INDICATING LAMPS	■ REQUIRED ☐ NOT REQUIRED	
	LOCAL REMOTE S/S	■ REQUIRED ☐ NOT REQUIRED	
	STATUS CONTACTS FOR MONITORING	■ REQUIRED ☐ NOT REQUIRED	
	INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (MOTOR THERMOSTAT TRIP , O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, PHASE LOSS, S/S IN LOCAL/ OFF MODE, STOP PB OPTD, TORQUE OPEN/CLOSE CUTOFF)	
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	■ INTERPOSING RELAY ■ OPTO COUPLER ☐ EITHER	
	QUANTITY	■ 2 NOs. ☐ 3 NOs.	
	DRIVING VOLTAGE	■ 20.5 – 24V DC ☐ _____V DC	
	DRIVING CURRENT	■ 125mA MAX ☐ _____mA MAX	
	LOAD RESISTANCE	■ > 192 ohms - <25 k ohms ☐ > _____ohms - < _____ohms	
TORQUE SWITCH (Not Applicable for Smart Actuator) **($$ Refer Notes)**	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN / CLOSE	■1 No. ☐2Nos. / ■1 No. ☐2Nos	
	CONTACT TYPE	2 NO + 2 NC	
	RATING	5A 240V AC 0.5A 220V DC and 10A, 250 VAC	
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE	
	ACCURACY	+3% OF SET VALUE	
LIMIT SWITCH (Not Applicable for Smart Actuator) **($$ Refer Notes)**	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN : INT : CLOSE	☐1 No ■2 Nos. / 2 Nos. (ADJ.) / ☐1 No. ■2Nos.	
	CONTACT TYPE	2 NO + 2 NC	
	RATING (AC / DC)	5A 240V AC , 0.5A 220V DC and 10A, 250 VAC	

BHEL	**SPECIFICATION FOR MOTORISED VALVE ACTUATOR FOR DEBRIS FILTER**	SPECIFICATION NO.: PE-DG-XXX-145-I902 VOLUME II B SECTION D REV. NO. 00 DATE: 26.04.2018 SHEET 3 OF 4

Data Sheet A & B

		DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)	■ REQUIRED ☐ NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ■ ELECTRONIC (2 WIRE) CONTACTLESS	
	SUPPLY	■ 24V DC ☐	
	OUTPUT	■ 4-20mA	
	ACCURACY	± 1% FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY (NON INTEGRAL)	■ 230V AC,1 PH.,50 Hz ■ 240V AC,1 PH.,50 Hz	
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY	
	@ RATING		
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED	
	ENCL CLASS ACTUATOR/MOTOR T.B.	@■ IP 68 @☐.....	
	@ EARTHING TERMINAL	REQUIRED	
	PLUG & SOCKET (9 PIN/ 11 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	■ REQUIRED ☐ NOT REQUIRED ■ 2 NOS. ☐ ----------	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE: suitable for 3Cx2.5sq mm Cu	
	@ SPACE HEATER CABLE GLAND		
	OTHER CONTROL CABLE GLANDS-1	1 no. for BFV of CW pump (Cable size 2PX1.5mm2)	
	OTHER CONTROL CABLE GLANDS-2	1 no. suitable for 8Px0.5 sq m Additional 1 no. suitable for 2P x 0.5 sq mm.	

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR FOR DEBRIS FILTER	SPECIFICATION NO.: PE-DG-XXX-145-I902	
		VOLUME II B	
		SECTION D	
		REV. NO. 00	DATE: 26.04.2018
		SHEET 4 OF 4	

Data Sheet A & B

	DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY _____ Kg.

NOTES:

1. **SCOPE**: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
2. **CODES & STANDARDS**: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATION STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
   IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
3. **ACTUATOR SHALL HAVE HARDWIRED CONTACTS FOR FOLLOWING SIGNALS (a) ACTUATOR IN LOCAL MODE (b) ACTUATOR IN REMOTE MODE.**
4. BIDDER TO ENSURE AVAILABILITY OF SPARE 1NO + 1NC LIMIT SWITCH & TORQUE SWITCH.
5. SS TAG NAME PLATE SHALL BE PROVIDED.
6. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
7. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, Ni PLATED BRASS MATERIAL SHALL BE PROVIDED.
8. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION.THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
9. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
10. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.
11. IT SHOULD BE POSSIBLE TO OPERATE THE ACTUATOR LOCALLY. LOCKABLE LOCAL/REMOTE SELECTION SHALL BE PROVIDED ON THE ACTUATOR.
12. POSITION INDICATOR SHALL BE PROVIDED FOR 0 TO 100 % TRAVEL
13. WIRING SHALL BE SUITABLE VOLTAGE GRADE COPPER WIRE 1.5 SQ. MM.
14. THE MOTOR SHALL BE CAPABLE OF STARTING AT 85 PERCENT OF RATED VOLTAGE AND RUNNING AT 80 PERCENT OF RATED VOLTAGE AT RATED TORQUE AND 85 PERCENT RATED VOLTAGE AT 33 PERCENT EXCESS RATED TORQUE FOR A PERIOD OF 5 MINUTES EACH.
15. THE ACTUATORS SHALL BE DESIGNED TO BE SELF-LOCKING UPON LOSS OF POWER. MOTOR SHALL BE DESIGNED TO CLOSE IN 30 SECS. FROM FULL OPEN POSITION AND SHALL HAVE ADEQUATE CAPACITY TO OPEN AND CLOSE UNDER FULL UNBALANCED DESIGN PRESSURE.
16. ALL SIX (6) LIMIT SWITCHES SHALL BE CHANGEOVER TYPE AND ADJUSTABLE BESIDES HAVING THE SNAP FACILITY.
17. THE INTEGRAL STARTER WHICH SHALL HAVE SOPHISTICATED ELECTRONIC CONTROLS WITH FIELD PROGRAMMING FEATURE. IT SHALL BE DESIGNED FOR REMOTE CONTROL FROM DCS/RESPECTIVE CONTROL SYSTEM. REQUIRED INTERPOSING RELAYS FOR RECEIVING OPEN/CLOSE/STOP COMMAND FROM DCS/RESPECTIVE CONTROL SYSTEM SHALL BE PROVIDED. POTENTIAL FREE CONTACTS AND TRANSDUCERS SHALL BE PROVIDED TO PROVIDE STATUS INDICATION AT REMOTE DCS/RESPECTIVE CONTROL SYSTEM.
18. THE REMOTE COMMAND SIGNAL (OPEN-STOP-CLOSE) FROM DCS/RESPECTIVE CONTROL SYSTEM/CONTROL PANEL SHALL BE ISOLATED FROM CONTROL ELECTRONICS THROUGH OPTO-ISOLATOR.
19. THE FOLLOWING INDIVIDUAL STATUS ANNUNCIATION LED'S (COLOUR-GREEN) SHALL BE PROVIDED LOCALLY (INTEGRAL TO ACTUATOR) TO ANNUNCIATE THE FOLLOWING FOR EASY LOCAL MONITORING.

    ACTUATOR IN LOCAL MODE
    ACTUATOR IN REMOTE MODE
    ACTUATOR RUNNING IN OPEN DIRECTION
    ACTUATOR RUNNING IN CLOSE DIRECTION
    ACTUATOR IN INCHING MODE
    ACTUATOR IN SELF-RETAINING MODE
    LIMIT SWITCH OPEN TRIP
    LIMIT SWITCH CLOSE TRIP
    CONTROL VOLTAGE AVAILABILITY

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

EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.

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

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER FOR DEBRIS FILTER** **(APPLICABLE FOR TYPE-I TO III)**	SPECIFICATION NO.: PE-TS-XXX-145-I100 VOLUME SECTION REV. NO. 00 DATE: 26.04.2018 SHEET 1 OF 2

TAG No. ……. Qty..... Data Sheet No.: **PES-145-01-DS1-0**

Data Sheet A & B

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

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

FORM NO. PEM-6666-0

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER FOR DEBRIS FILTER **(APPLICABLE FOR TYPE-I TO III)**	SPECIFICATION NO.: PE-TS-XXX-145-I100 VOLUME SECTION REV. NO. 00 DATE: 26.04.2018 SHEET 2 OF 2

TAG No. ……. Qty..... Data Sheet No.: **PES-145-01-DS1-0**

Data Sheet A & B

DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (TO BE FILLED BY PURCHASER)		DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
INSULATION RESISTANCE	TO BE SPECIFIED BY BIDDER	
OVER PRESSURE	■ 150% OF MAX. OPR. PRESS	
ZERO SUPPRESSION/ ELEVATION RANGE	■ At least 100% of Span	
INTEGRAL INDICATOR	■ YES, LCD indicator (5 digit) with scale of Engg. unit ☐ NO	
RESPONSE TIME	■ 150 msec.	
TRANSMITTER SHALL BE ABLE TO DRIVE LOAD IMPEDANCE OF 500 OHMS(min.) WITH DRIVE CAPABILITY OF 600OHMS NOMINAL	■ YES ☐ NO	
ELECTRICAL CONNECTION	■ PLUG & SOCKET TYPE	
PROCESS CONNECTION	■ I/2 " NPT (F)	
ZERO & SPAN DRIFT	■ ± 0.015 % PER DEG.C AT MAX. SPAN ■ ± 0.11 % PER DEG.C AT MIN. SPAN	
DIAGNOSTICS	■ SELF INDICATING FEATURE	
MANIFOLD		
a) PRESSURE MEASUREMENT	■ 2 WAY ■ MATERIAL: 316 SS	
B) DIFFERENTIAL PRESSURE MEASUREMENT	■ 5 WAY ■ MATERIAL: 316 SS	
CABLE ENTRY DETAIL	SUITABLE FOR DIA OF 17.5 mm	
NOTES: 1. TRANSMITTERS SHOULD NOT BE MOUNTED DIRECTLY ON MANIFOLD. MANIFOLD SHOULD BE NON-INTEGRAL AND STAND ALONE TYPE. 2. TRANSMITTERS TO BE EQUIPPED WITH MOUNTING BRACKETS. 3. ALL THE FIELD INSTRUMENTS SHALL BE PROVIDED WITH SS TAG NAME PLATE.		

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

FORM NO. PEM-6666-0

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER	SPECIFICATION NO.: PE-TS-XXX-145-I100
		VOLUME
		SECTION
		REV. NO. 00 | DATE: 26.04.2018
		SHEET 1 OF 2

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

Data Sheet C

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

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

FORM NO. PEM-6666-0

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER	SPECIFICATION NO.: PE-TS-XXX-145-I100
		VOLUME
		SECTION
		REV. NO. 00 | DATE: 26.04.2018
		SHEET 2 OF 2

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

Data Sheet C

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

INTEGRAL INDICATOR	
RESPONSE TIME	
TRANSMITTER SHALL BE ABLE TO DRIVE LOAD IMPEDANCE OF 500 OHMS(min.) WITH DRIVE CAPABILITY OF 600OHMS NOMINAL	
ELECTRICAL CONNECTION	
PROCESS CONNECTION	
ZERO & SPAN DRIFT	
DIAGNOSTICS	
MANIFOLD	
b) PRESSURE MEASUREMENT	
B) DIFFERENTIAL PRESSURE MEASUREMENT	
CABLE ENTRY DETAIL	

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

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE FOR DEBRIS FILTER**	SPECIFICATION NO.: PE-TS-XXX-145-I100 VOLUME SECTION REV. NO. 00 DATE: 26.04.2018 SHEET 1 OF 3

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

Data Sheet A & B

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

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE FOR DEBRIS FILTER	SPECIFICATION NO.: PE-TS-XXX-145-I100
		VOLUME
		SECTION
		REV. NO. 00 / DATE: 26.04.2018
		SHEET 2 OF 3

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

Data Sheet A & B

DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)

PERFORMANCE	ACCURACY	± 1% OR BETTER OF FULL SCALE DEFLECTION	
CONNECTION	PROCESS	½ " NPT (M)	
	LOCATION	☐ BACK ☐ BOTTOM	
ACCESSORIES	NAME PLATE / METAL TAG	SS	
	MOUNTING	☐ WALL ☐ PIPE – U CLAMPS & BOLTS ☐ PANEL / RACK TO BE DECIDED DURING DETAILED ENGG.	
		3 WAY NEEDLE VALVE / MANIFOLDS PROTECTIVE SEPARATING, CHEMICAL SEAL DIAPHRAGM – FOR CORROSIVE LIQUID LINES Union, nut & tail piece and other Installation accessories as required. 3-Way SS316 Gauge cock for pressure gauges	

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

FORM NO. PEM-6666-0

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE	SPECIFICATION NO.: PE-TS-XXX-145-I100
		VOLUME
		SECTION
		REV. NO. 00 | DATE: 26.04.2018
		SHEET 1 OF 2

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

Data Sheet C

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

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

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

BHEL	**SPECIFICATION FOR LOCAL CONTROL CUM STARTER PANELS FOR DEBRIS FILTER**	SPECIFICATION NO.: PE-SS –999- 145 –054A VOLUME II B SECTION D REV. NO. 00 DATE : 26.04.2018 SHEET 1 OF 5

1.0 SCOPE

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

2.0 CODES AND STANDARDS

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

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

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

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

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

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

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

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel
Frame thickness: Not less than 3.0mm
Enclosure thickness: Not less than 2.5 mm for load bearing sections (Mounted with instruments)
1.6 mm for doors and not less than 2.0 mm for others
Panel Height: Not less than 2365 mm (Refer data sheet-A (No. PES-145A-DS1-0)
Gland plate thickness: 3.0mm
Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.

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

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

3.1.7 The class of protection shall be in accordance with IP-42 unless otherwise specified in the data sheet – A (No. PES-145-54A-DS1-0).

3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as given in data sheet-A (No. PES-145A-DS1-0). Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.

3.1.9 The cable glands of the required size and type as given in data sheet-A (No. PES-145A-DS1-0) shall be supplied alongwith the Panel.

3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function.

No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.

3.1.11 Single / dual control power supply feeders of voltage class as specified in data sheet-A (No. PES-145A-DS1-0) shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.

3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm2 size. AC & DC wires shall be kept separate from each other. Separate coloured wires to be used for AC and DC circuits. All wires shall be properly numbered and identified with ferrules as per the Control scheme / wiring diagram. Wires shall be routed and run through PVC troughs.

3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm2 to 2.5mm2 external cables. The TB points in terminal block shall be cage clamp type / screw type. The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm height from finished floor. The panel shall have ten (20) percent spare terminal.

3.1.14 The interior of each panel shall be suitably illuminated through fluorescent lamps / tube lights with shrouded cover of minimum 15W operable on 240V 50 Hz AC power supply through panel door switch. A 15 Amp. 3-pin Power receptacle shall be provided.

3.1.15 Suitable space heaters operable on 240 Volts 50 Hz AC power system shall be provided at the panel bottom. These shall be designed to maintain the panel temperature five (5) deg. C above the ambient temperature during maintenance shutdown. Suitable isolating and control devices comprising of MCB, thermostat etc. shall be provided for the space heater.

3.1.16 The panel shall be provided with a copper earth bus of 25 x 6 mm size running throughout the width of the panel. It shall be terminated internally with 10 mm bolts at extreme ends for connection to; main station earth. The panel mounted equipments / devices shall be connected to earth bus through green coloured PVC insulated stranded copper conductor of 2.5 mm2 size.

3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte Sheet / 2 mm Anodised Aluminium Plate. The inscription shall be with white letters on black background on traffolyte sheet. The labels shall be fixed by self-tapping non-rusting screws.

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

3.2 Hazardous Area Panel Requirement

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

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

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

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

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

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

3.3 Control & Monitoring devices

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

3.3.2 Alarm Annunciator System

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

3.3.3 Relays

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

3.3.4 Timers

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

3.3.5 Control / Selector Switches

Switches shall be Rotary Cam type with minimum of 5 Amps AC & 2 Amp DC continuous current rating. Selector switches shall be stay put type while control switches shall be spring-return-to-neutral type. Contact configuration and rating shall be as per the control function requirement. The switches shall be

lockable type wherever specified. Each switch shall be provided with engraved plates indicating the switch position / functions.

3.3.6 Push Buttons / Indicating Lights

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

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

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

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

3.3.7 Ammeters

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

3.3.8 Miniature Circuit Breaker (MCB)

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

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

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

4.0 TESTING AND INSPECTION

4.1

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

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

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

4.3.1 Routine Tests

1. High Voltage (H.V.)
2. Insulation Resistance (I.R.)
3. Functional
4.

4.3.2 Type Tests

1. Enclosure Class Test

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

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

5.2. Mandatory Spares

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

5.3. Recommended Spares

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

6.0 DRAWINGS AND DOCUMENTS

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

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

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

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

7.0 MARKING AND PACKING

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

8.0 APPLICABLE DATA SHEET FORMS

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

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

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR LOCAL PANELS FOR DEBRIS FILTER**	SPECIFICATION NO.: PE-SS-999-145-054A VOLUME SECTION REV. NO. 00 DATE: 26.04.2018 SHEET 1 OF 3

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet A & B

	DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL	MANUFACTURER			
	CONSTRUCTION		■ FOLDED ☐ WELDED	
	ENCLOSURE SHEET THICKNESS	FRONT	■ 3.0 mm	
		OTHER	■ 2.0 mm	
		DOOR	■ 2 mm	
		HEIGHT	■ 2365 mm for stand-alone panels (THIS SHALL BE DECIDED BY BHEL DURING DETAILED ENGG.)	
		OTHER	■ Load bearing sheet front shall have 3mm thickness	
TECHNICAL	INPUT POWER SUPPLY * (ANY OTHER POWER REQUIREMENT TO BE DERIVED FROM THIS SUPPLY ONLY)		☐ 240V 50 Hz AC ☐ 220V DC ■ 415V 3 PHASE Kindly refer Electrical scope sheet	
	NO. OF FEEDERS		☐ ONE ■ TWO	
	STARTER WITH MCC		■ REQUIRED ☐ NOT REQUIRED	
	IPR POSITION		☐ MCC ■ CONTROL PANEL	
	CONTACT RATING OF RELAY		■ 5 Amp, 230 V AC ■ 0.25 Amp, 220V DC	
	CONTROL SUPPLY		☐ 10V AC ☐ 220V AC ■ 220V DC ☐ Other. (As per requirement)	
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		■ REQUIRED 10 nos. Actual no. shall be decided during detailed engg.	
	TEMP SCANNER (IF REQUIRED –NO. OF CHANNELS TO BE SPECIFIED UNDER SEC-C)		☐ REQUIRED ■ NOT REQUIRED	
	PAINT TYPE		■ EPOXY ENAMEL ☐ EPOXY POWDER COATED OR BETTER	
	MIMIC (TYPE OF MIMIC- MATERAIL, THICKNESS TO BE SPECIFIED DURING DETAILED ENGG.)		■ REQUIRED ☐ NOT REQUIRED	
	PANEL COLOUR (EXTERNAL)		☐ LIGHT GREY (Shade 631 IS-5) ☐ OPALINE GREEN (Shade 275) ☐ RAL 7032 SHALL BE DECIDED DURING DETAILED ENGINEERING	
	FINISH (EXTERNAL)		☐ MATT ☐ GLOSSY ☐ SEMI GLOSSY	
	PANEL COLOUR (INTERNAL)		☐ WHITE ☐ CREAM ☐ OFF WHITE SHALL BE DECIDED DURING DETAILED ENGINEERING	
	FINISH (INTERNAL)		☐ MATT ■ GLOSSY ☐ SEMI GLOSSY SHALL BE DECIDED DURING DETAILED ENGINEERING	

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR LOCAL PANELS FOR DEBRIS FILTER**	SPECIFICATION NO.: PE-SS-999-145-054A VOLUME SECTION REV. NO. 00 DATE: 26.04.2018 SHEET 2 OF 3

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet A & B

	DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)		DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
	CLASS OF PROTECTION	☐ IP-42 (FOR INDOOR SERVICE) ■ IP-55 (FOR OUTDOOR SERVICE) ☐ ANY OTHER	
	CONTROL HARDWARE	☐ RELAY BASED	
	FOUNDATION ARRANGEMENT	☐ FOUNDATION BOLTS ☐ ANCHOR FASTENERS	
	WEIGHT OF PANEL (Kg.)	……..(Vendor to specify)	
	PANEL TYPE	☐ PRESSURISED ■ UNPRESSURISED As per Requirement	
	CABLE GLAND	■ DOUBLE COMPRESSION	
	AMMETER (TYPE OF INPUT)	☐ 1 Amp CT ☐ 4-20 Ma NOT REQUIRED BELOW 30KW.	
	SCOPE OF SUPERVISION FOR ERECTION & COMMISSIONING	☐ APPLICABLE ☐ NA	

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

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR LOCAL PANELS FOR DEBRIS FILTER**	SPECIFICATION NO.: PE-SS-999-145-054A VOLUME SECTION REV. NO. 00 DATE: 26.04.2018 SHEET 3 OF 3

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet C

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

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

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR LOCAL PANELS FOR DEBRIS FILTER**	SPECIFICATION NO.: PE-SS-999-145-054A
		VOLUME
		SECTION
		REV. NO. 00 / DATE: 26.04.2018
		SHEET 3 OF 3

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet C

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

PANEL TYPE			
CABLE GLAND			
AMMETER (TYPE OF INPUT)			
SCOPE OF SUPERVISION			

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

QUALITY PLANS FOR

1. LOCAL CONTROL CUM STARTER PANEL
2. INSTRUMENTS

PEM :: C&I

STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	1 OF 7

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

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

$ P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	2 OF 7

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

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STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	3 OF 7

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

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STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	4 OF 7

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

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

$ P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	5 OF 7

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

LEGEND:
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MI - Minor characteristics

$ P - Agency Performing the Test.
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2 - Vendor
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PEM :: C&I

STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	6 OF 7

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

At Random by BHEL, based on 100 % internal test reports by Mfr.

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

$ P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	7 OF 7

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

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

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

CHECK LIST FOR TRANSMITTER

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

Legend :

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

Note :

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

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

CHECK LIST FOR PRESSURE & DP GAUGE

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

Legend :

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

Note :

1. Quantum of check shall be as below :
   100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. Manufacturer to carry out ROUTINE TEST on 100 %.
4. When material corelation is not available, MFR's compliance to be provided
5. Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.

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

CHECK LIST FOR ANNUNCIATORS

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

Legend :

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

Note :

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

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TECHNICAL SPECIFICATION
(CONTROL AND INSTRUMENTATION)
FOR
DEBRIS FILTER

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

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SPECIFIC TECHNICAL REQUIREMENTS (C&I)

SPECIFIC C&I TECHNICAL REQUIREMENTS
FOR DEBRIS FILTERS

1.1 The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. The Vendor list/ sub-vendor list shall be subject to BHEL / Customer approval during contract stage. No commercial implication in this regard shall be acceptable.

1.2 These requirements are to be read in conjunction with detailed Technical specification enclosed in the specification. In case of any conflict and repetition of clauses in the specification, the more stringent requirement as per interpretation of Customer shall prevail without any commercial implication. No deviations shall be acceptable.

1.3 Drawings/Documents and data to be furnished after award of the contract as per deliverables list attached elsewhere in the specification.

1.4 All local gauges as well as transmitters and sensors for parameters like pressure, temperature, flow etc. as required for the safe and efficient operation and maintenance under the scope of specification shall be provided. The necessary root valves, impulse piping, drain cock, gauge-zeroing cocks, valve manifolds, instrument racks and all the other accessories required for mounting / erection of these local instruments, transmitters and sensors shall be supplied by bidder even if not specifically asked for. Also the proposal shall include the necessary cables, flexible conduits, instrument racks, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg / Cm2.

1.5 All local gauges, transmitters and sensors shall be mounted on suitable enc losures, Instrument racks (LIR) in bidder's scope subject to Customer's approval.

1.6 Type of control system shall be DDCMIS (Station C&I) based, located in Central Control Room in BHEL scope. Field instrumentation for the package is in bidder's scope.

1.7 The local control cum starter panel in bidder's scope shall be NEMA 4X. Suitable canopy on top shall be provided for the panel.

1.8 Push buttons and indication lamps for Open/Close and Start/Stop of drives/equipment's shall be provided on the starter panel. Remote and local indication, indicating lamps / LED cluster for instruments/drives/equipment's status and critical alarms shall be provided on the starter panel. Nos. shall be decided during detailed engineering.

1.9 Colored MIMICS on the panel is to be provided as per system flow diagram. No. of facia on Starter panel shall be decided during detailed engineering.

1.10 Bidder to terminate all instrumentation and control elements in the control panel for further cabling to DDCMIS by BHEL.

1.11 All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. The enclosures of all electronic instruments shall conform to IP-65 unless otherwise specified (Explosion proof for NEC article 500, class 1, Division 1 area & flame proof) and an anticorrosive paint shall be applied to the field mounted enclosures / instruments. All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland. Gaskets, Fasteners, Counter and mating flange shall also be included wherever required with the field instruments.

1.12 Sea or saline water media is applicable for the project. The minimum requirement for sea water or saline water media is as below:

a. Instruments shall be suitable for sea or saline water application. MOC of impulse tubing and impulse pipe shall be CPVC (3/8") Sch 80 or better, Industrial grade up to manifold. MOC of impulse tubing, fittings (from manifold to instrument) and manifold shall be Super Duplex stainless steel.
b. MOC of all wetted parts, fittings, sampling pipes, tubes, fittings, diaphragm and all types of erection hardware of instrument/drives/equipment, shall be Duplex stainless steel or better suitable for sea or saline water application.

1.13 Epoxy coated painting is required for all I & C equipment.

1.14 All valve actuator shall be provided with conventional actuators with integral starter for ON/OFF valves. Non-contact type electronic 2-wire position transmitters shall be provided for all inching type motorized valves and dampers. The detailed specification of actuator is given elsewhere in the specification.

1.15 Differential pressure indicators & Differential pressure Transmitters across Debris filters shall be provided with independent impulse & isolation valves. Remote & Local indication DP transmitters & gauges across Debris filters shall be provided.

1.16 All the transmitters and gauges shall have remote seal type having 15m capillary length minimum.

1.17 All the instruments/equipment's/electrical items shall be provided & designed with maximum star rating as available in line with energy conservation policies notified by BEE, GOI at the time of supply.

1.18 All primary instruments shall be with protection class of IP 65 or better.

1.19 Transmitter should not be mounted directly on the manifold, Manifold shall be non-integral and standalone type.

1.20 LVDT type instrument is not acceptable.

1.21 All limit switch shall be conforming to IEC-60947-5-1.

1.22 Each switching element including the limit and torque switches of valve actuators shall be provided with minimum two SPDT OR DPDT contacts each for close, open and adjustable.

1.23 All transmitters shall be smart and electronic type, microprocessor based and HART compatible. All instruments should be supplied with valid calibration and test certificates provided by OEM.

1.24 The system shall be provided with annunciation system. It shall be an integral part of the control system. All the field contact shall be acquired through control system. The annunciation sequence/ logic shall conform to ISA sequence ISA-2A. The window lamps for the system shall be driven through output modules of the control system.

1.25 For plug in type instruments, the plug & sockets shall be polarized to prevent wrong connections and have facility for secure coupling in plug-in position to prevent loose connections.

1.26 Signal/Electrical connection shall be screwed connection with double compression type Nickel-plated brass cable glands.

1.27 All the field instruments shall also be provided with SS tag nameplate.

1.28 Cable scope shall be referred in Electrical scope sheet attached in the Electrical portion of the specification.

1.29 Push buttons and indication lamps for Open/Close and Start/Stop of drives/equipment's shall be provided on the starter panel in Bidder's scope. Remote and local indication, indicating lamps / LED cluster for instruments/drives/equipment's status and critical alarms shall be provided on the starter panel. Nos. shall be decided during detailed engineering.

1.30 Mandatory spare list shall be referred in 'List of mandatory spares' attached elsewhere in the specification and shall be supplied by bidder.

1.31 Power Supply Requirement:
415 V, 3 phase AC power supply shall be provided by Customer for the local control cum starter panel at a single point. Further any electrical distribution shall be in bidder's scope. Any other voltage requirement to be

arranged/derived by bidder by providing suitable control transformer. Starter panel in bidder's scope shall have provision for redundant feeder with fast automatic changeover.

1.32 Bidder shall provide an unlimited warranty on all equipment and software for three years after the start of the warranty period, i.e. after satisfactory completion of initial operations. This warranty shall include repair, replace ment or correction of identified software or hardware discrepancies at no cost to owner.

1.33 Bidder to delegate /depute their persons/experts as per Customer's require ment.

1.34 Bidder must offer general tools and tackles and special calibration instrume nts required during start-up, trial run, operation and maintenance of the sys tem.

1.35 The technical requirements for instruments/ equipment's/panels mentioned in the specification are minimum requirements. Items not specifically mentioned and required for the completeness of the system shall be supplied by bidder.

1.36 Following Instruments/control functions shall be provided at CW debris filter in addition to instruments provided as per process requirement

- Remote & Local indication DP transmitters & gauges across debris filters.
- Auto start /stop of Cleaning devices for debris filters for high DP and Low DP

2.0 **Requirements for flanged remote seal diaphragm:**

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

SCOPE MATRIX - DEBRIS FILTER (DF)		
S.No.	**PROJECT**	**2X660 MW UDANGUDI STPP**
1	**SYSTEM APPLICABLE: DEBRIS FILTER (DF)**	Y
2	**SYSTEM CONFIGURATION: UNITISED OR COMMON OR AS APPLICABLE**	UNITISED
3	**CONTROL SYSTEM**	REFER NOTE-1
4	**LOCATION OF CONTROL SYSTEM**	
5	**CONTROL SYSTEM SCOPE (BIDDER/BHEL/ CUSTOMER)**	
6	**CONTROL FROM PB's 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 LCP (Y/N)**	Y; REFER NOTE-5
9	**ACTUATOR WITH INTEGRAL STARTER (Y/N)**	Y
10	**DPG/ DPT PER DEBRIS FILTER (DF) ***	DIFFERENTIAL PRESSURE TRANSMITTER = 2 nos. (Across each strainer) DIFFERENTIAL PRESSURE GAUGE = 1 no. (Across each strainer)
11	**SEA WATER APPLICATION**	Y
12	**DETAILED CUSTOMER SPECIFICATION**	ANNEXURE - I

	NOTES:
1	Type of control system shall be DDCMIS (Station C&I) based, located in Central Control Room in BHEL scope. Field instrumentation, drives, equipments for the package are in bidder's scope.
2	Local control cum starter panel for DEBRIS FILTER (DF) is in bidder's scope of supply. Items not specifically mentioned and required for the completeness of the system shall be supplied by bidder.
3	Push buttons and indication lamps for open/close and Start/stop of drives/equipments for DEBRIS FILTER (DF) 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 starter panel for DEBRIS FILTER (DF). Nos. shall be decided during detailed engineering.

4	Number of facia shall be decided during detailed engineering.
5	Colored MIMICS on Local control cum starter panel to be provided as per system flow diagram for both streams of Debris Filter.
6	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.
7	Bidder to terminate all instrumentation and control elements in the local control cum starter panel for further cabling to DDCMIS. Complete cable schedule (in BHEL excel format provided in electrical portion of the specification) and cable interconnection details from field to Local control cum Starter panel and ,Local control cum Starter panel to DDCMIS shall be provided by bidder.
8	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. Cable schedule (in BHEL excel format provided in electrical portion of the specification) & cable interconnection details from field to Local control cum Starter panel and, Local control cum starter panel to DDCMIS.
9	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.
10	LIR (Instrument Rack) to be provided for mounting the instruments in the field.
11	Cable for local wiring, between field instruments to Starter panel shall be screened with 1.5 mm2 minimum and shall be in bidder's scope. Refer 'electrical scope sheet between BHEL and bidder' attached in electrical specification for cable scope.
12	Mandatory spare list shall be referred in 'List of mandatory spares' attached elsewhere in the specification and shall be supplied by bidder.
13	*Instruments, root valves, impulse pipe shall be suitable for sea water application having corrossion resistance where media is sea water. All the transmitters and gauges shall have remote seal type having 15m capillary length.
14	The Vendor list/ sub-vendor list shall be subject to BHEL/Customer approval during contract stage.
15	The specifications for instruments mentioned in the specification are minimum requirements. The detailed specifications shall be finalized during detail engineering.

16	No deviations with respect to technical specification shall be acceptable.
17	Local control cum starter panel can be common for two streams of Debris Filter (left and right) for One Unit.

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

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LIST OF DOCUMENTS/DELIVERABLES

C&I DELIVERABLES LIST FOR DEBRIS FILTER FOR 2X660 MW UDANGUDI PROJECT			
Sl.No.	**DRAWING NO.**	**DRAWING/DOCUMENT TITLE**	**CATEGORY**
INSTRUMENTATION			
1	PE-V9-435-165-I901C	INSTRUMENT DATA SHEETS	A
2	PE-V9-435-165-I902C	BOQ	I
3	PE-V9-435-165-I903C	INSTRUMENT QP / CHECK LIST	A
LOCAL CONTROL CUM STARTER PANEL			
1	PE-V9-435-165-I950C	LOCAL CONTROL CUM STARTER PANEL DATA SHEET	A
2	PE-V9-435-165-I951C	WIRING DIAGRAM	A
3	PE-V9-435-165-I952C	PANEL EXTERNAL & INTERNAL GA DRAWING & TERMINATION DETAILS (INCLUDING FOUNDATION DETAILS & FLOOR CUT-OUT)	A
4	PE-V9-435-165-I953C	RECOMMENDED CONTROL LOGICS / CONTROL PHILOSOPHY	A
5	PE-V9-435-165-I954C	LIST OF HARDWIRED SIGNAL EXCHANGE WITH DDCMIS	A
6	PE-V9-435-165-I955C	BILL OF MATERIAL	I
7	PE-V9-435-165-I956C	LOCAL CONTROL PANEL QUALITY PLAN	A
8	PE-V9-435-165-I957C	INPUT/OUTPUT LIST; DRIVE LIST	I
9	PE-V9-435-165-I958C	RELAY BASED PANEL O & M MANUAL	I
10	PE-V9-435-165-I959C	Cable schedule & cable interconnection details from field to Local control cum Starter panel and, Local control cum starter panel to DDCMIS.	I

NOTES:

1) ANY OTHER DOCUMENT DECIDED DURING DETAILED ENGINEERING SHALL BE PROVIDED BY BIDDER WITHOUT ANY COMM ERCIAL/TECHNICAL IMPLICATION.

2) CONTRACTOR TO SUBMIT REUSABLE DATABASE FORMATS IN BHEL/CUSTOMER APPROVED FORMATS LIKE MS EXCEL,MS A CCESS OF DOCUMENTS LIKE INSTRUMENT SCHEDULE, I/O LIST, DRIVE LIST,FIELD JB TERMINATIONS, CABLE SCHEDULE & INTE RCONNECTION, etc. SOFT COPY OF FORMATS SHALL BE PROVIDED TO SUCCESSFUL BIDDERS.

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

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DATA SHEETS FOR MOTORISED VALVE ACTUATOR

FORM NO. PEM-6666-0

BHEL	**SPECIFICATION FOR MOTORISED VALVE ACTUATOR**	SPECIFICATION NO.:
		VOLUME II B
		SECTION D
		REV. NO. 01 DATE: 06.08.18
		SHEET 1 OF 4

Data Sheet A & B

		DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL*	* PROJECT	2 X 660 MW UDANGUDI TPP	
	OFFER REFERENCE		
	* TAG NO. SERVICE		
	* DUTY	☐ ON / OFF ☐ INCHING	
	* LINE SIZE (inlet/outlet): MATERIAL		
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY	
	* OPENING / CLOSING TIME		
	* WORKING PRESSURE		
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF -20 to70 DEG C AND RELATIVE HUMIDITY OF 0-95%IN HOT HUMID AND TROPICAL ATMOSPHERE AND HIGHLY POLLUTED AT PLACES OF COAL DUST AND FLY DUST	
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY	
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY	
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY	
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF,DUST TIGHT SUITABLE FOR OUTDOOR USE WITHOUT CANOPY, NEMA6/IP:68	
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL	
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.	
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.	
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 90% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. **FOR INCHING SERVICE - 150 STARTS/HR MINIMUM.**	
HANDWHEEL	* REQUIRED	■ YES ☐ NO	
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED	
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.		
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY	
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY	
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT-INCLUSIVE OF **I.S.** TOLERANCE	
	ACTUATOR APPLICABLE WIRING DIAGRAM	■ ENCLOSED (BIDDER TO CONFIRM) A: ☐ DRG. NO. 3-V-MISC-24227 R00 B: ☐DRG. NO. 3-V-MISC-24550 R00 C: ■ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram	
	COLOUR SHADE	☐ BLUE (RAL 5012) ■ SIEMENES GRAY RAL 7030	
	PAINT TYPE **(## Refer Notes)**	☐ ENAMEL ■ EPOXY ☐ …….	
	SHAFT RPM	BIDDER TO SPECIFY	
	OLR SET VALUE	BIDDER TO SPECIFY	
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY	
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY	
	@ PWR SUPP TO MTR / STARTER	415V +/- 10%, 3 Phase, 3 Wire 50HZ +/-5%	
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ■ 110 V	

BHEL	**SPECIFICATION FOR MOTORISED VALVE ACTUATOR**	SPECIFICATION NO.:
		VOLUME II B
		SECTION D
		REV. NO. 01 DATE: 06.08.18
		SHEET 2 OF 4

Data Sheet A & B

DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
	@ ENCLOSURE CLASS OF MOTOR	☐ IP 68 ☐ FLAME PROOF	
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B	
	@ WINDING TEMP PROTECTION	■ THERMOSTAT (3 Nos.,1 IN EACH PHASE) ☐ ----------	
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED	
INTEGRAL STARTER	INTEGRAL STARTER	■ REQUIRED ☐ NOT REQUIRED	
	TYPE OF SWITCHING DEVICE	■ CONTACTORS(Reversing type) ☐ THYRISTORS	
	TYPE	■ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)	
	IF SMART		
	a) SERIAL LINK INTERFACE	☐ INTEGRAL ☐ FIELD MOUNTED	
	b) SERIAL LINK PROTOCOL	☐ FOUNDATION FIELD-BUS ☐ PROFI-BUS ☐ DEVICE NET ☐.....	
	c) SERIAL LINK MEDIA	☐ TWISTED PAIR Cu-CBL ☐ CO-AXIAL Cu-CBL ☐ OFC	
	d) HAND HELD PROGRAMMER	☐ REQUIRED ☐ NOT REQUIRED	
	e) TYPE OF HAND HELD PROGRAMMER	☐ BLUETOOTH ☐ INFRARED ☐.....	
	f) MASTER STATION	☐ REQUIRED ☐ NOT REQUIRED	
	g) MASTER STN INTRFACE WITH DCS	☐ MODBUS ☐ TCP/IP	
	h) DETAILS OF SPECIAL CABLE	☐ ENCLOSED ☐ NOT REQUIRED	
	STEP DOWN CONT. TRANSFORMER	■ REQUIRED	
	OPEN-STOP-CLOSE PB(running open/close LED) THREE POSITION SELECTOR SWITCH	■ REQUIRED ☐ NOT REQUIRED	
	INDICATING LAMPS	■REQUIRED ☐ NOT REQUIRED	
	LOCAL-OFF- REMOTE S/S(THREE POSITION SELECTOR SWITCH)	■REQUIRED ☐ NOT REQUIRED	
	STATUS CONTACTS FOR MONITORING	■ REQUIRED ☐ NOT REQUIRED	
	INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (MOTOR THERMOSTAT TRIPO/L RELAY OPERATED, CONT. /POWER SUPPLY FAILED, S/S IN LOCAL/REMOTE/OFF MODE, TORQUE SWITCH OPEN/CLOSE CUT OFF/STOP PB OPTD.)	
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	☐INTERPOSING RELAY ■OPTO COUPLER ☐ EITHER	
	QUANTITY	■ 2 NOs. ☐ 3 NOs.	
	DRIVING VOLTAGE	■ 20.5 – 24V DC ☐ _____V DC	
	DRIVING CURRENT	■ 125mA MAX ☐ _____mA MAX	
	LOAD RESISTANCE	■ > 192 ohms - <25 k ohms ☐ > _____ohms - < _____ohms	
TORQUE SWITCH (Not Applicable for Smart Actuator) **($$ Refer Notes)**	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN / CLOSE	■1 No. ☐2Nos. / ■1 No. ☐2Nos	
	CONTACT TYPE	2 NO + 2 NC	
	RATING	10A 240V AC AND 0.5A 220V DC	
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE	
	ACCURACY	+3% OF SET VALUE	
LIMIT SWITCH (Not Applicable for Smart Actuator) **($$ Refer Notes)**	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN : INT : CLOSE	■2 Nos. / 2 nos(adj) / 1 No. ■2Nos.	
	CONTACT TYPE	2 NO + 2 NC	
	RATING (AC / DC)	10A 240V AC AND 0.5A 220V DC	

FORM NO. PEM-6666-0

BHEL	**SPECIFICATION FOR MOTORISED VALVE ACTUATOR**	SPECIFICATION NO.:
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		SHEET 3 OF 4

Data Sheet A & B

	DATA SHEET-A (TO BE FILLED BY PURCHASER)		DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)	REQUIRED for regulating/inching duty only.	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ■ ELECTRONIC (2 WIRE) contactless inductive type	
	SUPPLY	■ 24V DC ☐	
	OUTPUT	■ 4-20mA	
	ACCURACY	± 1% FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY (NON INTEGRAL)	240V AC,1 PH.,50 Hz	
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY	
	@ RATING		
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED	
	ENCL CLASS ACTUATOR/MOTOR T.B.	@■ IP 68 @☐ NEMA6	
	@ EARTHING TERMINAL	REQUIRED	
	PLUG & SOCKET(9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	■ REQUIRED ☐ NOT REQUIRED☐ ■ 2 NOS. ☐ ----------	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:----------	
	@ SPACE HEATER CABLE GLAND	SIZE:----------	
	OTHER CONTROL CABLE GLANDS-1	☐ 1No. for BFV of CW PUMP(Cable size 2Px1.5mm2)	
	OTHER CONTROL CABLE GLANDS-2	1 no suitable for 8P X 0.5 sq mm Additional 1 no suitable for 2P X 0.5 sq mm(inching duty only)	

BHEL	**SPECIFICATION FOR MOTORISED VALVE ACTUATOR**	SPECIFICATION NO.:
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Data Sheet A & B

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

WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	_____ Kg.

NOTES:

1. **SCOPE**: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.

2. **CODES & STANDARDS**: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATION STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
   IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722

3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.

4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.

5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION.THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.

6. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.

7. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.

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

EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.

8. IT SHOULD BE POSSIBLE TO OPERATE THE ACTUATOR LOCALLY. LOCKABLE LOCAL/REMOTE SELECTION SHALL BE PROVIDED ON THE ACTUATOR.

9. POSITION INDICATOR SHALL BE PROVIDED FOR 0 TO 100 % TRAVEL

10. WIRING SHALL BE SUITABLE VOLTAGE GRADE COPPER WIRE 1.5 SQ. MM.

11. THE MOTOR SHALL BE CAPABLE OF STARTING AT 85 PERCENT OF RATED VOLTAGE AND RUNNING AT 80 PERCENT OF RATED VOLTAGE AT RATED TORQUE AND 85 PERCENT RATED VOLTAGE AT 33 PERCENT EXCESS RATED TORQUE FOR A PERIOD OF 5 MINUTES EACH.

12. THE ACTUATORS SHALL BE DESIGNED TO BE SELF-LOCKING UPON LOSS OF POWER. MOTOR SHALL BE DESIGNED TO CLOSE IN 30 SECS. FROM FULL OPEN POSITION AND SHALL HAVE ADEQUATE CAPACITY TO OPEN AND CLOSE UNDER FULL UNBALANCED DESIGN PRESSURE.

13. THE INTEGRAL STARTER WHICH SHALL HAVE SOPHISTICATED ELECTRONIC CONTROLS WITH FIELD PROGRAMMING FEATURE. IT SHALL BE DESIGNED FOR REMOTE CONTROL FROM DCS/RESPECTIVE CONTROL SYSTEM. REQUIRED INTERPOSING RELAYS FOR RECEIVING OPEN/CLOSE/STOP COMMAND FROM DCS/RESPECTIVE CONTROL SYSTEM SHALL BE PROVIDED. POTENTIAL FREE CONTACTS AND TRANSDUCERS SHALL BE PROVIDED TO PROVIDE STATUS INDICATION AT REMOTE DCS/RESPECTIVE CONTROL SYSTEM.

14. THE REMOTE COMMAND SIGNAL (OPEN-STOP-CLOSE) FROM DCS/RESPECTIVE CONTROL SYSTEM/CONTROL PANEL SHALL BE ISOLATED FROM CONTROL ELECTRONICS THROUGH OPTO-ISOLATOR.

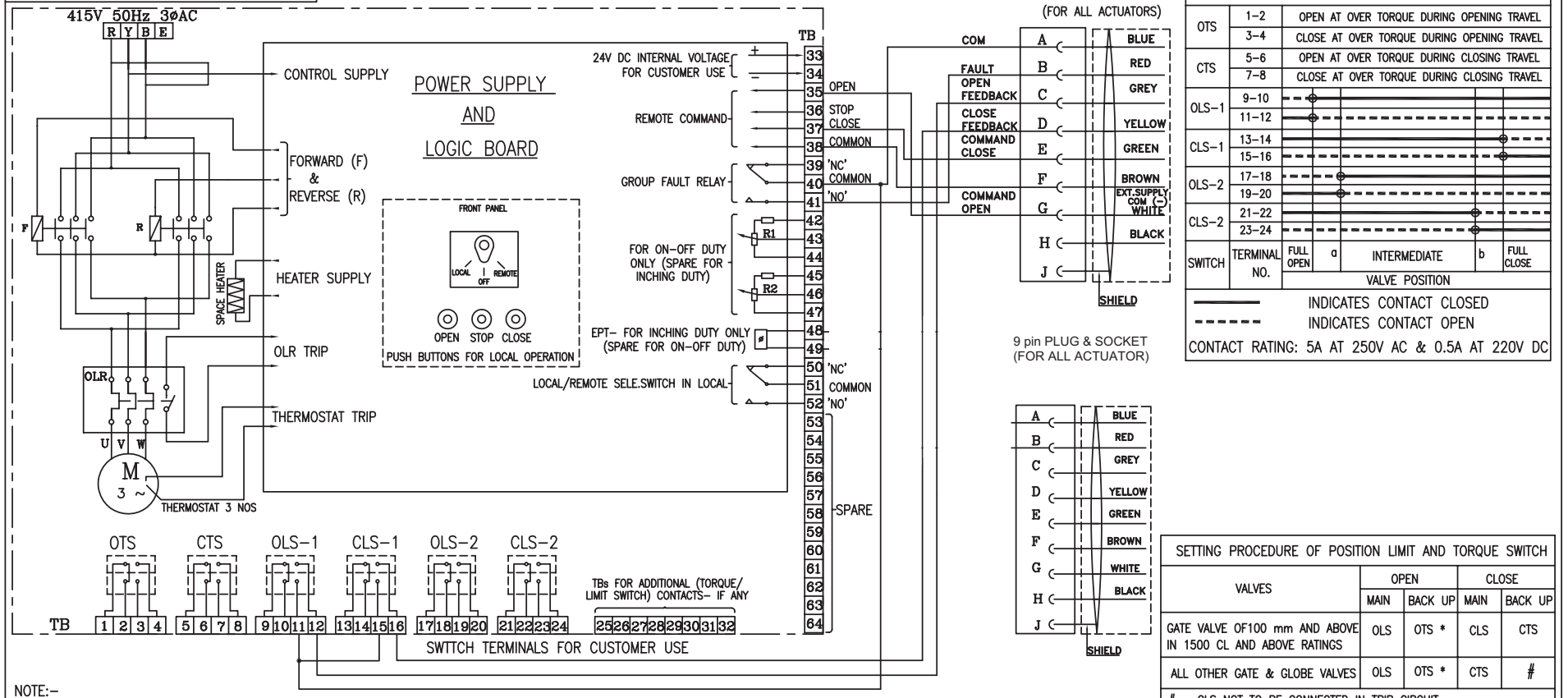
15. THE FOLLOWING INDIVIDUAL STATUS ANNUNCIATION LED'S (COLOUR-GREEN) SHALL BE PROVIDED LOCALLY (INTEGRAL TO ACTUATOR) TO ANNUNCIATE THE FOLLOWING FOR EASY LOCAL MONITORING.
    ACTUATOR IN LOCAL MODE
    ACTUATOR IN REMOTE MODE
    ACTUATOR RUNNING IN OPEN DIRECTION
    ACTUATOR RUNNING IN CLOSE DIRECTION
    ACTUATOR IN INCHING MODE.
    ACTUATOR IN SELF-RETAINING MODE
    LIMIT SWITCH OPEN TRIP
    LIMIT SWITCH CLOSE TRIP
    CONTROL VOLTAGE AVAILABILITY

16. AUTOMATIC PHASE CORRECTION FACILITY AND POTENTIAL FREE CONTACT FOR ANNUNCIATION OF POWER FAILURE SHALL BE PROVIDED.

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

ALL DIMENSIONS ARE IN MILLIMETRES. FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP / QP.

DRAWING NO. 3-V-MISC-24283



CONTACT DEVELOPMENT DIAGRAM

OTS	1-2	OPEN AT OVER TORQUE DURING OPENING TRAVEL
	3-4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL
CTS	5-6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL
	7-8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL
OLS-1	9-10	
	11-12	
CLS-1	13-14	
	15-16	
OLS-2	17-18	
	19-20	
CLS-2	21-22	
	23-24	

SWITCH — TERMINAL NO. — FULL OPEN | a | INTERMEDIATE | b | FULL CLOSE — VALVE POSITION

INDICATES CONTACT CLOSED

INDICATES CONTACT OPEN

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

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH

VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	CLS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CTS	#

\# - CLS NOT TO BE CONNECTED IN TRIP CIRCUIT

* - BYPASS OTS FOR INITIAL 5% OF TRAVEL(FOR GATE VALVES ONLY)

NOTE:-

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

REV	DATE	ALTERED
		CHD & APPD

TYPE OF PRODUCT: ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS

2 X800 MW UPPUR TPP

(DRAWN FOR INTERMEDIATE POSITION OF VALVES)

BHARAT HEAVY ELECTRICALS LTD.,
UNIT: HIGH PRESSURE BOILER PLANT.
TIRUCHIRAPALLI-620014.
365-121

	NAME	SIGN	DATE	NO.OF VAR.
DRN	N.P.ESWAR	N.P	17.03.05	-
CHD	D.DINAKARAN	D.D	17.03.05	
APPD	K.ARUNACHALAM	K.A	17.03.05	

DEPT	SCALE	WEIGHT (KG).	REFERENCE INFORMATIONS	NO. OF ITEMS
VL	NTS	-		-
CODE				

TITLE: WIRING DIAGRAM (TERMINAL PLAN)
FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET

CARD CODE: U 01

DRAWING NO.: 3-V-MISC-24283

REV: 0

Size A3

SECTION–3.17: ELECTRICAL ACTUATORS

1.0.0 INTENT OF SPECIFICATION

This section covers the requirements of motor operated electrical actuators.

2.0.0 CODES AND STANDARDS

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

3.0.0 TECHNICAL REQUIREMENTS

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

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

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

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

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

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

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

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

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

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

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

3.11.0 The actuator shall be complete with motor, reduction gears, change gears, terminal compartment, switch compartment with limit switches and torque switches, local position indicator, position transmitter for remote position indicator, thermistor, space heaters, cable glands, mechanical position indicator, hand wheel for manual operation, valve attachment etc.

3.12.0 Each actuator shall have a hand wheel fitted on it for emergency operation. The hand wheel shall be designed such that it is declutched automatically when the power supply to the motor is restored. The material of the hand wheel shall be either malleable iron or steel. The hand wheel shall have adequate clearance from housing for each gripping and operation. Actuators offered shall be with self-locking worm.

3.13.0 Two number adjustable torque switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts shall be provided. It is required to have calibration for the torque switches so that the switches can be easily set to any value desired.

3.14.0 Two numbers of position limit switches (one for open and one for close) each with 2 NO and 2 NC potential free contacts shall be provided. Two auxiliary limit switches (one for open and one for close) with 2 NO and 2 NC potential free contacts shall also be provided. The limit switches shall be of independently adjustable type. Limit switches and actuating mechanism shall be rust proof suitable for damp atmospheres. Limit switch compartment shall be weather proof and spacious enough for easy setting. The limit switches shall be suitable for the following ratings, both 240 Volts AC, 10 A and 220 V DC, 0.5 Amps.

3.15.0 Each actuator shall have a space heater in the limit switch compartment suitable for 240 V AC 50 Hz single phase supply.

3.16.0 The wiring from the limit switches, torque switches etc. shall be brought out in a separate terminal box of adequate size, so as to easily terminate the control cables.

3.17.0 Actuators shall be supplied with integral starter which shall have sophisticated electronic controls with field programming feature. It shall be designed for remote control from DCS/Respective control system. Required interposing relays for receiving open/close/stop command from DCS/Respective control system shall be provided. Potential free contacts and transducers shall be provided to provide status indication at remote DCS/Respective control system..

3.18.0 A three position selector switch (marked as LOCAL-OFF-REMOTE) and push buttons OPEN-STOP-CLOSE (for local operation) with indication lamps for running OPEN and running CLOSE shall be provided.

3.19.0 The Remote command signal (OPEN-STOP-CLOSE) from DCS/Respective control system/Control panel shall be isolated from control electronics through opto-isolator.

3.20.0 The following individual sStatus annunciation LED's and fault annunciation LED's shall be provided locally (Integral to actuator) to annunciate the following for easy local monitoring.

- Actuator in local mode
- Actuator in remote mode
- Actuator running in OPEN direction
- Actuator running in CLOSE direction
- Actuator in inching mode.
- Actuator in self-retaining mode
- Limit switch OPEN trip
- Limit switch CLOSE trip
- Control voltage availability

3.21.0 The following individual fault annunciation LED's (Colour-Red) shall be provided locally. (Integral to Actuator)

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

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

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

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

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

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

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

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

4.0.0 TESTING AND INSPECTION

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

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

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

5.0.0 DRAWINGS & DOCUMENTS

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

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

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

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SPECIFICATION FOR MEASURING INSTRUMENTS (PRIMARY & SECONDARY), TRANSMITTERS,

E. Pressure Gauge and Differential Pressure Gauge

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

			Accuracy of ± 1.6 % of span or better for Differential Pressure gauge
14.	Operating ambient Temperature	:	0 - 50 ^{O}C
15.	Safety Feature	:	Blow out disc. /diaphragm at the back
16.	Accessories	:	a) Snubbers and Glycerin filled for pulsating fluid applications and at pump discharge. b) Stainless steel 316 Diaphragm with Teflon coated seals for corrosive, viscous and solid-bearing or slurry type process fluids. c) 3-Way stainless steel Gauge cock for pressure gauges. Process connection ½" NPT. d) 5-valve SS316 manifold constructed from barstock for differential pressure gauge. Process connection ½" NPT. e) Union, nut & tail piece and other Installation accessories as required.
17.	Applicable standard	:	IS-3624 / 1996
18.	Electrical Contact rating	:	240V, 5A AC/ 220V, 0.5A DC (for gauges with alarm contact). Number of Contacts:2 SPDT
19.	Nameplate	:	Tag number, service engraved in stainless steel tag plate

B. Differential Pressure Transmitter

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

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

Notes

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1) Differential pressure transmitters of the capacitance type, regardless of the applied service, shall be capable of withstanding a differential pressure equal to full process pressure on either side of the measurement element without damage or loss of calibration.

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2) Differential pressure transmitters will be supplied with integral mounted three valve manifolds for air service and 5 way valve manifold for steam & water service.

.

3) Response time for pressure and differential pressure transmitter shall be 100 ms.

VOLUME II

SUB-SECTION 4.21

C&I ERECTION

1.0.0 TECHNICAL REQUIREMENT

1.1.0 Panels

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

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

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

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

Mounting heights

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

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

D. CONTROL BOARD

I. Control Desk / Console / Panel Construction

01.	Applicable for	:	Indoor Panel, Desk & console.
02.	Material of construction	:	Cold rolled steel sheet (Metal and plastic - Heat resistant, shrinkage free for mosaic tiles).
03.	Thickness of Sheet	:	a) 3.2 mm for faces supporting instruments / terminals. b) 2 mm for other sides and top.
04.	Construction	:	Welded throughout as per (metallic parts) approved National Standards.
05.	i) Corners	:	7 mm inner radius
	ii) Dimensional Tolerances	:	a) In height & length - 3 mm b) In height between adjacent sections - 2 mm. c) Total for a group - 6 mm
06.	Doors	:	Double, recessed, turned back edges
	i) Thickness of Sheet	:	2 mm
	ii) Hinges	:	Stainless steel
	iii) Door latches	:	Three point type
	iv) Door gaskets	:	Neoprene rubber on fixed frame to result dust proof / weatherproof enclosure.
	v) Opening of the doors	:	Outward
	vi) Louvers	:	With removable wire mesh to ensure dust and vermin proof.
07.	Color of interior	:	Glossy white
08.	Colour external	:	IS 5 No. 628 (Typical) [To be decided later]
09.	Protection of painting	:	Plastic peel coating
10.	Gland plates	:	Removable 4 mm thick (bottom)
11.	Cable entry	:	Bottom
12.	Hardware	:	a) Vibration dampeners b) Predrilled base channel ISMC - 100 or equivalent for all sides. c) Stainless steel buff- finished 2 mm thick kick plate for all sides. d) Stainless steel scratch strips along desk edges fixed with pan-head recessed screws. e) Rubber strips to ensure air tightness between kick plate and finished floor. f) Power supply points 5/15 A plug point with indication lamp 5 Nos.
13.	Enclosure Protection Class	:	IP-42 or as per environment condition.
14.	Earthing	:	4 per standards

1.8.0 Junction Boxes

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

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

Junction box shall be provided with double compression glands.

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

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

08. Junction Boxes

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

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

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

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

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

FORM NO. PEM-6666-0

	2x660 MW UDANGUDI STPP	SPECIFICATION NO.: PE-TS-XXX-145-I100
		VOLUME
	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER FOR DEBRIS FILTER	SECTION
		REV. NO. 00 / DATE: 12.10.2018
		SHEET 1 OF 2

TAG No. ……. Qty..... Data Sheet No.: **PES-145-01-DS1-0**

Data Sheet A & B

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

FORM NO. PEM-6666-0

	2x660 MW UDANGUDI STPP **DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER FOR DEBRIS FILTER**	SPECIFICATION NO.: PE-TS-XXX-145-I100 VOLUME SECTION REV. NO. 00 DATE: 12.10.2018 SHEET 2 OF 2

TAG No. ……. Qty..... Data Sheet No.: **PES-145-01-DS1-0**

Data Sheet A & B

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

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

FORM NO. PEM-6666-0

	2x660 MW UDANGUDI STPP **DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER**	SPECIFICATION NO.: PE-TS-XXX-145-I100	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE: 12.10.2018
		SHEET 1 OF 2	

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

Data Sheet C

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

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

BHEL	**2x660 MW UDANGUDI STPP** **DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER**	SPECIFICATION NO.: PE-TS-XXX-145-I100 VOLUME SECTION REV. NO. 00 DATE: 12.10.2018 SHEET 2 OF 2

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

Data Sheet C

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

INTEGRAL INDICATOR	
RESPONSE TIME	
TRANSMITTER SHALL BE ABLE TO DRIVE LOAD IMPEDANCE OF 500 OHMS(min.) WITH DRIVE CAPABILITY OF 600OHMS NOMINAL	
ELECTRICAL CONNECTION	
PROCESS CONNECTION	
ZERO & SPAN DRIFT	
DIAGNOSTICS	
MANIFOLD	
b) PRESSURE MEASUREMENT	
B) DIFFERENTIAL PRESSURE MEASUREMENT	
CABLE ENTRY DETAIL	

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

FORM NO. PEM-6666-0

	2x660 MW UDANGUDI STPP	SPECIFICATION NO.: PE-TS-435-145-I100
		VOLUME
	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE FOR DEBRIS FILTER	SECTION
		REV. NO. 00 / DATE: 12.10.2018
		SHEET 1 OF 3

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

Data Sheet A & B

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

FORM NO. PEM-6666-0

	2x660 MW UDANGUDI STPP	SPECIFICATION NO.: PE-TS-435-145-I100
		VOLUME
	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE FOR DEBRIS FILTER	SECTION
		REV. NO. 00 / DATE: 12.10.2018
		SHEET 2 OF 3

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

Data Sheet A & B

DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)

PERFORMANCE	ACCURACY	± 1% OR BETTER OF FULL SCALE DEFLECTION	
CONNECTION	PROCESS	½ " NPT (M)	
	LOCATION	☐ BACK ☐ BOTTOM	
ACCESSORIES	NAME PLATE / METAL TAG	SS	
	MOUNTING	☐ WALL ☐ PIPE – U CLAMPS & BOLTS ☐ PANEL / RACK TO BE DECIDED DURING DETAILED ENGG.	
		3 WAY NEEDLE VALVE / MANIFOLDS PROTECTIVE SEPARATING, CHEMICAL SEAL DIAPHRAGM – FOR CORROSIVE LIQUID LINES Union, nut & tail piece and other Installation accessories as required. 3-Way SS316 Gauge cock for pressure gauges	

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

FORM NO. PEM-6666-0

	2x660 MW UDANGUDI STPP	SPECIFICATION NO.: PE-TS-435-145-I100
		VOLUME
	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE	SECTION
		REV. NO. 00 / DATE: 12.10.2018
		SHEET 1 OF 2

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

Data Sheet C

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

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

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

1.0 SCOPE

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

2.0 CODES AND STANDARDS

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

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

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

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

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

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

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

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel
Frame thickness: Not less than 3.0mm
Enclosure thickness: Not less than 2.5 mm for load bearing sections (Mounted with instruments)
1.6 mm for doors and not less than 2.0 mm for others
Panel Height: Not less than 2365 mm (Refer data sheet-A (No. PES-145A-DS1-0)
Gland plate thickness: 3.0mm
Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.

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

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

3.1.7 The class of protection shall be in accordance with IP-42 unless otherwise specified in the data sheet – A (No. PES-145-54A-DS1-0).

3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as given in data sheet-A (No. PES-145A-DS1-0). Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.

3.1.9 The cable glands of the required size and type as given in data sheet-A (No. PES-145A-DS1-0) shall be supplied alongwith the Panel.

3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function.

No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.

3.1.11 Single / dual control power supply feeders of voltage class as specified in data sheet-A (No. PES-145A-DS1-0) shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.

3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm2 size. AC & DC wires shall be kept separate from each other. Separate coloured wires to be used for AC and DC circuits. All wires shall be properly numbered and identified with ferrules as per the Control scheme / wiring diagram. Wires shall be routed and run through PVC troughs.

3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm2 to 2.5mm2 external cables. The TB points in terminal block shall be cage clamp type / screw type. The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm height from finished floor. The panel shall have ten (20) percent spare terminal.

3.1.14 The interior of each panel shall be suitably illuminated through fluorescent lamps / tube lights with shrouded cover of minimum 15W operable on 240V 50 Hz AC power supply through panel door switch. A 15 Amp. 3-pin Power receptacle shall be provided.

3.1.15 Suitable space heaters operable on 240 Volts 50 Hz AC power system shall be provided at the panel bottom. These shall be designed to maintain the panel temperature five (5) deg. C above the ambient temperature during maintenance shutdown. Suitable isolating and control devices comprising of MCB, thermostat etc. shall be provided for the space heater.

3.1.16 The panel shall be provided with a copper earth bus of 25 x 6 mm size running throughout the width of the panel. It shall be terminated internally with 10 mm bolts at extreme ends for connection to; main station earth. The panel mounted equipments / devices shall be connected to earth bus through green coloured PVC insulated stranded copper conductor of 2.5 mm2 size.

3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte Sheet / 2 mm Anodised Aluminium Plate. The inscription shall be with white letters on black background on traffolyte sheet. The labels shall be fixed by self-tapping non-rusting screws.

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

3.2 Hazardous Area Panel Requirement

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

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

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

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

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

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

3.3 Control & Monitoring devices

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

3.3.2 Alarm Annunciator System

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

3.3.3 Relays

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

3.3.4 Timers

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

3.3.5 Control / Selector Switches

Switches shall be Rotary Cam type with minimum of 5 Amps AC & 2 Amp DC continuous current rating. Selector switches shall be stay put type while control switches shall be spring-return-to-neutral type. Contact configuration and rating shall be as per the control function requirement. The switches shall be

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 and as called for in the data sheet-A (No. PES-145-54A-DS1-0). Ammeters for motors shall have six (6) times folded scale at upper end to enable motor starting current indication

3.3.8 Miniature Circuit Breaker (MCB)

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

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

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

4.0 TESTING AND INSPECTION

4.1

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

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

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

4.3.1 Routine Tests

1. High Voltage (H.V.)
2. Insulation Resistance (I.R.)
3. Functional
4.

4.3.2 Type Tests

1. Enclosure Class Test

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

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

5.2. Mandatory Spares

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

5.3. Recommended Spares

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

6.0 DRAWINGS AND DOCUMENTS

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

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

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

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

7.0 MARKING AND PACKING

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

8.0 APPLICABLE DATA SHEET FORMS

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

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

FORM NO. PEM-6666-0

BHEL	**2x660 MW UDANGUDI STPP** **DATA SHEET FOR LOCAL PANELS FOR DEBRIS FILTER**	SPECIFICATION NO.: PE-SS-999-145-054A VOLUME SECTION REV. NO. 00 DATE: 12.10.2018 SHEET 1 OF 3

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet A & B

				DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL	MANUFACTURER				
	CONSTRUCTION			■ FOLDED ☐ WELDED	
	ENCLOSURE SHEET THICKNESS	FRONT		■ 3.0 mm	
		OTHER		■ 2.0 mm	
		DOOR		■ 2 mm	
		HEIGHT		■ 2365 mm for stand-alone panels (THIS SHALL BE DECIDED BY BHEL DURING DETAILED ENGG.)	
		OTHER		■ Load bearing sheet front shall have 3mm thickness	
TECHNICAL	INPUT POWER SUPPLY * (ANY OTHER POWER REQUIREMENT TO BE DERIVED FROM THIS SUPPLY ONLY)			☐ 240V 50 Hz AC ☐ 220V DC ■ 415V 3 PHASE Kindly refer Electrical scope sheet	
	NO. OF FEEDERS			☐ ONE ■ TWO	
	STARTER WITH MCC			■ REQUIRED ☐ NOT REQUIRED	
	IPR POSITION			☐ MCC ■ CONTROL PANEL	
	CONTACT RATING OF RELAY			■ 5 Amp, 230 V AC ■ 0.25 Amp, 220V DC	
	CONTROL SUPPLY			☐ 10V AC ☐ 220V AC ■ 220V DC ☐ Other. (As per requirement)	
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)			■ REQUIRED 10 nos. Actual no. shall be decided during detailed engg.	
	TEMP SCANNER (IF REQUIRED –NO. OF CHANNELS TO BE SPECIFIED UNDER SEC-C)			☐ REQUIRED ■ NOT REQUIRED	
	PAINT TYPE			■ EPOXY ENAMEL ☐ EPOXY POWDER COATED OR BETTER	
	MIMIC (TYPE OF MIMIC- MATERAIL, THICKNESS TO BE SPECIFIED DURING DETAILED ENGG.)			■ REQUIRED ☐ NOT REQUIRED	
	PANEL COLOUR (EXTERNAL)			☐ LIGHT GREY (Shade 631 IS-5) ☐ OPALINE GREEN (Shade 275) ☐ RAL 7032 SHALL BE DECIDED DURING DETAILED ENGINEERING	
	FINISH (EXTERNAL)			☐ MATT ☐ GLOSSY ☐ SEMI GLOSSY	
	PANEL COLOUR (INTERNAL)			☐ WHITE ☐ CREAM ☐ OFF WHITE SHALL BE DECIDED DURING DETAILED ENGINEERING	
	FINISH (INTERNAL)			☐ MATT ■ GLOSSY ☐ SEMI GLOSSY SHALL BE DECIDED DURING DETAILED ENGINEERING	

BHEL	**2x660 MW UDANGUDI STPP** **DATA SHEET FOR LOCAL PANELS FOR DEBRIS FILTER**	SPECIFICATION NO.: PE-SS-999-145-054A VOLUME SECTION REV. NO. 00 DATE: 12.10.2018 SHEET 2 OF 3

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet A & B

	DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
CLASS OF PROTECTION	☐ IP-42 (FOR INDOOR SERVICE) ■ IP-55 (FOR OUTDOOR SERVICE) ☐ ANY OTHER	
CONTROL HARDWARE	☐ RELAY BASED	
FOUNDATION ARRANGEMENT	☐ FOUNDATION BOLTS ☐ ANCHOR FASTENERS	
WEIGHT OF PANEL (Kg.)	……..(Vendor to specify)	
PANEL TYPE	☐ PRESSURISED ■ UNPRESSURISED As per Requirement	
CABLE GLAND	■ DOUBLE COMPRESSION	
AMMETER (TYPE OF INPUT)	☐ 1 Amp CT ☐ 4-20 Ma NOT REQUIRED BELOW 30KW.	
SCOPE OF SUPERVISION FOR ERECTION & COMMISSIONING	☐ APPLICABLE ☐ NA	

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

FORM NO. PEM-6666-0

BHEL	**2x660 MW UDANGUDI STPP** **DATA SHEET FOR LOCAL PANELS FOR DEBRIS FILTER**	SPECIFICATION NO.: PE-SS-999-145-054A VOLUME SECTION REV. NO. 00 DATE: 12.10.2018 SHEET 3 OF 3

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet C

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

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

FORM NO. PEM-6666-0

	2x660 MW UDANGUDI STPP **DATA SHEET FOR LOCAL PANELS FOR DEBRIS FILTER**	SPECIFICATION NO.: PE-SS-999-145-054A VOLUME SECTION REV. NO. 00 DATE: 12.10.2018 SHEET 3 OF 3

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet C

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

PANEL TYPE			
CABLE GLAND			
AMMETER (TYPE OF INPUT)			
SCOPE OF SUPERVISION			

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

QUALITY PLANS FOR

LOCAL CONTROL CUM STARTER PANEL

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STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	1 OF 7

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

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

$ P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor

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STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
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SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	2 OF 7

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

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STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
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SHEET	3 OF 7

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

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SHEET	4 OF 7

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

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SHEET	5 OF 7

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

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STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	6 OF 7

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

At Random by BHEL, based on 100 % internal test reports by Mfr.

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STANDARD QUALITY PLAN
FOR LOCAL CONTROL CUM STARTER PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 28.03.2017
SHEET	7 OF 7

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

LEGEND:

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

$ P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor

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

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QUALITY ASSURANCE FOR INSTRUMENTS

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

CHECK LIST FOR TRANSMITTER

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

Legend :

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

Note :

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

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

CHECK LIST FOR PRESSURE & DP GAUGE

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

Legend :

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

Note :

1. Quantum of check shall be as below :
   100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. Manufacturer to carry out ROUTINE TEST on 100 %.
4. When material corelation is not available, MFR's compliance to be provided
5. Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.

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

CHECK LIST FOR ANNUNCIATORS

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

Legend :

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

Note :

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

	2x660 MW UDANGUDI STPP (UNIT#1&2)	
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TYPE TEST REQUIREMENT

VOLUME II

SUB-SECTION 4.22

C&I TESTING AND COMMISSIONING

1.0.0 ERECTION, FIELD TESTING AND COMMISSIONING

1.1.0 The Bidder shall select and adopt methods and procedures for equipment erection to suit the nature of equipment and erection, involved according to the best modern industrial practice and his own experience.

1.2.0 The Bidder shall arrange for the transportation and handling of cabinets and desks from stores to work site suitably without any damage. If any damage is observed before handling, this shall be brought to the notice of the OWNER

1.3.0 Before installation of cabinets and desks, the necessary openings and inserts required to be made on the floor by the Bidder shall be checked and then after proper alignment, the cabinets and desks shall be installed on the floor by the Bidder. All necessary civil work to be carried out for this shall be in Bidder's scope of supply. The cabinets and desks shall be cleaned by blowing air to remove dust or foreign particles.

1.4.0 Nameplates shall be installed for all the I&C equipments bearing the service description, instrument number and calibrated range.

1.5.0 The data base covering the instrument No. type, application, process parameters, range, set point, calibrated/feasible range & span, maximum admissible value, recommended periodicity of calibration, other information for all the instruments, final control elements etc., for the unit, BOP, etc., shall be given in soft form.

1.6.0 All cables shall be tested for insulation level. Cable ends shall be properly cleaned. The entry to and exit from pipes shall be smooth and free from burr where cables are run through pipes. Cable shall be pulled into the pipes in such a way that there shall be no damage to the cables. Flexible conduits shall be provided wherever necessary. Cable in hot areas shall have proper heat protection. A minimum distance of 300 mm shall be kept between instrument / signal cables and power cables. Each tray shall be filled with a maximum of two layers for instrument and control cables and one layer for power cables providing 20% spare space in the number of layers specified. Instrument Cable Trays, shall be erected vertically as far as possible to avoid dust accumulation. All the cables laid shall be tied individually to the Tray. Thermocouple cables shall be run completely independent of all other cables with minimum separation as per relevant standard and with cross over at right angles. The cabling accessories shall include terminal blocks, splicing materials, crimping tools, cable support grips, insulating tapes, GI flexible conduits, conduit fittings, GI perforated covered trays, supports, accessories, and cadmium plated trays & cable glands.

1.7.0 The Bidder shall get prior approval as per approved quality assurance plan of the Owner Representative before any installation work starts. If any work is carried out by the Bidder before prior approval from Owner Representative and modification is sought by Owner Representative later, then the work shall be redone by Bidder without any cost / material implications to the Owner Representative. Impulse / sample piping, air supply and pneumatic tubing, cable trays and equipment shall be supported rigid enough to prevent vibration and anchored sufficiently to prevent strains on equipment installed. Supporting clamps shall be provided at least at every one meter distance for better rigidity. Impulse / sampling piping shall be provided with adequate slope, (preferably 1:10). Hanger and supports shall be so installed as not to interfere with free expansion and contraction of the piping and tubing between anchors. Suitable vibration dampeners, etc., shall be provided wherever necessary. In addition, care shall be taken that the arrangement of impulse / sampling piping, air supply and pneumatic tubing from detrimental sagging, mechanical injury, abuse due to unusual

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

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

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

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

1.10.0 Pipes shall be bent using pipe benders and any hot bending will be totally rejected. Pipe shall be cut, using pipe-cutting devices. Hot cutting will not be allowed.

1.11.0 Hydro test shall be performed for all other impulse lines / sampling lines / sensors. Necessary equipment such as hydro test pumps and temporary piping to the required point, fill pump etc., materials such as temporary gaskets, miscellaneous fasteners, etc. tools and tackles including test pressure gauges, etc. are to be provided by the Bidder. For all electrical actuators of the valves, functioning, setting and performance of limit switches / torque switches of various positions shall be checked before and after installation of the actuators. The position transmitters for inching applications shall also be calibrated. Pneumatic actuators shall be calibrated at site. PG test points shall be provided on the process line at various location by the Bidder.

1.12.0 Chipping of foundations, alignment, as required for instrumentation installations.

1.13.0 Fabrication and erection of stanchions/supports for all local instruments, junction boxes, etc. Fabrication and erection of suitable supports for surface mounted instruments.

1.14.0 Fabrication and erection of structural steel plates, angles, pipes, required for supporting ducts, trays, local instruments, etc., complete with bolts and nuts. (GI bolts and nuts shall be used wherever applicable or directed).

1.15.0 Painting of all stanchion/structures meant for instrumentation work (ducts, trays, pipe/ angle, supports, etc. as per specification). Colour and codes shall be strictly followed as per guidelines/ specifications as per direction of the Engineer-in-charge.

1.16.0 Earthing of the Instrumentation panels on the separate earthing pits (by others).

1.17.0 Double compression cable glands, cable lug, ferrules, cable identification tags, trefoil clamps for single core cables, cable dressing materials etc.

1.18.0 Cable sealing compound to prevent water entry wherever cables enters from outdoor to indoor areas.

1.19.0 Supporting structures for cable trays, cable racks, etc. using mild steel sections like channels, angles, flats, chequered plates etc. shall be in bidder's scope

1.20.0 Excavation & refilling of soil for buried cable trench / earthing with necessary materials.

1.21.0 GI Cable tray with all accessories and its MS supports.

1.22.0 Minor civil works like drilling, chipping and punching holes and openings in concrete floors, slabs, brick walls, fabrication of supporting structures, drainage of water from cable trenches and cleaning of all debris due to instrumentation installation.

1.23.0 Primary impulse tubing, laying of all types of cables, glanding and wiring and all kinds of pipe/tube fittings.

1.24.0 Fabrication and installation of primary tubing for pressure and differential pressure instruments complete with manifolds as per standards.

1.25.0 Erection & supply of the PVC instrument ducts(if required for the internal wiring of GCP cables), and perforated cable trays generally as per drawing including bends, tees, supports and opening wherever required, including provision of covers wherever required. No jumping of cables will be allowed.

1.26.0 Laying of multi-core / pair cables for all applications on perforated trays with proper tagging, dressing clamping, glanding and terminations (including proper termination of shields) at both the ends.

1.27.0 Laying of multi/single pair cables in trenches wherever required.

1.28.0 Interconnection wiring/tubing of various field mounted instruments, viz., transmitters, transducers, positioners etc.

1.29.0 Identification of each cable by proper tags at every 10 meters on the main tray as per cable schedule.

1.30.0 Fabrication of nipples from pipes and threading of the same wherever required.

1.31.0 Tapping/threading of coupling wherever required for special instruments.

1.32.0 Welding electrodes required for the complete of the job shall be in bidder's scope..

1.33.0 Completion/updating of Owner's drawings/documents as per the work done at site. This should be done before applying for completion certificate.

1.34.0 Pre-commissioning service and commissioning assistance during start-up of plant, wherever required.

1.35.0 Provision of copper wire, GI wires to panel earth bus, laying and grounding of the same to the system earth pits.

1.36.0 Fabrication and erection of canopy (single) for instruments, wherever required.

1.37.0 Minor modifications/repairs required to be done on the existing instruments namely, replacement of damaged signal tubes, tapping of damaged threads on couplings, tees and other fittings.

1.38.0 Identification of each cable by proper tag plate/ferrules at instrument ends, inside junction boxes and inside control room outside JB's by tagging the cables with SS tags as per the cable schedule.

1.39.0 Drilling holes on all Panels etc. for cables/ glands/ grommets, if required, after obtaining approval from the owner. Unused holes to be plugged after completion of job.

1.40.0 Grounding of shield for all shielded cables to respective instrument earth bus provided in the thermocouple head/junction boxes.

1.41.0 Sealing of switches with standard lead seals after final setting in the presence of Engineer-in-charge.

1.42.0 Painting of welded joints etc. as per the engineer in charge's instruction.

1.43.0 Excavating roads, laying cable road crossing sleeves and refilling and finishing wherever required.

2.0.0 LOOP TESTING

2.1.0 The action of the controller is set as prescribed. Controller settings for various modes of operation (Proportional band, reset and rate action) are at nominal value. For current signals, 4 – 20 mA shall be injected and checked the loop for 0%, 25%, 50%, 75% and 100% of full-scale inputs. For temperature loops with thermocouples, a known milli volt signal shall be injected and the output display shall be checked for input signals of 0%, 25%, 50%, 75% and 100%. For temperature loops with RTDs, a known resistance shall be injected in the control cable through decade resistance box and Output display shall be checked for 0%, 25%, 50%, 75% and 100%. For field mounted switches for alarms / interlocks, the action shall be simulated by disconnecting the wires / shorting the terminals and the function of the associated system shall be checked. Any equipment required by the Bidder for testing, calibration and commissioning shall be brought by the Bidder at site. The list of such equipment shall be furnished along with the offer

2.2.0 Prior to taking the instruments in service, all impulse lines, sampling lines and air supply lines shall be blown as required with the establishment of adequate line pressure and temperature conditions to keep the lines thoroughly clean. On-line i.e., without removing control valves from the pipe, calibration of the positioners and stroking of control valves / control dampers shall be carried out as required during control system tuning. Pre-commissioning checks, individuals loop checks, power initialisation, verification of system functioning, trouble shooting final solutions to application and / or instrument problems, etc., is Bidder's responsibility. All the required software and hardware changes shall be incorporated as required for successful commissioning to Owner satisfaction. Any other tests as may be directed by the Owner Representative. After delivery of the equipment, the Bidder shall locate all the equipment including electronic cards in its final position, check all the power wiring, grounding and interconnection cables, all in accordance with manufacturer's recommendations. The Bidder shall perform initialisation of system power, field loading of system configuration / software and data base, demonstration of system functionality to verify conformance with manufacturer's instructions and specifications, tuning of control loops, implementation of any configuration changes including hardware, software and additional tapping's / instruments, cabinets as required and providing general trouble shooting and final solutions to application and / or instrument problems.

2.3.0 The Bidder shall take care to complete all pre-commissioning activities and simulation tests after erection to suit the over all start up of respective plant equipment. The controllers shall be tuned as per the process requirement. The list of set points, alarms / Interlocks, settings for the controllers shall be furnished in the standard format and handed over to the Owner.. Control loops shall be put in auto mode as per the operational requirement of different phases. Processor, Bus Worst loading conditions calculation and other control system performance requirements shall be proved at the time of commissioning. Before taking over of the plant by the OWNER , all the system and auto control loops shall run satisfactorily for at least one month at varying loads without disturbing any adjustment. During this period, supervision and maintenance of the system shall be the scope and responsibility of the Bidder. The performance test shall be carried out for the system offered and certificates to these effects shall be approved by the OWNER .

3.0.0 INSPECTION, TESTING, GUARANTEE & SPECIAL TOOLS / TACKLES

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

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

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

3.2.1 Factory Acceptance Test (FAT):

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

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

3.2.2 Site Test (SAT):

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

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

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

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

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

CODES & STANDARDS

VOLUME – II

SUB-SECTION 4.4

CODES AND STANDARDS

1.0.0 CODES AND STANDARDS

1.1.0 Temperature Measurement

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

1.2.0 Pressure Measurement

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

1.3.0 Flow Measurement

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

1.4.0 Electronic Measuring Instruments and Control Hardware

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

a) Unpackaged

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

b) Packaged

Vibration, Drop & Static Compression - NSTA

c) Electromagnetic Compatibility

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

1.5.0 Enclosures

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

1.6.0 Sampling System

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

1.7.0 Interlocks, Protections, Symbols

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

1.8.0 Annunciations

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

1.9.0 Control Valves

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

1.10.0 Cables

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

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

1.11.0 Instrument testing

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

1.12.0 Process connection and tubing

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

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

1.13.0 Annunciations

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

1.14.0 DCS and other Control system

a. Interlocks, protections, symbols

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

b. Communication system

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

- Information Processing System – Open System interconnection,
- Basic Reference Model and connectionless Mode transmission - ISO 7498
- Internal organization of network layers - ISO 8648
- For power system monitoring, control and associated communications. - IEC 60870 - 5-101

c. Hardware Testing of Digital Process computers - ISA RP-55.1- 1983

d. Standard Digital Interface For Programmable Instrumentation - IEEE - 488.2 - 1990

e. Electromagnetic compatibility Tests –

- Voltage and current surge – IEC 1000-4-5, EN 61000-4-5,
- Fast transient bursts – IEC 1000-4-4, EN 61000-4-4,
- Damped oscillatory wave – IEC 1000-4-12, EN 61000-4-12,
- Ring wave – IEC 1000-4-12, EN 61000-4-12.

f. Electrostatic discharge Tests – IEC 1000-4-2, EN 61000-4-2

g. Magnetic and Electromagnetic fields –

- Power frequency magnetic fields – IEC 1000-4-8, EN 61000-4-8,
- Pulse magnetic fields – IEC 1000-4-9, EN 61000-4-9,
- Damped oscillatory magnetic field – IEC 1000-4-10, EN 61000-4-10,
- Ring wave – IEC 1000-4-12, EN 61000-4-12.
- Radiated radio-frequency electromagnetic field – IEC 1000-4-3, EN 61000-4-3,
- Immunity to conducted disturbances, induced by radio- frequency fields – IEC 1000-4-6, EN 61000-4-6,

h. Emission test RF radiated fields – CISPR 11/EN 55011.

1.15.0 Instrument switches & contacts – BS 6134

1.16.0 Cable trays & conduits - IEEE 422 / NEMA VE-1 / NFPA-70

1.17.0 Surge protection system

Surge Withstand capability Test as per ANSI C 37.90.1 (1989), R1994

1.18.0 Sample coolers for SWAS - ASTM D 11

1.19.0 Others

- Printed Circuit Boards – IEC 326 C
- General requirements and tests for printed for wiring boards – IS 7405 (Part 1)
- Edge socket connections – IEC 130 – 11
- Dimensions of attachment plugs & receptacles ANSI C73/1973
- Direct acting Electrical indicating Instruments IS 1248/1968

1.20.0 NFPA 72 – National fire alarm code (Latest edition)

In addition to the codes and standards specifically mentioned in the relevant technical specifications for the equipment / plant / system, all equipment parts, systems and works covered under this specification shall comply with all currently applicable statutory regulations and safety codes of the Republic of India, as well as of the locality

where they will be installed, including the following:

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

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

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

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

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KKS TAGGING PHILOSOPHY

TYPICAL DRIVE LIST WITH KKS TAG		
KKS_CODE	**DESCRIPTION**	**AREA**
PCA11AA001	DEBRIS DISCHARGE VALVE	DF- 1
PCA11AE011	DF GEARED MOTOR DRIVE	DF-1
PCA21AA001	DEBRIS DISCHARGE VALVE	DF- 2
PCA21AE011	DF GEARED MOTOR DRIVE	DF-2

NOTES:-

1.IF THE NUMBER OF EQUIPMENT/INSTRUMENTS CHANGES, THE KKS FOR THE SAME SHALL BE FINALIZED DURING DETAILED ENGINEERING.

2.FOR INSTRUMENTS KKS 6th AND 7th PLACE VALUE OF KKS CODE SHALL BE CHANGED FOR CORRESPONDING EQUIPMENT AS FOLLOWS:-

1.FOR PRESSURE -CP

FOR INSTRUMENTS 8th,9th AND 10th PLACE VALUE OF KKS CODE SHALL BE CHANGED FOR CORRESPONDING EQUIPMENT AS FOLLOWS:-

1.FOR PRESSURE/TEMPERATURE/LEVEL TRANSMITTER-011

2.FOR PRESSURE/TEMPERATURE/LEVEL GAUGE-511

3.FOR PRESSURE/TEMPERATURE/LEVEL SWITCH-111

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

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SUB VENDOR LIST

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

Sl No	Package Name	Supplier Name	Supplier Communication Address
1	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in
2	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	BOSE PANDA INSTRUMENTS PVT.LTD.	Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, Sarani, Kolkata Phone- +91 33 2548 7220 Pincode : 700074 Email : parthabosebpi@gmail.com; bosepanda@vsnl.net
3	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net
4	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
5	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
6	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
7	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
8	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,
9	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in
10	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone- 9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
11	TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR ROAD, BANGALORE, Phone- 080-41586000, Pincode : Email : uday.shankar@in.yokogawa.com,
12	TRANSMITTERS	ABB INDIA LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD Phone- 09971085678 Pincode : 121003 Email : vipin.swami@in.abb.com
13	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
14	TRANSMITTERS	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.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	Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St. North Hills Phone- +1 818 830 5548 Pincode : 91343 Email : mmoren@miinet.com
19	TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,
20	TRANSMITTERS	Honeywell Automation India Limited	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE TOWER, NEHRU PLACE, NEW DELHI Phone- 9890200584 Pincode : 110019 Email : rajesh.chaudhary@honeywell.com
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 : vikramraj.singh@emerson.com
22	TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road MIDC Andheri (East) MUMBAI Phone- 28208477 Pincode : 400093 Email : corp@delbby.rpgms.ems.vsnl.net.in
23	TRANSMITTERS	SIEMENS LIMITED	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com
24	TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex, Indore Phone- 0731-4081305 Pincode : 452010 Email : sales@nivocontrols.com
25	JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com
26	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
27	JUNCTION BOX	Shrenik & Company,	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com

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

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

SUB-SECTION – ID

DATASHEET-A

	DATA SHEET - A			SPECIFICATION NO.: PE-TS-417/435-165-N003
	DEBRIS FILTER (DF)			REV. NO.: 00; DATE : 11.10.18
				SECTION : I SUB-SECTION : ID
SL NO	**DESCRIPTION**	**UNITS**	**5X800 MW YADADRI TPP**	**2X660 MW UDANGUDI STPP STG I**
1.00	**GENERAL**			
1.1	No. of Strainers/ Filters required for station	Nos.	Total 10 Sets (viz. 2 Nos. Per Unit) viz. One independent set common for each half of two condensers placed in series	Total 4 Sets (viz. 2 Nos. Per Unit)
1.2	Liquid Handled		Clarified water (Refer enclosed water analysis at Annexure III of Datasheet A)	Sea water (Refer enclosed water analysis at Annexure III of Datasheet A)
1.3	Size of Debris Filter Shell	NB	2700	2600
1.4	Length of Debris Filter Shell	mm	Maximum 5000 including counter flanges (Flap of butterfly valve shall be extended to approx 500 mm inside the Debris Filter from starting edge of C/F)	Maximum 5400 (Debris Filter Inlet shall be mounted directly on the existing Butterfly valve) (Flap of butterfly valve shall be extended to 1250-1350 mm inside the Debris Filter)
1.5	Scope of Counter Flange of Debris Filter Shell		In Bidder's Scope. (Associated Gaskets, nuts and bolts are in Bidder's Scope)	In Purchaser's Scope. (Associated Gaskets, nuts and bolts are in Bidder's Scope)
1.6	BOQ for Debris Discharge Piping		1. Dia of pipe: To be decided by bidder. 2. Length of pipe(In Bidder's scope): 50 m pipe length. 3. No. of bends (in Bidder's scope): 5 Nos.	1. Dia of pipe: To be decided by bidder 2. Length of pipe: (In Purchaser's Scope) – Bidder to furnish the BOM & Isometric Drawing 3. No. of bends: (In Purchaser's Scope) – Bidder to furnish the BOM & Isometric Drawing
1.7	Filter type/ duty		On line / continuous	On line / continuous
1.8	Location		Condenser Inlet (Outside TG Hall)	Condenser Inlet (Outside TG Hall)
2	**DESIGN DATA**			
2.1	Operating pressure at Debis Filter Inlet Flange	kg/cm2 (g)	2.0 to 2.5	2.0 to 2.5
2.2	Design pressure for Debis Filter Shell	kg/cm2 (g)	5 Kg/cm2 (g) & Vacuum 0.1Kg/cm2 (abs)	5.7 Kg/cm2 (g) & Vacuum 0.1Kg/cm2 (abs)
2.3	Design Mechanical temperature	Deg. C	60	60
2.4	Flow rate through filter			
	a) Normal	Cub m/Hr	43000	41000
	b) Maximum	Cub m/Hr	51600	49200
2.5	Design differential pressure for filter section/ screen	kg/cm2 (g)	1.5 (Min.)	1.5 (Min.)
2.6	Type of suspended matter likely to enter the filter		Typical debris encountered in closed circuit CW system with Cooling Tower	Typical debris encountered in closed circuit CW system with Cooling Tower

	DATA SHEET - A			SPECIFICATION NO.: PE-TS-417/435-165-N003
	DEBRIS FILTER (DF)			REV. NO.: 00; DATE : 11.10.18
				SECTION : I SUB-SECTION : ID
SL NO	**DESCRIPTION**	**UNITS**	**5X800 MW YADADRI TPP**	**2X660 MW UDANGUDI STPP STG I**
2.7	Differential pressure measuring system set pressure			
	• For initiating flushing/ backwashing	mbar	90	90
	• For alarm/ annunciation	mbar	110	110
2.8	Filter section/ screen perforation size	mm	5 mm (Max)	5 mm (Max)
2.9	Free flow area in the screen basket		Atleast 110 % of pipe inlet area	Atleast 110 % of pipe inlet area
2.10	Debris discharge flow during flushing period	Cub m/ Hr.	As per Bidder design	Not to exceed 3.0% of total flow rate for flushing period of maximum 3.0 minutes
3	**GUARANTEED PERFORMANCE REQUIREMENT**			
3.1	Pressure drop across the filter (i.e. between inlet and outlet connection) at normal flow			
	a) Clean condition	MWC	0.6	0.5
	b) Partially (50%) chocked condition	MWC	1.1	1.1
4	**MATERIALS OF CONSTRUCTION**			
4.1	Filter body/ housing along with Body Flange		Carbon Steel to IS -2062 Gr.B. with epoxy painted inside (with minimum housing thickness same as connecting pipe thickness)	Carbon Steel to IS -2062 Gr.B. Rubber Lined(Min. 5mm thick) inside (with minimum housing thickness same as connecting pipe thickness)
4.2	Connecting pipe (Inlet/ Outlet)		Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589	Carbon Steel to IS – 2062 Gr. B rolled & welded conforming to IS:3589 Internally lined with Poly Urea/CorroCoat/Glass Flake Coating inside of 1500 Microns DFT
4.3	Filter screen/ section		SS-316	Duplex SS (UNS 32205/31803)
4.4	Shaft		SS-316	Duplex SS (UNS 32205/31803)
4.5	Supporting cage		SS-316	Duplex SS (UNS 32205/31803)
4.6	Differential measuring system		SS-316	Duplex SS
4.7	Backwash rotor shoes		Neoprene	Neoprene
4.8	Any other internal hardware /pipes etc.		SS-316 or Equiv.	Duplex SS (UNS 32205/31803)
4.9	Flushing Pump (If applicable)			
	a) Casing		SA 351 CF8M	Duplex SS (UNS 32205/31803)
	b) Impeller		SA 351 CF8M	Duplex SS (UNS 32205/31803)
	c) Shaft		SS 316	ASTM (A276 UNS 31803)
4.10	Valves			
4.10.1	Check Valves (65 NB & Above)		For sizes 65 NB and above:- Swing check or dual plate type.	For sizes 65 NB and above-Swing check type or dual plate type.
	a) Body & Bonnet		SS316, Flanged Ends	A 439 Gr. D2- NI RESIST / Duplex SS

	DATA SHEET - A			SPECIFICATION NO.: PE-TS-417/435-165-N003
	DEBRIS FILTER (DF)			REV. NO.: 00; DATE : 11.10.18
				SECTION : I SUB-SECTION : ID
SL NO	**DESCRIPTION**	**UNITS**	**5X800 MW YADADRI TPP**	**2X660 MW UDANGUDI STPP STG I**
	b) Disc for Check Valve		SS316	A 439 Gr. D2- NI RESIST / Duplex SS
	c) Stem		ASTM A182 Gr F6a	Duplex SS
4.10.2	Check Valves (50 NB & Below)		For size 50 NB and below-Piston type	For size 50 NB and below-Piston type
	a) Body & Bonnet		SS-316, Socket welded Ends	A 439 Gr. D2- NI RESIST / Duplex SS
	b) Disc for Check Valve		SS316	A 439 Gr. D2- NI RESIST / Duplex SS
	c) Stem		ASTM A182 Gr F6a	Duplex SS
4.10.3	Gate/ Globe Valves 50 Nb & Below			
	Body & Bonnet		SS-316, Socket welded Ends	Duplex SS
4.10.4	Gate/Globe Valves (65NB & above)			
	➢ Body & Bonnet		SA 351 CF8M	A 439 Gr. D2- NI RESIST / Duplex SS
	➢ Disc		SA 351 CF8M	A 439 Gr. D2- NI RESIST / Duplex SS
	➢ Stem		ASTM A182 Gr F6a	Duplex SS
	➢ Companinon Flange		SS316	Same as Connecting Pipe MOC
4.10.5	BFV Valves (65NB & above)			BFV (Above 200 Nb)
	➢ Body & Disc		SA 351 CF8M	A 439 Gr. D2- NI RESIST / Duplex SS
	➢ Sealing, Retaining segment & internals		18 – 8 -SS	Duplex SS
	➢ Bearing		Self lubricating type	Self lubricating type
	➢ Companinon Flange		SS316	Same as Connecting Pipe MOC
4.10.6	Ball valves			
	i) Body		SA 351 CF8M	A 439 Gr. D2- NI RESIST / Duplex SS
	ii) Ball		SA 351 CF8M	Duplex SS
	iii) Stem		SS316	Duplex SS
4.11	Debris discharge/ Interconnecting Piping material		In Bidder's Scope	By Purchaser
	MATERIAL		SS316	a) PIPING UPTO 300Nb SHALL BE DUPLEX SS (AS PER SCH 40S FOR PIPE UPTO 50 NB & SCH 10S FOR PIPE SIZE ABOVE 50 NB) b) PIPING 350 NB AND ABOVE SHALL BE CARBON STEEL AS PER IS 3589 FABRICATED FROM IS 2062 PLATES INTERNALLY LINED WITH CORROCOAT OR POLYUREA OR GLASS FLAKE COATING INSIDE OF 1500 MICRONS DFT.
4.12	Inspection hole/ Man hole		Required 600mm	Required 600mm

	DATA SHEET - A			SPECIFICATION NO.: PE-TS-417/435-165-N003
	DEBRIS FILTER (DF)			REV. NO.: 00; DATE : 11.10.18
				SECTION : I SUB-SECTION : ID
SL NO	**DESCRIPTION**	**UNITS**	**5X800 MW YADADRI TPP**	**2X660 MW UDANGUDI STPP STG I**
5	**COUNTER FLANGES FOR DEBRIS FILTER SHELL**		In Bidder's Scope	In Purchaser's Scope
5.1	MATERIAL			
	a) Flanges		Carbon Steel to IS 2062 Gr. B or eq for thickness, drilling etc refer Annexure II in section C1(In Bidder's Scope)	Carbon Steel to IS -2062 Gr.B. or eq(Internally Lined with CorroCoat or PolyUrea or Glass Flake) for thickness, drilling etc refer Annexure II in section C1 (In Purchaser's Scope)
	b) Fasteners		A 193 & A 194 (In Bidder's scope).	SS 316 L (In Bidder's scope).
	c) Gaskets		Min 4 mm thick rubber (In Bidder's scope).	Min 4 mm thick rubber (In Bidder's scope).
5.2	Drilling Standard		BS 4504 or equivalent	BS 4504 or equivalent
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 for thickness, drilling etc refer Annexure II in section C1(In Bidder's Scope)	Same as Pipe MOC
	b) Fasteners		A 193 & A 194 (In Bidder's scope).	SS 316L (Non-Wetted) (In Bidder's scope).
	c) Gaskets		Min 4 mm thick rubber (In Bidder's scope).	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.	1. All Wetted & Non-wetter Fastners in Bidder's Scope shall be of DUPLEX SS & SS316L material respectively. 2. Suitable for intended duty and shall be subject to Purchasers approval during detailed engg. In the event of order.
8	**Connecting pipe size (OD x Thk)**	mm x mm	2743X20	2640X20
9	**PAINTING**			
9.1	External Surface			
	a) Surface preparation		SA - 2.5 of Swedish Specn. SIS-05-59-00-1967	SA - 2.5 of Swedish Specn. SIS-05-59-00-1967 / By Sand Blasting
	b) Primer		Two coat of Red Lead primer	Two (2) coats of Epoxy primer coats with minimum thickness of 35 microns dft of each coat.
	c) Intermediate Paint		-	Epoxy based TiO2 pigmented coat
	d) Final paint		Two (2) coats of High build Epoxy paint with minimum thickness of 35 microns dft of each coat with total dft of 200 to 250 microns.	Two (2) coats of High build Epoxy paint with minimum thickness of 35 microns dft of each coat

	DATA SHEET - A			SPECIFICATION NO.: PE-TS-417/435-165-N003
	DEBRIS FILTER (DF)			REV. NO.: 00; DATE : 11.10.18
				SECTION : I SUB-SECTION : ID
SL NO	**DESCRIPTION**	**UNITS**	**5X800 MW YADADRI TPP**	**2X660 MW UDANGUDI STPP STG I**
9.2	Internal Surface (for Applications not in Direct Contact with Sea Water)			
	a) Surface preparation		SA - 2.5 of Swedish Specn. SIS-05-59-00-1967	SA - 2.5 of Swedish Specn. SIS-05-59-00-1967 / By Sand Blasting
	b) Primer		Two coat of Epoxy Resin based Red oxide primer	Two coat of Epoxy Resin based Zinc Phosphate epoxy primer
	c) Final paint		Adequate no. of coats (min. Two) of Synthetic Enamel paint to achieve total DFT of min. 200 to 250 microns. Colour-code shall be as per IS 9404	Adequate no. of coats of coal tar epoxy paint to achieve total dry film thickness of 200 to 250 microns
10	**SHOP TEST**			
10.1	Hydrostatic test			
	a) Test Pressure	bar (g)	1.5 times design pressure	1.5 times design pressure
	b) Test duration	min.	30	30
10.2	Leakage test			
	a) Test Pressure	bar (g)	Design Pressure	Design Pressure
	b) Test duration	min.	30	30
11	**Adequate provision for future installation of cathodic protection required**		YES	YES (Along with Sacrificial type anodic protection by Bidder)
12	**Whether automatic flushing/ back- washing operation effected by the following :**			
	i. Differential pressure		YES	YES
	ii. Adjustable timer		YES	YES
	iii. Push button		YES	YES
13	**Whether provision for manual flushing / backwashing operation is made in the event of control system failure.**		YES (if required)	YES (if required)
14	**Whether built in flushing arrangement complete with flushing pump, valves, and associated piping, is provided.**		YES (if required)	YES (if required)
15	**MANDATORY SPARES –**			
15.1	Valve Complete Assembly	LOT	2 LOTS (10% of each type and size of total population or minimum 1(one) No. whichever is higher= 1 LOT)	NOT APPLICABLE

	DATA SHEET - A			SPECIFICATION NO.: PE-TS-417/435-165-N003
	DEBRIS FILTER (DF)			REV. NO.: 00; DATE : 11.10.18
				SECTION : I SUB-SECTION : ID
SL NO	**DESCRIPTION**	**UNITS**	**5X800 MW YADADRI TPP**	**2X660 MW UDANGUDI STPP STG I**
15.2	**Field Instruments**			
15.2.1	Transmitters/ Gauges/Switches etc. along with relevant accessories	LOT	2 LOTS (10% of total or at least two (whichever is higher) for each type along with accessories. = 1 LOT)	NOT APPLICABLE
15.2.2	Temperature element/RTD	LOT	2 LOTS (10% of each type, range and immersion length. Or Minimum 5 nos.= 1 LOT)	NOT APPLICABLE
15.2.3	Furnace Temperature Probe	LOT	2 LOTS (Thermocouple 1 no. = 1 LOT)	NOT APPLICABLE
15.3	**Control Panel/ Desk**			
15.3.1	Back up panel mounted devices (selector switched/push buttons/indicators etc.)	LOT	2 LOTS (5% of installed capacity= 1 LOT)	NOT APPLICABLE
15.3.2	Lamps/ LEDs	LOT	2 LOTS (100% of the total quantity =1 LOT)	NOT APPLICABLE
15.3.3	Blank Tiles	LOT	2 LOTS (10% of installed capacity =1 LOT)	NOT APPLICABLE
15.3.4	MCBs	LOT	2 LOTS (10% of each type & rating =1 LOT)	NOT APPLICABLE
15.3.5	Fuses/ Fuse holder	LOT	2 LOTS (100% of each type & rating =1 LOT)	NOT APPLICABLE
15.4	**Annunciation System**			
15.4.1	Each type of module	LOT	2 LOTS (1(one) No. each = 1 LOT)	NOT APPLICABLE
15.4.2	Lamp Box with Facia & Lamps (LED type)	LOT	2 LOTS (5 (five) Nos. = 1 LOT)	NOT APPLICABLE
15.4.3	Hooter	LOT	2 LOTS (1 (one) No.= 1 LOT)	NOT APPLICABLE
15.5	**415 Volt Motor (Upto 30KW Rating)**			
15.5.1	Driving End & Non-Driving End Bearing	LOT	2 LOTS (3 Set for each type and rating of Motor = 1 LOT)	1 LOT (1 Set of each type=1 LOT)

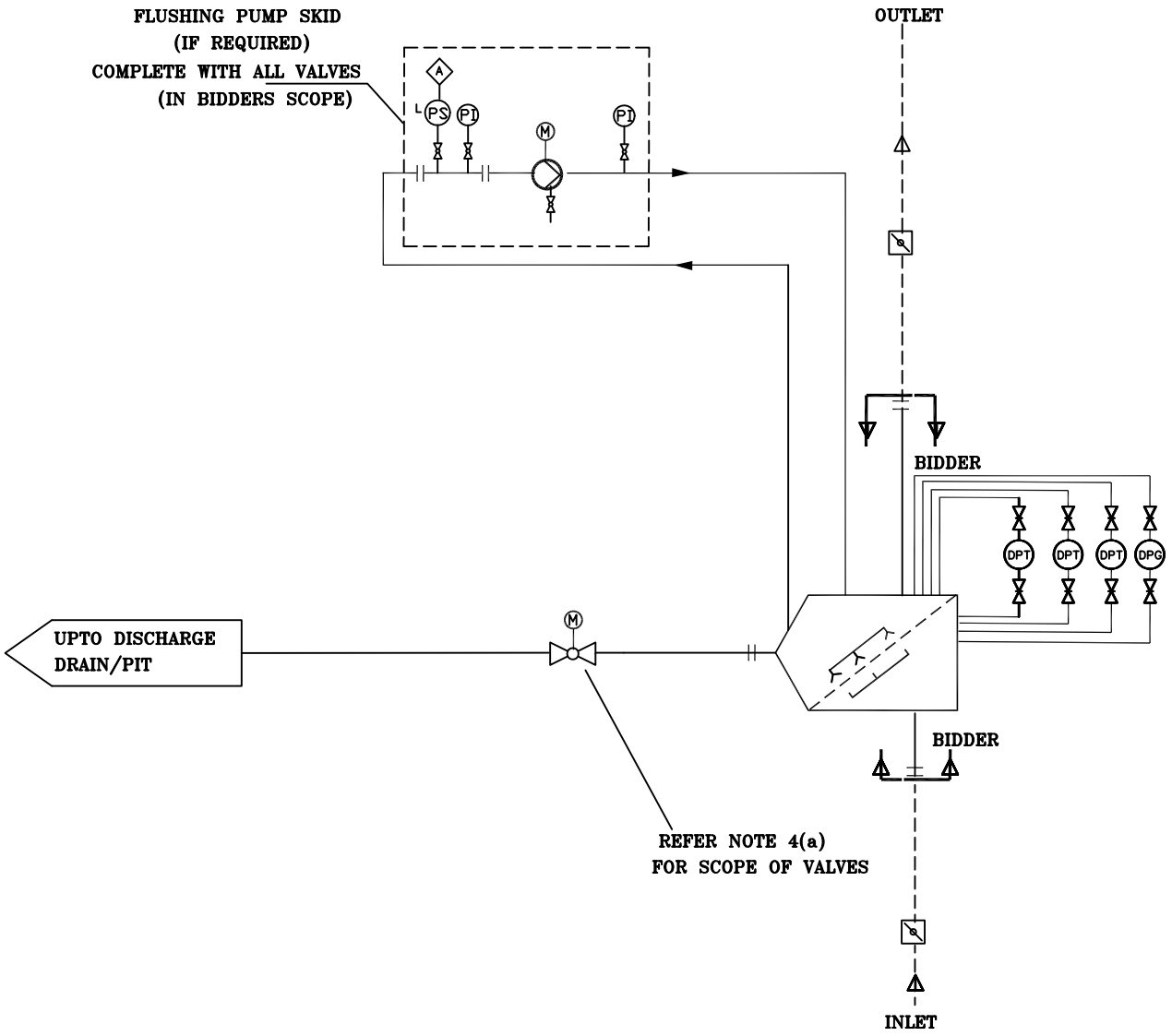
	DATA SHEET - A			SPECIFICATION NO.: PE-TS-417/435-165-N003
	DEBRIS FILTER (DF)			REV. NO.: 00; DATE : 11.10.18
				SECTION : I SUB-SECTION : ID
SL NO	**DESCRIPTION**	**UNITS**	**5X800 MW YADADRI TPP**	**2X660 MW UDANGUDI STPP STG I**
15.5.2	Cooling Fan	LOT	2 LOTS (2 No. for each type and rating of Motor = 1 LOT)	NOT APPLICABLE
15.5.3	Motor Terminal Block	LOT	2 LOTS (5 No. for each type and rating of Motor = 1 LOT)	1 LOT (10 Nos. for each type and rating of Motor = 1 LOT)
15.5.4	Complete Set of Coupling	LOT	2 LOTS (1 Set for each Application = 1 LOT)	NOT APPLICABLE
15.5.5	Motors of each type & rating	LOT	NOT APPLICABLE	1 LOT (1 No. = 1 LOT)
15.6	Actuator along with motors	LOT	NOT APPLICABLE	1 LOT (1 Set = 1 LOT)
15.7	Debris discharge valve	LOT	NOT APPLICABLE	1 LOT (1 Set = 1 LOT)
15.8	Local Indicators like temperature gauges, pressure gauges, differential pressure gauges, flow gauges, flow meters etc.,	LOT	NOT APPLICABLE	2 LOTS (10% or 2 no. of each make, model and type whichever is more.= 1 LOT)
15.9	**INSTRUMENTATION CABLE. INTERNAL WIRING AND ELECTRICAL FIELD**			
15.9.1	Pre fabricated cable of each type	LOT	NOT APPLICABLE	2 LOTS (10% of installed quantity= 1 LOT)
15.9.2	Pre fabricated cable connector	LOT	NOT APPLICABLE	2 LOTS (10% or 1 no.of each type and model, whichever is more. = 1 LOT)
15.9.3	Other cables	LOT	NOT APPLICABLE	2 LOTS (5% of each type, pair and size of actual installed quantity = 1 LOT)
15.10	Electrical actuator, complete assembly, of each rating	LOT	NOT APPLICABLE	1 LOT (2 Nos. = 1 LOT)

Notes for Mandatory Spares:

1	Spares not applicable for the Package to be specifically quoted as “NOT APPLICABLE”.
2	In case if such items of spares indicated as “not applicable” by bidder in its offer, are found applicable at a later date during execution of the project, such items of spares are to be supplied within the ordered cost of the mandatory spares.

	DATA SHEET - A			SPECIFICATION NO.: PE-TS-417/435-165-N003
	DEBRIS FILTER (DF)			REV. NO.: 00; DATE : 11.10.18
				SECTION : I SUB-SECTION : ID
SL NO	**DESCRIPTION**	**UNITS**	**5X800 MW YADADRI TPP**	**2X660 MW UDANGUDI STPP STG I**
3	Wherever % is indicated for the mandatory spares, the quantity shall be calculated for % of supply for one unit, unless otherwise specified. The quantity to be reckoned for % indicated shall be rounded off to the next higher whole number. For example if the % arrived is 0.2 the quantity to be supplied shall be 1 and if the % arrived is 5.1 the quantity to be supplied shall be 6.			
4	In respect of quantity mentioned as 'Set' means the total quantity of all the components/items used in particular equipment unless otherwise specified.			

ANNEXURE–I



NOTE :–

1. SCHEMATIC SHOWN IS TYPICAL FOR ONE DF, SHALL BE IDENTICAL FOR THE SECOND DF.

2. INSTRUMENTS/ANNUNCIATIONS/ INTERLOCKS INDICATED IN THE SCHEME ARE TENTATIVE, SHALL BE PROVIDED AS PER APPROVED DRGS./ DOCUMENTS/ CONTROL PHILOSOPHY IN THE EVENT OF ORDER.

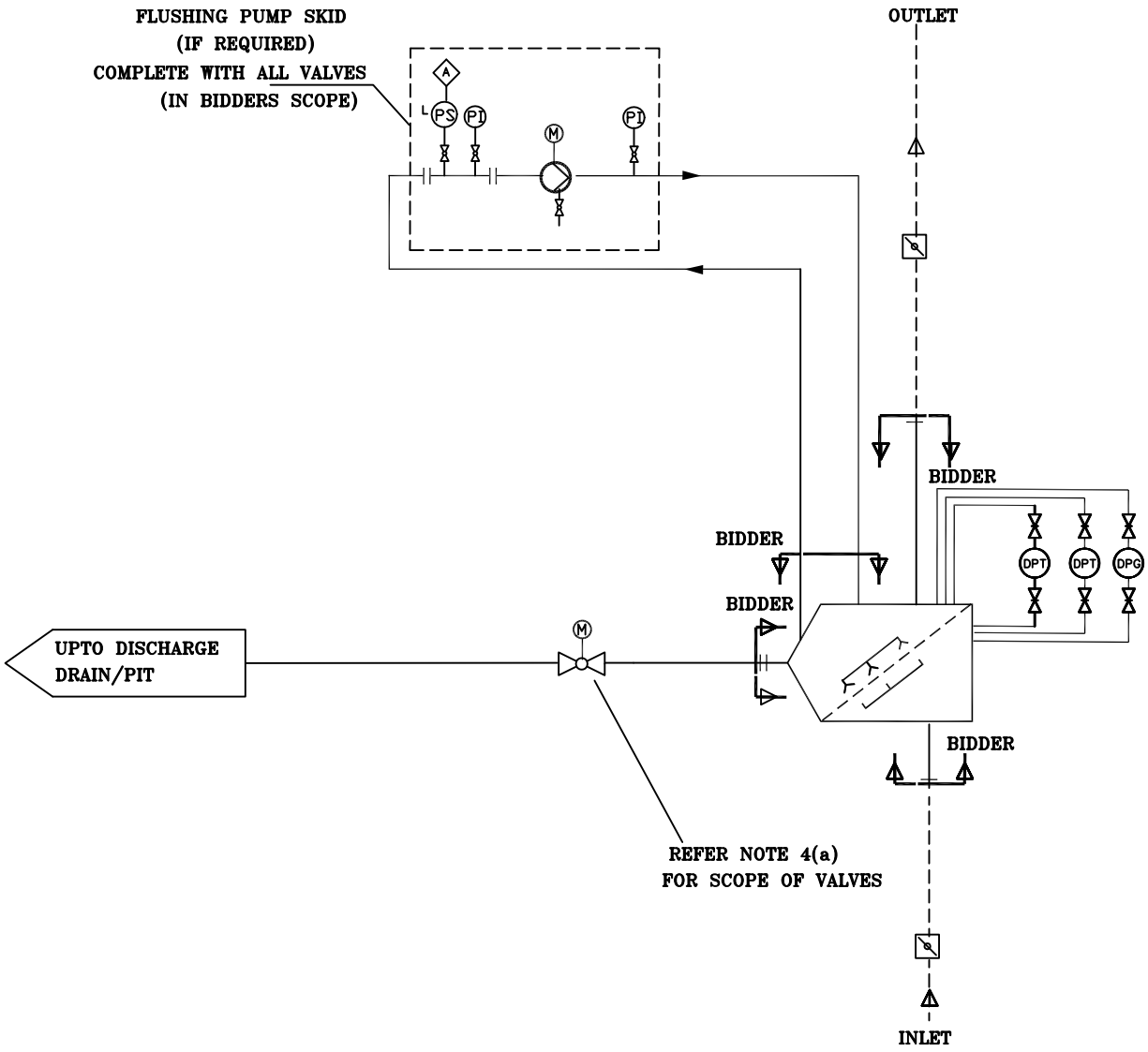
3. COUNTERFLANGES FOR DF ARE INCLUDED IN BIDDERS SCOPE. ALL INTERCONNECTING / DEBRIS DISPOSAL PIPING IS INCLUDED IN BIDDER SCOPE.

4. BIDDER's SCOPE OF SUPPLY ALSO INCLUDES :
   a) ALL VALVES ON BIDDER'S INTERCONNECTING /DEBRIS DISPOSAL PIPING ALONGWITH THEIR COUNTER FLANGES.
   b) FLUSHING PUMP SKID, IF REQUIRED COMPLETE WITH FLUSHING PUMP, VALVES, INSTRUMENTS ETC.

5. PURCHASER — BIDDER'S SCOPE OF SUPPLY

FLOW DIAGRAM FOR
DEBRIS FILTER
5X800 MW YADADRI TPP

ANNEXURE–I



NOTE :–

1. SCHEMATIC SHOWN IS TYPICAL FOR ONE DF, SHALL BE IDENTICAL FOR THE SECOND DF.

2. INSTRUMENTS/ANNUNCIATIONS/ INTERLOCKS INDICATED IN THE SCHEME ARE TENTATIVE, SHALL BE PROVIDED AS PER APPROVED DRGS./ DOCUMENTS/ CONTROL PHILOSOPHY IN THE EVENT OF ORDER.

3. COUNTERFLANGES FOR DF ARE EXCLUDED FROM BIDDER'S SCOPE. ALL INTERCONNECTING / DEBRIS DISPOSAL PIPING IS INCLUDED IN PURCHASER SCOPE.

4. BIDDER's SCOPE OF SUPPLY ALSO INCLUDES :
   a) ALL VALVES ON PURCHASER'S INTERCONNECTING /DEBRIS DISPOSAL PIPING ALONGWITH THEIR COUNTER FLANGES.
   b) FLUSHING PUMP SKID, IF REQUIRED COMPLETE WITH FLUSHING PUMP, VALVES, INSTRUMENTS ETC.

5. PURCHASER — BIDDER'S SCOPE OF SUPPLY

FLOW DIAGRAM FOR
DEBRIS FILTER
2X660 MW UDANGUDI STPP STG I

(ANNEXURE II)

DESIGN CLARIFIED WATER ANALYSIS (FOR 5X800 MW YADADRI TPP)

S.No.	CONSTITUENTS	As	CONTENT
1.	Calcium	$CaCO_3$	76.9 ppm
2.	Magnesium	$CaCO_3$	59.5 ppm
3.	Sodium	$CaCO_3$	148.2 ppm
4.	Potassium	$CaCO_3$	2.5 ppm
5.	Iron in Soln.	Fe	0.7 ppm
6.	Hydrogen (FMA)	$CaCO_3$	0.0 ppm
7.	Strontium (Sr)	$CaCO_3$	0.0 ppm
8.	Barium	$CaCO_3$	4.6 ppm
9.	Ammonia (NH4)	NH_4	0.0 ppm
	TOTAL CATIONS (Except Fe)	**$CaCO_3$**	**291.7 ppm**
10.	Bicarbonate	$CaCO_3$	116 ppm
11.	Sulphate	$CaCO_3$	82.9 ppm
12.	Chloride	$CaCO_3$	82.6 ppm
13.	Nitrate	$CaCO_3$	7 ppm
14.	Phosphate	$CaCO_3$	0.6 ppm
15.	Fluoride	$CaCO_3$	2.6 ppm
	TOTAL ANIONS	**$CaCO_3$**	**291.7 ppm**
16.	Boron	B	0.52 ppm
17.	Reactive Silica	SiO_2	14 ppm
18.	Colloidal Silica	SiO_2	2.9 ppm
19.	Total Silica	SiO_2	16.9 ppm
20.	Nitrites	NO_2	1.8 ppm
21.	Total Hardness	$CaCO_3$	109.7 ppm
22.	Total Suspended Solid		15 ppm
23.	Total Dissolved Solids		411 ppm
24.	Conductivity at 25°C		610 µS/cm
25.	pH value at 25°C	-	8.3
26.	Turbidity		15 NTU
27.	TOC		8.9 ppm
28.	BOD_3 at 27°C		12 ppm
29.	COD		40 ppm
30.	Dissolved Oxygen		6.3 ppm
31.	Oil & Grease		<1 ppm

NOTE:

1. **THE CYCLE OF CONCENTRATION (COC) SHALL BE CONSIDERED AS 6.5** for sets of cooling water systems.

2. **DATA FOR COOLING TOWER:**

ANNEXURE II

TYPICAL SEA WATER ANALYSIS (FOR 2X660 MW UDANGUDI)

SAMPLE IDENTIFIED AS : SEA WATER

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

S.NO	Parameter	Protocol	Result
1	pH	ASTM D1292-99	7.98
2	Conductivity	ASTM D1125-99	53700µS/cm
3	Temperature	ASTM method	34°C
4	Turbidity	ASTM D1889-00	12.5 NTU
5	Salinity	ASTM method	35.5
6	Total Suspended Solids	ASTM D1888	6 mg/l
7	Total Organic Carbon	ASTM D4129-98	Less than 5 mg/l
8	Calcium as Ca	ASTM D511-98	400 mg/l
9	Magnesium as Mg	ASTM D511-98	1274 mg/l
10	Sodium as Na	ASTM D1428	12600 mg/l
11	Potassium as K	ASTM D1428	380 mg/l
12	Ammonia as NH3	ASTM D1426-98	BDL (DL : 0.01 mg/l)
13	Strontium as Sr	ASTM D5673-02	1.57 mg/l
14	Barium as Ba	ASTM D5673-02	BDL (DL : 0.41 mg/l)
15	Total Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
16	Dissolved Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
17	Total Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
18	Dissolved Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
19	Total iron as Fe	ASTM D1068-03	0.30 mg/l
20	Dissolved iron as Fe	ASTM D1068-03	0.16 mg/l
21	Chloride as Cl	ASTM D512-99	21088 mg/l
22	Sulfate as SO4	ASTM D516-02	3189 mg/l
23	Nitrate as NO3	ASTM 3867-99	0.87 mg/l
24	Nitrite as NO2	ASTM D3867-99	0.008 mg/l
25	Bicarbonate as HCO3	ASTM D1067-02	140 mg/l
26	Carbonates as CO3	ASTM D1067-02	NIL

27	Fluoride as F	ASTM D1179-99	1.4 mg/l
28	Boron as B	ASTM D3082-03	1.29 mg/l
29	Phosphate as PO4	ASTM D515-97	0.08 mg/l
30	Sulfide as H2S	ASTM D4658-03	BDL (DL : 0.01 mg/l)
31	Total Silica as SiO2	ASTM D859-00	0.31 mg/l
32	Dissolved Silica as SiO2	ASTM D859-00	0.18 mg/l
33	Dissolved Oxygen	ASTM D888-96	5.5 mg/l
34	BOD @ 27°C for 3 days.	ASTM method	10 mg/l
35	Phenols	ASTM D1783-01	BDL (DL : 0.001 mg/l)
36	COD	ASTM D1252-00	62 mg/l
37	Oil & Grease	ASTM D4281-01	Less than 1 mg/l
38	Zinc as Zn	ASTM D5673-02	BDL (DL : 0.003 mg/l)
39	Copper as Cu	ASTM D5673-02	BDL (DL : 0.006 mg/l)
40	Nickel as Ni	ASTM D5673-02	BDL (DL : 0.008 mg/l)
41	Cadmium as Cd	ASTM D5673-02	BDL (DL : 0.003 mg/l)
42	Lead as Pb	ASTM D5673-02	BDL (DL : 0.01 mg/l)
43	Mercury as Hg	ASTM D5673-02	BDL (DL : 0.001 mg/l)

NOTE: BDL: Below Detection Limit.
DL : Detection Limit

COC of 1.5 to be considered for MOC selection

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

S.NO	Parameter	Protocol	Result
1	pH	ASTM D1292-99	7.98
2	Conductivity	ASTM D1125-99	53700µmhos/cm
3	Temperature	ASTM method	34°C
4	Turbidity	ASTM D1889-00	14.8 NTU
5	Salinity	ASTM method	35.4
6	Total Suspended Solids	ASTM D1888	8 mg/l
7	Total Organic Carbon	ASTM D4129-98	Less than 5 mg/l
8	Calcium as Ca	ASTM D511-98	400 mg/l
9	Magnesium as Mg	ASTM D511-98	1270 mg/l
10	Sodium as Na	ASTM D1428	12500 mg/l
11	Potassium as K	ASTM D1428	376 mg/l
12	Ammonia as NH3	ASTM D1426-98	BDL (DL : 0.01 mg/l)
13	Strontium as Sr	ASTM D5673-02	1.76 mg/l
14	Barium as Ba	ASTM D5673-02	BDL (DL : 0.41 mg/l)
15	Total Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
16	Dissolved Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
17	Total Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
18	Dissolved Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
19	Total iron as Fe	ASTM D1068-03	0.33 mg/l
20	Dissolved iron as Fe	ASTM D1068-03	0.17 mg/l
21	Chloride as Cl	ASTM D512-99	20987 mg/l
22	Sulfate as SO4	ASTM D516-02	3000 mg/l
23	Nitrate as NO3	ASTM 3867-99	1.21 mg/l
24	Nitrite as NO2	ASTM D3867-99	0.008 mg/l

25	Bicarbonate as HCO3	ASTM D1067-02	137 mg/l
26	Carbonates as CO3	ASTM D1067-02	NIL
27	Fluoride as F	ASTM D1179-99	1.2 mg/l
28	Boron as B	ASTM D3082-03	1.36 mg/l
29	Phosphate as PO4	ASTM D515-97	0.08 mg/l
30	Sulfide as H2S	ASTM D4658-03	BDL (DL : 0.01 mg/l)
31	Total Silica as SiO2	ASTM D859-00	0.40 mg/l
32	Dissolved Silica as SiO2	ASTM D859-00	0.20 mg/l
33	Dissolved Oxygen	ASTM D888-96	5.4 mg/l
34	BOD @ 27°C for 3 days.	ASTM method	9 mg/l
35	Phenols	ASTM D1783-01	BDL (DL : 0.001 mg/l)
36	COD	ASTM D1252-00	53 mg/l
37	Oil & Grease	ASTM D4281-01	Less than 1 mg/l
38	Zinc as Zn	ASTM D5673-02	0.10 mg/l
39	Copper as Cu	ASTM D5673-02	BDL (DL : 0.006 mg/l)
40	Nickel as Ni	ASTM D5673-02	BDL (DL : 0.008 mg/l)
41	Cadmium as Cd	ASTM D5673-02	BDL (DL : 0.003 mg/l)
42	Lead as Pb	ASTM D5673-02	BDL (DL : 0.01 mg/l)
43	Mercury as Hg	ASTM D5673-02	BDL (DL : 0.001 mg/l)

NOTE: BDL: Below Detection Limit
DL : Detection Limit.

COC of 1.5 to be considered for MOC selection

SAMPLING METHOD	N.A.
SAMPLE DESCRIPTION	SEA WATER
SAMPLE QTY.	20L
SAMPLE CODE	N.08+23.641,E-78+03,898/10.09.06
MARK	TOP LAYER
COLLECTED ON	10/09/2006
TEST START DATE	13/09/2006
TEST END DATE	27/09/2006

S.NO	Parameter	Protocol	Result
1	pH	ASTM D1292-99	8.1
2	Conductivity	ASTM D1125-99	53700µmhos/cm
3	Temperature	ASTM method	32°C
4	Turbidity	ASTM D1889-00	13.9 NTU
5	Salinity	ASTM method	35.5
6	Total Suspended Solids	ASTM D1888	11 mg/l
7	Total Organic Carbon	ASTM D4129-98	Less than 5 mg/l
8	Calcium as Ca	ASTM D511-98	400 mg/l
9	Magnesium as Mg	ASTM D511-98	1270 mg/l
10	Sodium as Na	ASTM D1428	12500 mg/l
11	Potassium as K	ASTM D1428	375 mg/l
12	Ammonia as NH3	ASTM D1426-98	BDL (DL : 0.01 mg/l)
13	Strontium as Sr	ASTM D5673-02	1.87 mg/l
14	Barium as Ba	ASTM D5673-02	BDL (DL : 0.41 mg/l)
15	Total Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
16	Dissolved Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
17	Total Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
18	Dissolved Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
19	Total iron as Fe	ASTM D1068-03	0.35 mg/l
20	Dissolved iron as Fe	ASTM D1068-03	0.21 mg/l
21	Chloride as Cl	ASTM D512-99	20886 mg/l
22	Sulfate as SO4	ASTM D516-02	3113 mg/l
23	Nitrate as NO3	ASTM 3867-99	0.83 mg/l
24	Nitrite as NO2	ASTM D3867-99	0.01 mg/l

25	Bicarbonate as HCO3	ASTM D1067-02	137 mg/l
26	Carbonates as CO3	ASTM D1067-02	NIL
27	Fluoride as F	ASTM D1179-99	1.4 mg/l
28	Boron as B	ASTM D3082-03	1.29 mg/l
29	Phosphate as PO4	ASTM D515-97	0.15 mg/l
20	Sulfide as H2S	ASTM D4658-03	BDL (DL : 0.01 mg/l)
31	Total Silica as SiO2	ASTM D859-00	0.36 mg/l
32	Dissolved Silica as SiO2	ASTM D859-00	0.23 mg/l
33	Dissolved Oxygen	ASTM D888-96	5.5 mg/l
34	BOD @ 27°C for 3 days.	ASTM method	11 mg/l
35	Phenols	ASTM D1783-01	BDL (DL : 0.001 mg/l)
36	COD	ASTM D1252-00	57 mg/l
37	Oil & Grease	ASTM D4281-01	Less than 1 mg/l
38	Zinc as Zn	ASTM D5673-02	0.10 mg/l
39	Copper as Cu	ASTM D5673-02	BDL (DL : 0.006 mg/l)
40	Nickel as Ni	ASTM D5673-02	BDL (DL : 0.008 mg/l)
41	Cadmium as Cd	ASTM D5673-02	BDL (DL : 0.003 mg/l)
42	Lead as Pb	ASTM D5673-02	BDL (DL : 0.01 mg/l)
43	Mercury as Hg	ASTM D5673-02	BDL (DL : 0.001 mg/l)

NOTE: BDL: Below Detection Limit
DL : Detection Limit.

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COC of 1.5 to be considered for MOC selection

SAMPLING METHOD	N.A.
SAMPLE DESCRIPTION	SEA WATER
SAMPLE QTY.	20L
SAMPLE CODE	N.08+23.641,E-78+03,898/10.09.06
MARK	BOTTOM LAYER
COLLECTED ON	10/09/2006
TEST START DATE	13/09/2006
TEST END DATE	27/09/2006

S.NO	Parameter	Protocol	Result
1	pH	ASTM D1292-99	8.1
2	Conductivity	ASTM D1125-99	53700µmhos/cm
3	Temperature	ASTM method	34°C
4	Turbidity	ASTM D1889-00	12.8 NTU
5	Salinity	ASTM method	35.5
6	Total Suspended Solids	ASTM D1888	11 mg/l
7	Total Organic Carbon	ASTM D4129-98	Less than 5 mg/l
8	Calcium as Ca	ASTM D511-98	393 mg/l
9	Magnesium as Mg	ASTM D511-98	1260 mg/l
10	Sodium as Na	ASTM D1428	12500 mg/l
11	Potassium as K	ASTM D1428	378 mg/l
12	Ammonia as NH3	ASTM D1426-98	BDL (DL : 0.01 mg/l)
13	Strontium as Sr	ASTM D5673-02	1.90 mg/l
14	Barium as Ba	ASTM D5673-02	BDL (DL : 0.41 mg/l)
15	Total Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
16	Dissolved Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
17	Total Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
18	Dissolved Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
19	Total iron as Fe	ASTM D1068-03	0.49 mg/l
20	Dissolved iron as Fe	ASTM D1068-03	0.25 mg/l
21	Chloride as Cl	ASTM D512-99	20987mg/l
22	Sulfate as SO4	ASTM D516-02	3019 mg/l
23	Nitrate as NO3	ASTM 3867-99	1.35 mg/l
24	Nitrite as NO2	ASTM D3867-99	0.01 mg/l
25	Bicarbonate as HCO3	ASTM D1067-02	135 mg/l
26	Carbonates as CO3	ASTM D1067-02	NIL

27	Fluoride as F	ASTM D1179-99	1.0 mg/l
28	Boron as B	ASTM D3082-03	1.19 mg/l
29	Phosphate as PO4	ASTM D515-97	0.15 mg/l
30	Sulfide as H2S	ASTM D4658-03	BDL (DL : 0.01 mg/l)
31	Total Silica as SiO2	ASTM D859-00	0.37 mg/l
32	Dissolved Silica as SiO2	ASTM D859-00	0.21 mg/l
33	Dissolved Oxygen	ASTM D888-96	5.6 mg/l
34	BOD @ 27°C for 3 days.	ASTM method	7 mg/l
35	Phenols	ASTM D1783-01	BDL (DL : 0.001 mg/l)
36	COD	ASTM D1252-00	45 mg/l
37	Oil & Grease	ASTM D4281-01	Less than 1 mg/l
38	Zinc as Zn	ASTM D5673-02	0.10 mg/l
39	Copper as Cu	ASTM D5673-02	BDL (DL : 0.006 mg/l)
40	Nickel as Ni	ASTM D5673-02	BDL (DL : 0.008 mg/l)
41	Cadmium as Cd	ASTM D5673-02	BDL (DL : 0.003 mg/l)
42	Lead as Pb	ASTM D5673-02	BDL (DL : 0.01 mg/l)
43	Mercury as Hg	ASTM D5673-02	BDL (DL : 0.001 mg/l)

NOTE: BDL: Below Detection Limit.
DL : Detection Limit

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COC of 1.5 to be considered for MOC selection

SAMPLING METHOD	N.A.
SAMPLE DESCRIPTION	SEA WATER
SAMPLE QTY.	20L
SAMPLE CODE	N.08+24,396,E-78+04,025/11.09.06
MARK	TOP LAYER
COLLECTED ON	11/09/2006
TEST START DATE	13/09/2006
TEST END DATE	27/09/2006

S.NO	Parameter	Protocol	Result
1	pH	ASTM D1292-99	8.05
2	Conductivity	ASTM D1125-99	53700µmhos/cm
3	Temperature	ASTM method	32°C
4	Turbidity	ASTM D1889-00	13.4 NTU
5	Salinity	ASTM method	35.4
6	Total Suspended Solids	ASTM D1888	11 mg/l
7	Total Organic Carbon	ASTM D4129-98	Less than 5 mg/l
8	Calcium as Ca	ASTM D511-98	393 mg/l
9	Magnesium as Mg	ASTM D511-98	1260 mg/l
10	Sodium as Na	ASTM D1428	12500 mg/l
11	Potassium as K	ASTM D1428	378 mg/l
12	Ammonia as NH3	ASTM D1426-98	BDL (DL : 0.01 mg/l)
13	Strontium as Sr	ASTM D5673-02	2.11 mg/l
14	Barium as Ba	ASTM D5673-02	BDL (DL : 0.41 mg/l)
15	Total Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
16	Dissolved Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
17	Total Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
18	Dissolved Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
19	Total iron as Fe	ASTM D1068-03	0.38 mg/l
20	Dissolved iron as Fe	ASTM D1068-03	0.17 mg/l
21	Chloride as Cl	ASTM D512-99	20886 mg/l
22	Sulfate as SO4	ASTM D516-02	3396 mg/l
23	Nitrate as NO3	ASTM 3867-99	1.33 mg/l
24	Nitrite as NO2	ASTM D3867-99	0.01 mg/l
25	Bicarbonate as HCO3	ASTM D1067-02	135 mg/l

26	Carbonates as CO3	ASTM D1067-02	NIL
27	Fluoride as F	ASTM D1179-99	0.8 mg/l
28	Boron as B	ASTM D3082-03	1.38 mg/l
29	Phosphate as PO4	ASTM D515-97	0.10 mg/l
30	Sulfide as H2S	ASTM D4658-03	BDL (DL : 0.01 mg/l)
31	Total Silica as SiO2	ASTM D859-00	0.39 mg/l
32	Dissolved Silica as SiO2	ASTM D859-00	0.25 mg/l
33	Dissolved Oxygen	ASTM D888-96	5.2 mg/l
34	BOD @ 27°C for 3 days.	ASTM method	8 mg/l
35	Phenols	ASTM D1783-01	BDL (DL : 0.001 mg/l)
36	COD	ASTM D1252-00	41 mg/l
37	Oil & Grease	ASTM D4281-01	Less than 1 mg/l
38	Zinc as Zn	ASTM D5673-02	0.10 mg/l
39	Copper as Cu	ASTM D5673-02	BDL (DL : 0.006 mg/l)
40	Nickel as Ni	ASTM D5673-02	BDL (DL : 0.008 mg/l)
41	Cadmium as Cd	ASTM D5673-02	BDL (DL : 0.003 mg/l)
42	Lead as Pb	ASTM D5673-02	BDL (DL : 0.01 mg/l)
43	Mercury as Hg	ASTM D5673-02	BDL (DL : 0.001 mg/l)

NOTE: BDL: Below Detection Limit.
DL : Detection Limit

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COC of 1.5 to be considered for MOC selection

SAMPLING METHOD	N.A.
SAMPLE DESCRIPTION	SEA WATER
SAMPLE QTY.	20L
SAMPLE CODE	N.08+24,396,E-78+04,025/11.09.06
MARK	BOTTOM LAYER
COLLECTED ON	11/09/2006
TEST START DATE	13/09/2006
TEST END DATE	27/09/2006

S.NO	Parameter	Protocol	Result
1	pH	ASTM D1292-99	8.05
2	Conductivity	ASTM D1125-99	53300 µmhos/cm
3	Temperature	ASTM method	34°C
4	Turbidity	ASTM D1889-00	13.6 NTU
5	Salinity	ASTM method	35.2
6	Total Suspended Solids	ASTM D1888	4 mg/l
7	Total Organic Carbon	ASTM D4129-98	Less than 5 mg/l
8	Calcium as Ca	ASTM D511-98	385 mg/l
9	Magnesium as Mg	ASTM D511-98	1265 mg/l
10	Sodium as Na	ASTM D1428	12000 mg/l
11	Potassium as K	ASTM D1428	376 mg/l
12	Ammonia as NH3	ASTM D1426-98	BDL (DL : 0.01 mg/l)
13	Strontium as Sr	ASTM D5673-02	2.25 mg/l
14	Barium as Ba	ASTM D5673-02	BDL (DL : 0.41 mg/l)
15	Total Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
16	Dissolved Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
17	Total Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
18	Dissolved Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
19	Total iron as Fe	ASTM D1068-03	0.29 mg/l
20	Dissolved iron as Fe	ASTM D1068-03	0.14 mg/l
21	Chloride as Cl	ASTM D512-99	20683 mg/l
22	Sulfate as SO4	ASTM D516-02	2747 mg/l
23	Nitrate as NO3	ASTM 3867-99	1.43 mg/l
24	Nitrite as NO2	ASTM D3867-99	0.04 mg/l
25	Bicarbonate as HCO3	ASTM D1067-02	128 mg/l
26	Carbonates as CO3	ASTM D1067-02	NIL
27	Fluoride as F	ASTM D1179-99	1.4 mg/l

28	Boron as B	ASTM D3082-03	1.22 mg/l
29	Phosphate as PO4	ASTM D515-97	0.12 mg/l
30	Sulfide as H2S	ASTM D4658-03	BDL (DL : 0.01 mg/l)
31	Total Silica as SiO2	ASTM D859-00	0.34 mg/l
32	Dissolved Silica as SiO2	ASTM D859-00	0.20 mg/l
33	Dissolved Oxygen	ASTM D888-96	5.5 mg/l
34	BOD @ 27°C for 3 days.	ASTM method	11 mg/l
35	Phenols	ASTM D1783-01	BDL (DL : 0.001 mg/l)
36	COD	ASTM D1252-00	57 mg/l
37	Oil & Grease	ASTM D4281-01	Less than 1 mg/l
38	Zinc as Zn	ASTM D5673-02	0.10 mg/l
39	Copper as Cu	ASTM D5673-02	BDL (DL : 0.006 mg/l)
40	Nickel as Ni	ASTM D5673-02	BDL (DL : 0.008 mg/l)
41	Cadmium as Cd	ASTM D5673-02	BDL (DL : 0.003 mg/l)
42	Lead as Pb	ASTM D5673-02	BDL (DL : 0.01 mg/l)
43	Mercury as Hg	ASTM D5673-02	BDL (DL : 0.001 mg/l)

NOTE: BDL: Below Detection Limit.
DL : Detection Limit

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COC of 1.5 to be considered for MOC selection

SAMPLING METHOD	N.A.
SAMPLE DESCRIPTION	SEA WATER
SAMPLE QTY.	20L
SAMPLE CODE	N.08+24,503,E-78+04,543/12.09.06
MARK	TOP LAYER
COLLECTED ON	12/09/2006
TEST START DATE	13/09/2006
TEST END DATE	27/09/2006

S.NO	Parameter	Protocol	Result
1	pH	ASTM D1292-99	8.05
2	Conductivity	ASTM D1125-99	53600 µmhos/cm
3	Temperature	ASTM method	32°C
4	Turbidity	ASTM D1889-00	13.6 NTU
5	Salinity	ASTM method	35.4
6	Total Suspended Solids	ASTM D1888	6 mg/l
7	Total Organic Carbon	ASTM D4129-98	Less than 5 mg/l
8	Calcium as Ca	ASTM D511-98	401 mg/l
9	Magnesium as Mg	ASTM D511-98	1265 mg/l
10	Sodium as Na	ASTM D1428	12400 mg/l
11	Potassium as K	ASTM D1428	378 mg/l
12	Ammonia as NH3	ASTM D1426-98	BDL (DL : 0.01 mg/l)
13	Strontium as Sr	ASTM D5673-02	2.13 mg/l
14	Barium as Ba	ASTM D5673-02	BDL (DL : 0.41 mg/l)
15	Total Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
16	Dissolved Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
17	Total Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
18	Dissolved Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
19	Total iron as Fe	ASTM D1068-03	0.28 mg/l
20	Dissolved iron as Fe	ASTM D1068-03	0.15 mg/l
21	Chloride as Cl	ASTM D512-99	20784 mg/l
22	Sulfate as SO4	ASTM D516-02	2855 mg/l
23	Nitrate as NO3	ASTM 3867-99	1.62 mg/l
24	Nitrite as NO2	ASTM D3867-99	0.03 mg/l
25	Bicarbonate as HCO3	ASTM D1067-02	130 mg/l

26	Carbonates as CO3	ASTM D1067-02	NIL
27	Fluoride as F	ASTM D1179-99	1.2 mg/l
28	Boron as B	ASTM D3082-03	1.24 mg/l
29	Phosphate as PO4	ASTM D515-97	0.11 mg/l
30	Sulfide as H2S	ASTM D4658-03	BDL (DL : 0.01 mg/l)
31	Total Silica as SiO2	ASTM D859-00	0.33 mg/l
32	Dissolved Silica as SiO2	ASTM D859-00	0.20 mg/l
33	Dissolved Oxygen	ASTM D888-96	5.6 mg/l
34	BOD @ 27°C for 3 days.	ASTM method	8 mg/l
35	Phenols	ASTM D1783-01	BDL (DL : 0.001 mg/l)
36	COD	ASTM D1252-00	41 mg/l
37	Oil & Grease	ASTM D4281-01	Less than 1 mg/l
38	Zinc as Zn	ASTM D5673-02	0.10 mg/l
39	Copper as Cu	ASTM D5673-02	BDL (DL : 0.006 mg/l)
40	Nickel as Ni	ASTM D5673-02	BDL (DL : 0.008 mg/l)
41	Cadmium as Cd	ASTM D5673-02	BDL (DL : 0.003 mg/l)
42	Lead as Pb	ASTM D5673-02	BDL (DL : 0.01 mg/l)
43	Mercury as Hg	ASTM D5673-02	BDL (DL : 0.001 mg/l)

NOTE: BDL: Below Detection Limit.
DL : Detection Limit

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COC of 1.5 to be considered for MOC selection

SAMPLING METHOD	N.A.
SAMPLE DESCRIPTION	SEA WATER
SAMPLE QTY.	20L
SAMPLE CODE	N.08+24,503,E-78+04,543/12.09.06
MARK	BOTTOM LAYER
COLLECTED ON	12/09/2006
TEST START DATE	13/09/2006
TEST END DATE	27/09/2006

S.NO	Parameter	Protocol	Result
1	pH	ASTM D1292-99	7.98
2	Conductivity	ASTM D1125-99	53200 µmhos/cm
3	Temperature	ASTM method	32°C
4	Turbidity	ASTM D1889-00	13.4 NTU
5	Salinity	ASTM method	35.1
6	Total Suspended Solids	ASTM D1888	5 mg/l
7	Total Organic Carbon	ASTM D4129-98	Less than 5 mg/l
8	Calcium as Ca	ASTM D511-98	377 mg/l
9	Magnesium as Mg	ASTM D511-98	1274 mg/l
10	Sodium as Na	ASTM D1428	12000 mg/l
11	Potassium as K	ASTM D1428	375 mg/l
12	Ammonia as NH3	ASTM D1426-98	BDL (DL : 0.01 mg/l)
13	Strontium as Sr	ASTM D5673-02	2.37 mg/l
14	Barium as Ba	ASTM D5673-02	BDL (DL : 0.41 mg/l)
15	Total Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
16	Dissolved Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
17	Total Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
18	Dissolved Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
19	Total iron as Fe	ASTM D1068-03	0.27 mg/l
20	Dissolved iron as Fe	ASTM D1068-03	0.14 mg/l
21	Chloride as Cl	ASTM D512-99	20480 mg/l
22	Sulfate as SO4	ASTM D516-02	2729 mg/l
23	Nitrate as NO3	ASTM 3867-99	1.49 mg/l
24	Nitrite as NO2	ASTM D3867-99	0.03 mg/l
25	Bicarbonate as HCO3	ASTM D1067-02	128 mg/l
26	Carbonates as CO3	ASTM D1067-02	NIL

27	Fluoride as F	ASTM D1179-99	1.0 mg/l
28	Boron as B	ASTM D3082-03	1.24 mg/l
29	Phosphate as PO4	ASTM D515-97	0.16 mg/l
30	Sulfide as H2S	ASTM D4658-03	BDL (DL : 0.01 mg/l)
31	Total Silica as SiO2	ASTM D859-00	0.34 mg/l
32	Dissolved Silica as SiO2	ASTM D859-00	0.19 mg/l
33	Dissolved Oxygen	ASTM D888-96	5.2 mg/l
34	BOD @ 27°C for 3 days.	ASTM method	8 mg/l
35	Phenols	ASTM D1783-01	BDL (DL : 0.001 mg/l)
36	COD	ASTM D1252-00	41 mg/l
37	Oil & Grease	ASTM D4281-01	Less than 1 mg/l
38	Zinc as Zn	ASTM D5673-02	0.10 mg/l
39	Copper as Cu	ASTM D5673-02	BDL (DL : 0.006 mg/l)
40	Nickel as Ni	ASTM D5673-02	BDL (DL : 0.008 mg/l)
41	Cadmium as Cd	ASTM D5673-02	BDL (DL : 0.003 mg/l)
42	Lead as Pb	ASTM D5673-02	BDL (DL : 0.01 mg/l)
43	Mercury as Hg	ASTM D5673-02	BDL (DL : 0.001 mg/l)

NOTE: BDL: Below Detection Limit.
DL : Detection Limit

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COC of 1.5 to be considered for MOC selection

SAMPLING METHOD	N.A.
SAMPLE DESCRIPTION	SEA WATER
SAMPLE QTY.	20L
SAMPLE CODE	N.08+23,977,E-78+04,380/12.09.06
MARK	TOP LAYER
COLLECTED ON	12/09/2006
TEST START DATE	13/09/2006
TEST END DATE	27/09/2006

S.NO	Parameter	Protocol	Result
1	pH	ASTM D1292-99	8.08
2	Conductivity	ASTM D1125-99	53300 µmhos/cm
3	Temperature	ASTM method	32°C
4	Turbidity	ASTM D1889-00	12.5 NTU
5	Salinity	ASTM method	35.2
6	Total Suspended Solids	ASTM D1888	6 mg/l
7	Total Organic Carbon	ASTM D4129-98	Less than 5 mg/l
8	Calcium as Ca	ASTM D511-98	385 mg/l
9	Magnesium as Mg	ASTM D511-98	1265 mg/l
10	Sodium as Na	ASTM D1428	12000 mg/l
11	Potassium as K	ASTM D1428	376 mg/l
12	Ammonia as NH3	ASTM D1426-98	BDL (DL : 0.01 mg/l)
13	Strontium as Sr	ASTM D5673-02	2.17 mg/l
14	Barium as Ba	ASTM D5673-02	BDL (DL : 0.41 mg/l)
15	Total Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
16	Dissolved Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
17	Total Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
18	Dissolved Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
19	Total iron as Fe	ASTM D1068-03	0.26 mg/l
20	Dissolved iron as Fe	ASTM D1068-03	0.13 mg/l
21	Chloride as Cl	ASTM D512-99	20582 mg/l
22	Sulfate as SO4	ASTM D516-02	2747 mg/l
23	Nitrate as NO3	ASTM 3867-99	1.39 mg/l
24	Nitrite as NO2	ASTM D3867-99	0.04 mg/l
25	Bicarbonate as HCO3	ASTM D1067-02	128 mg/l

26	Carbonates as CO3	ASTM D1067-02	NIL
27	Fluoride as F	ASTM D1179-99	1.4 mg/l
28	Boron as B	ASTM D3082-03	1.36 mg/l
29	Phosphate as PO4	ASTM D515-97	0.16 mg/l
30	Sulfide as H2S	ASTM D4658-03	BDL (DL : 0.01 mg/l)
31	Total Silica as SiO2	ASTM D859-00	0.32 mg/l
32	Dissolved Silica as SiO2	ASTM D859-00	0.19 mg/l
33	Dissolved Oxygen	ASTM D888-96	5.5 mg/l
34	BOD @ 27°C for 3 days.	ASTM method	10 mg/l
35	Phenols	ASTM D1783-01	BDL (DL : 0.001 mg/l)
36	COD	ASTM D1252-00	62 mg/l
37	Oil & Grease	ASTM D4281-01	Less than 1 mg/l
38	Zinc as Zn	ASTM D5673-02	0.10 mg/l
39	Copper as Cu	ASTM D5673-02	BDL (DL : 0.006 mg/l)
40	Nickel as Ni	ASTM D5673-02	BDL (DL : 0.008 mg/l)
41	Cadmium as Cd	ASTM D5673-02	BDL (DL : 0.003 mg/l)
42	Lead as Pb	ASTM D5673-02	BDL (DL : 0.01 mg/l)
43	Mercury as Hg	ASTM D5673-02	BDL (DL : 0.001 mg/l)

NOTE: BDL: Below Detection Limit.
DL : Detection Limit

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COC of 1.5 to be considered for MOC selection

SAMPLING METHOD	N.A.
SAMPLE DESCRIPTION	SEA WATER
SAMPLE QTY.	20L
SAMPLE CODE	N.08+23,977,E-78+04,380/12.09.06
MARK	BOTTOM LAYER
COLLECTED ON	12/09/2006
TEST START DATE	13/09/2006
TEST END DATE	27/09/2006

S.NO	Parameter	Protocol	Result
1	pH	ASTM D1292-99	8.05
2	Conductivity	ASTM D1125-99	53100 µmhos/cm
3	Temperature	ASTM method	34°C
4	Turbidity	ASTM D1889-00	13.2 NTU
5	Salinity	ASTM method	35
6	Total Suspended Solids	ASTM D1888	5 mg/l
7	Total Organic Carbon	ASTM D4129-98	Less than 5 mg/l
8	Calcium as Ca	ASTM D511-98	409 mg/l
9	Magnesium as Mg	ASTM D511-98	1265 mg/l
10	Sodium as Na	ASTM D1428	12000 mg/l
11	Potassium as K	ASTM D1428	375 mg/l
12	Ammonia as NH3	ASTM D1426-98	BDL (DL : 0.01 mg/l)
13	Strontium as Sr	ASTM D5673-02	2.11 mg/l
14	Barium as Ba	ASTM D5673-02	BDL (DL : 0.41 mg/l)
15	Total Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
16	Dissolved Aluminium as Al	ASTM D5673-02	BDL (DL : 0.03 mg/l)
17	Total Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
18	Dissolved Manganese as Mn	ASTM D5673-02	BDL (DL : 0.02 mg/l)
19	Total iron as Fe	ASTM D1068-03	0.27 mg/l
20	Dissolved iron as Fe	ASTM D1068-03	0.15 mg/l
21	Chloride as Cl	ASTM D512-99	20480 mg/l
22	Sulfate as SO4	ASTM D516-02	2729 mg/l
23	Nitrate as NO3	ASTM 3867-99	1.56 mg/l
24	Nitrite as NO2	ASTM D3867-99	0.03 mg/l
25	Bicarbonate as HCO3	ASTM D1067-02	140 mg/l

26	Carbonates as CO3	ASTM D1067-02	NIL
27	Fluoride as F	ASTM D1179-99	1.2 mg/l
28	Boron as B	ASTM D3082-03	1.21 mg/l
29	Phosphate as PO4	ASTM D515-97	0.12 mg/l
30	Sulfide as H2S	ASTM D4658-03	BDL (DL : 0.01 mg/l)
31	Total Silica as SiO2	ASTM D859-00	0.32 mg/l
32	Dissolved Silica as SiO2	ASTM D859-00	0.20 mg/l
33	Dissolved Oxygen	ASTM D888-96	5.5 mg/l
34	BOD @ 27°C for 3 days.	ASTM method	9 mg/l
35	Phenols	ASTM D1783-01	BDL (DL : 0.001 mg/l)
36	COD	ASTM D1252-00	53 mg/l
37	Oil & Grease	ASTM D4281-01	Less than 1 mg/l
38	Zinc as Zn	ASTM D5673-02	0.10 mg/l
39	Copper as Cu	ASTM D5673-02	BDL (DL : 0.006 mg/l)
40	Nickel as Ni	ASTM D5673-02	BDL (DL : 0.008 mg/l)
41	Cadmium as Cd	ASTM D5673-02	BDL (DL : 0.003 mg/l)
42	Lead as Pb	ASTM D5673-02	BDL (DL : 0.01 mg/l)
43	Mercury as Hg	ASTM D5673-02	BDL (DL : 0.001 mg/l)

NOTE: BDL: Below Detection Limit.
DL : Detection Limit

*****

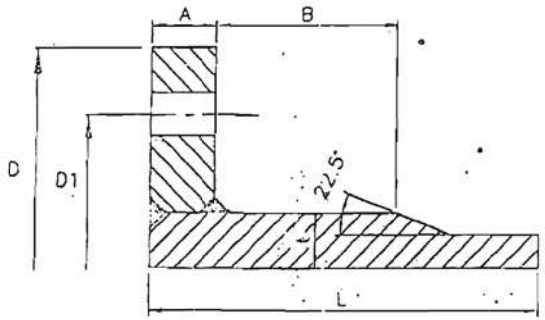
COC of 1.5 to be considered for MOC selection

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

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

ANNEXURE III



NOTES:-

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

PIPE SIZE	PIPE THK.	FLANGE OD 'D'	Bolt PCD 'D1'	WELD NECK FLANGE				SLIP-ON FLANGE THICKNESS
				FLANGE THK. 'A'	NECK THK. 't'	NECK Length 'B'	Appx. Total Length 'L'	
1200	10-12	1465	1380	40	24	70	200	90
1400	14	1675	1590	50	24	70	200	100
1600	14	1915	1920	60	32	80	220	110
1800	14-16	2115	2020	70	32	90	250	120
2200	18	2550	2420	80	36	100	300	140
2300	20			90	38	110	325	150
2500	20			90	38	110	325	150
2700 (CS)	20			90	38	110	325	150
2700 (Dup. SS)	20			50 (Min.)				125 (Min.)

— TENTATIVE

DRAWING FOR BAL. SEPARATOR COUNTER FLANGE

REV.	DATE	ALTD	CHD	APPD

JOB NO. 999

STATUS -

DISTRIBUTION

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

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

TITLE
COUNTER FLANGE/ BODY FLANGE DETAILS

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

SHEET 01 OF 01 REV 00

SUB-SECTION - IIA

STANDARD TECHNICAL SPECIFICATION (MECHANICAL)

STANDARD TECHNICAL SPECIFICATION FOR DEBRIS FILTER

STANDARD QUALITY PLANS

1.00.00 **GENERAL**

This specification covers the Design, Performance and Operational Requirements, Constructional Features, Manufacture, Assembly. Inspection and Testing at the Manufacturer's and/or his Sub-contractor's works and Painting for delivery of Debris Filter (Backwash Type) complete with all accessories as specified hereinafter.

2.00.00 **CODES AND STANDARDS**

2.01.00 The design, materials manufacture, inspection and testing of the Debris Filter complete with all accessories, shall comply with the requirements of the latest revisions of the following appropriate codes and standards :

2.01.01 IS/ BS/ DIN/ US Standards regarding pressure vessels, pipes, 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 their 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 Debris Filter shall be supplied.

3.01.02 The Debris Filter shall be capable of safe, proper and continuous operation. 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 wherever necessary. Adequate provision for future installation of cathodic protection shall be provided.

3.01.04 The Debris Filter shall be designed to suit installation in on-line or off-line arrangement as specified in Data Sheet-A.

In the on-line arrangement, the inlet and outlet pipes of the debris filter shall be in line with each other on the same axis without any off-set between the centre lines of inlet and outlet pipes.
In the off-line arrangement, the debris filter inlet and outlet pipes shall be at right angle (90^{o}) to each other.

3.02.00 **Performance Requirements**

The Debris Filter with all accessories shall be designed and guaranteed to meet the following requirements:-

3.02.01 The Debris Filter shall perform satisfactorily under the flow and pressure conditions specified in Data Sheet -A and shall be capable of housing the various forms of debris / sludge i.e., suspended particles / matter, mussels, grass, leaves, wood pieces etc. The performance of the Debris Filter shall be continuous with minimum number of flushing/ backwashing operations.

3.02.02 The Debris Filter shall be designed such that the pressure drop across the Debris Filter (i.e., between inlet and outlet connections) under clean conditions and partially (50%) chocked conditions shall not be more than those specified in Data Sheet -A.

3.02.03 Unless otherwise specified in Data Sheet -A, debris discharge / wash water flow rate during flushing/back washing operation shall be limited to 10% of the total flow rate and flushing / backwashing operation shall be completed within a period of maximum three (3) minutes. The pressure drop across the debris filter during flushing/ backwashing operation shall not be more than the pressure drop under partially (50%) chocked condition.

3.02.04 The coarse particles and floating matter accumulating at the filter section/screen are flushed out of the system by the system by the debris flushing / backwash unit such that the pressure drop across the filter after flushing / backwashing, shall not be more than 1.1 times the pressure drop under clean conditions.

3.03.00 **Operational Requirement**

The Debris Filter and other accessories shall be designed for the following flushing/backwashing operation modes:

3.03.01 Complete automatic flushing/backwashing operation effected by the following:-

- differential pressure measuring system at a pre-determined differential pressure across the filter screen.
- adjustable timer (0-24 hours)
- push button (for manual initiation of sequential flushing / backwashing)

3.03.02 Manual operation in the event of failure of control system.

3.04.00 **Filter Housing/ Body**

3.04.01 The Debris Filter housing/body shall be designed and manufactured as per the applicable codes for pressure vessels. It shall house the filter section / screen assembly and shall have flanged inlet, outlet, flushing/ debris discharge openings and pressure measuring tappings etc.

3.04.02 In design of Debris Filter housing/ body due attention shall be given for easy removal and replacement of filter section / screen assembly.

3.04.03 The Debris Filter shall be provided with inspection hole with bolted cover.

3.04.04 The Debris Filter body / housing shall be provided with vent and drain connections with isolating valves. It shall be possible to drain unfiltered and filtered water.

3.04.05 If specified in Data Sheet-A, filter body/housing shall be epoxy painted.

3.05.00 **Filter Section / Screen assembly.**

3.05.01 The Debris Filter section/screen shall be designed for the maximum differential pressure across the filter and shall be securely positioned by a supporting cage and shall be securely mounted in the housing or body.

3.05.02 The perforation/mesh size of the Debris Filter section shall not be more than that specified in Data Sheet-A.

3.05.03 The arrangement of the Debris Filter section shall be such that the forced accumulation of debris on the filter screen / section shall be minimum.

3.06.00 **Differential Pressure Measuring System**

3.06.01 The Debris Filter shall be provided with a measuring system for differential pressure across the filter section/screen, to check debris accumulation and to initiate flushing/ backwashing operation. This shall consist of a differential pressure transmitter for automatic flushing operation, a differential pressure gauge for manual observation with adequate number of taping with isolating valves and equalising valves.

3.06.02 The contacts for differential pressure transmitter and for differential pressure gauge shall be independent so that in the event of failure of one, the other is available.

3.06.03 The differential pressure measuring system shall be provided with D.P. transmitter & DPG of remote seal arrangement..

3.07.00 **Flushing / Backwash Unit. :**

3.07.01 The Debris Filter shall be provided with suitable flushing/backwash unit (to be installed at ground floor) and debris discharge/ backwash outlet valve with associated actuator to flush out the accumulated debris/ sludge.

3.07.02 The flushing pump shall be provided with mechanical seals to the extent possible. If gland packing is provided it should be of good quality to prevent leakage of water bran pump glands.

3.07.03 The flushing arrangement shall be either fixed type with flushing valves or a rotating debris extractor.

3.07.04 If any water is to be injected for backwashing the filter section/screen, water shall be taken from down-stream side of the filter section/ screen. Necessary pump, valves and piping for water injection shall be supplied.

3.07.05 View glass to be provided in debris outlet pipe to monitor the flushing of debris.

3.08.00 **Valves**

The flushing valves (if any,) the debris discharge/backwash outlet valve, isolation, vent and drain valves shall conform to appropriate codes / standards.

3.09.00 **Instrumentation and Control System**

3.09.01 Complete instrumentation and control system for automatic flushing/ backwashing operation, protection, interlocking, indication/ annunciation of high differential pressure and other malfunctions etc. shall be provided. This shall consist of adequate operational hardware, local control panel and interconnecting control and power cabling between the control panel and the debris filter and its associated electrical devices.

3.09.02 The control panel shall house all necessary instruments, indicating/ annunciation lamps, alarms, differential pressure indicator, timer, function selector switches, relays, protection and interlocking systems, start/stop push buttons, counter to register number of flushing operations etc., and shall be complete with internal wiring. In addition to the above, the control panel shall meet the requirements of the enclosed specification.

3.09.03 All instrumentation shall be of reputed make and shall meet the requirement of the enclosed specification.

3.10.00 **Actuators :**

The actuators for flushing arrangement and debris discharge valve shall be electric motor operated and shall meet the requirements of the enclosed specification. The actuators shall be provided with auxiliary hand-wheel for manual operation in the event of power failure.

3.11.00 **Electric Motors :**

The drive motors for differential pressure measuring system flushing pump and water injected pump (if applicable) shall confirm to the requirements of the enclosed specification.

3..12.00 **Other Accessories.**

3.12.01 Counter flanges, complete with gaskets, bolts and nuts etc., shall be supplied for the filter 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.

3.12.02 Debris Filter shall be provided with suitable lifting arrangement for handling during erection and maintenance.

4.00.00 **SHOP INSPECTION AND TESTS**

4.01.00 **General:**

4.01.01 Manufacturer shall conduct all tests and stage inspections as per the approved quality plan to ensure that the Debris Filter and other accessories shall conform to the requirements of this specification and of the applicable codes/ standards.

4.01.02 All materials used for manufacture/fabrication of the Debris Filter 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 approved quality plan and applicable codes at his cost, for which samples shall be identified by BHEL's representative.

4.01.03 All shop tests shall be conducted in the presence of BHEL's representative and test certificates / reports for the same shall be furnished to BHEL for approval.

4.01.04 Qualification of welding procedures and welders shall be as per ASME B&PV Code, Section-IX / applicable codes.

4.02.00 **Filter Housing / Body**

4.02.01 Chemical analysis, mechanical tests shall be carried out on housing/body, strainer/ screen, strainer/ screen shaft and other appurtenances as per the applicable material specification standards.

4.02.02 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.

4.03.00 **Rubber Lining (as applicable)**

Rubber lining shall be subjected to surface crack test, 100% spark and hardness tests and shall be checked for layer thickness, defects etc.

4.04.00 **Filter Section/Screen assembly**

Supporting cage and filter section/screen materials shall be tested for chemical properties. Checks shall be carried out for perforation/mesh size, defects etc.

4.05.00 **Flushing / Backwash Unit**

4.05.01 Material of various components of the flushing/Backwash Unit shall be tested for chemical and mechanical properties.

4.05.02 Hollow shaft of backwash rotor shall be ultrasonically tested as per ASTM-A 388 for internal flaws. Penetrant test shall be carried out for surface flaws.

4.06.00 **Valves**

Inspection and testing of valves including leakage test shall be carried out as per the requirements of the applicable standards. Correlating test certificates for materials of the valve components shall be furnished.

4.07.00 **Flanges**

4.07.01 In case of fabricated flanges, all the welds shall be subjected to 100% radiography as per ASME B&PV code, section VIII, Division-1.

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

4.07.03 If the thickness of the plate used for flanged 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.

4.07.04 Chemical and mechanical test certificates shall be furnished for flange materials.

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

4.08.00 All materials for various nozzles, seals, pipes, gaskets, nuts bolts etc., shall be of tested quality and correlating test certificates for chemical and mechanical properties shall be furnished.

4.09.00 **Dimensional Checks**

Dimensional checks of various components of the Debris Filter shall be carried out as per the drawings approved by BHEL. Alignment and fit up of movable parts shall be checked.

4.10.00 **Hydrostatic Test**

Hydrostatic test shall be conducted on the Debris Filter housing/body at a pressure of 1.5 times the design pressure. The duration of the test shall be minimum 30 minutes.

4.11.00 **Leakage Test**

Leakage test shall be conducted at the design pressure to demonstrate that the filter assembly is leak tight and no water seepage shall take place at various nozzle and valve connections.

4.12.00 **Functional Tests**

The Debris Filter assembly complete with valves, actuators and other accessories shall be subjected to functional tests and the following shall be checked:-

4.12.01 Smooth and free operation of all movable parts.

4.12.02 Interlocks and sequential operation.

4.12.03 Satisfactory operation of actuator torque switches, limit switches etc.

4.13.0 Performance Test:

Performance Test shall be conducted to ensure that the Debris Filter meets the specified performance requirements.

5.00.00 **TESTING AT SITE**

After completion of installation at site, the Debris Filter with complete accessories, will be tested to check that the filter performance meets the requirements of its 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 equipment/ parts not meeting the requirement if the deficiency still persists.

6.00.00 **QUALITY ASSURANCE & QUALITY PLAN**

6.01.00 The Debris Filter and other accessories to be supplied shall have assured quality and workmanship.

6.02.00 Typical quality plans are enclosed herewith this specification for bidder's guidance. The bidder shall comply with these minimum requirements and shall furnishing own quality plan based on materials and components of the filter being offered.

7.00.00 **NAME PLATE AND TAG NUMBERS**

7.01.00 The Debris Filter 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
c) Design temperature
d) Filter section/screen mesh size
e) Empty and operating weights
f) Revolving speed of backwash rotor

7.02.00 Each valve 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 drawing submitted for approval during contract stage.

7.03.00 Each motor / actuator shall be provided with a name plate indicating the following details:

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

8.00.00 **DRAWINGS, DATA & INFORMATION TO BE SUBMITTED AFTER THE AWARD OF CONTRACT**:

The drawings, data and other documents as required in Data Sheet-C shall be furnished after the award of contract.

1.00.00 **DRAWINGS, DATA AND 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 NIT.

1.01.01 Data Sheet -B.

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

a) General arrangement / Installation drawings of the Debris Filter with all accessories, indicating the principal dimensions and weights of equipment offered, size and location of various nozzle connections, withdrawal space and scope of supply etc.

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

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 drawings of filter housing/body, filter screen/section assembly, flushing / backwash unit, differential pressure measuring system, actuators, motors, control panel etc. indicating bill of quantities and materials of construction.

10.02.02 Flow and control logic diagrams for complete filter during normal and flushing operation and system write-up covering all modes of operation.

1.02.03 Final version of performance evaluation procedures at site.

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

1.02.05 Detailed schedule of power & control cable.

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

1.02.07 Control panel layout and list of instruments provided on control panel and internal wiring diagrams.

1.02.08 List of annunciations, protections and interlocks provided.

1.02.09 Detailed drawings of flanges.

1.02.10 Quality Plan

1.02.11 Material test certificates.

1.02.12 Shop tests reports and certificates.

1.02.13 Write-up and instruction manuals for erection, operation and maintenance.

1.02.14 Storage instructions.

1.02.15 Vendor to send 3 sets of final documents (O&M Manual, GA drg, P&ID) direct to site under intimation to PEM.

	Manufacturer's Name & Address P.O. No.	**STANDARD QUALITY PLAN**		BHEL Doc No.: PE-QP-999-165-N003
		INDEX	Vendor Q.P. NO. PACKAGE : DEBRIS FILTER Date : Page 01 of 10	PROJECT: CUSTOMER: PURCHASER: CONSULTANT:

Note: Items not included in quality plan to be inspected as per Approved datasheet/drawings.

		LEGEND * Records identified with "STAR" shall be essentially included by contractor in QA Documentation. ** M : Manufacturer/ Sub-contractor C : Contractor O : Owner Indicate : "P" - Perform, "W" - Witness and "V" - Verification		
Manufacturer / Sub-Contractor	Contractor			Name & Sign. Of approving authority & Seal
Signature				

	Manufacturer's Name & Address	STANDARD QUALITY PLAN		BHEL Doc No.: PE-QP-999-165-N003
		Item :	Vendor Q.P. NO.	PROJECT:
	P.O. No.	DEBRIS FILTER	PACKAGE : DEBRIS FILTER	CUSTOMER:
			Date :	PURCHASER:
			Page 02 of 10	CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency M	Agency C	Agency O	Remarks
1	2	3	4	5	6	7	8	9		** 10			11
1.0.0	**DEBRIS FILTER**												
1.1.0	Raw Material												
[a]	Housing Shell, Nozzle flanges & Main flanges/Counter Flange	Chemical properties	Major	Chemical Analysis	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	All raw material identification as per manufacturer TC/Lab report by BHEL
		Physical properties	Major	Physical test	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Surface Defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate /Inspection Report	--	P	V	V	
		Sub Surface Defects	Major	Ultrasonic Test	100%	ASME A 435/A609	ASME A 435/A609	Inspection report	*	P	V	V	Plates > 20mm Thk only
[b]	Nozzle Pipes	Chemical properties	Major	Chemical Analysis	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Physical properties	Major	Physical test	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Surface defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate /Inspection Report	--	P	V	V	
		Leak tightness	Major	Hydrostatic test	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate /Inspection Report	--	P	V	V	
[c]	Screen basket	Chemical properties	Major	Chemical Analysis	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Physical properties	Major	Physical test	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Surface Defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate /Inspection Report	--	P	V	V	
		Sub-surface defects	Major	Ultrasonic test	100%	ASME A 745	ASME A 745	Inspection report	*	P	V	V	Plates > 20mm Thk only (UT full volume)
		Corrosion Resistance	Major	IGCI	One/Heat	ASTM A 923	ASTM A 923	Test Report	*	P	V	V	

LEGEND

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C : Contractor O : Owner

Indicate : "P" - Perform, "W" - Witness and "V" - Verification

Manufacturer / Sub-Contractor	Contractor
Signature	

Name & Sign. Of approving authority & Seal

	Manufacturer's Name & Address	STANDARD QUALITY PLAN		BHEL Doc No.: PE-QP-999-165-N003
	P.O. No.	Item : DEBRIS FILTER	Vendor Q.P. NO. PACKAGE : DEBRIS FILTER Date : Page 03 of 10	PROJECT: CUSTOMER: PURCHASER: CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency			Remarks
										M	C	O	
1	2	3	4	5	6	7	8	9		**	10		11
1.2.0	**Inprocess Quality Control**												
1.2.1	Welding procedure specification	Correctness	Critical	Scrutiny	100%	ASME Sec. IX	ASME Sec. IX	QW 482 of ASME Sec.IX	--	P	V	V	
1.2.2	Welding procedure qualification	Weld soundness	Critical	Physical test	100%	ASME Sec. IX	ASME Sec. IX	QW 483 of ASME Sec.IX	--	P	V	V	Welding procedure already approved by BHEL/ LRQA / NTPC shall be followed.
1.2.3	Welder performance qualification	Weld soundness	Critical	Physical test	100%	ASME Sec. IX	ASME Sec. IX	QW 484 of ASME Sec.IX	--	P	V	V	Welders already qualified by BHEL/ LRQA / NTPC shall be employed for this job.
1.2.4	Fit-up of butt weld	Alignment.and dimensions	Major	Template, visual	100%	Manufacturing Drawng	ASME Sec.VIII Div. I	Log book	--	P	V	–	
1.2.5	Fit-up of shell flange and nozzle assembly to shell	Orientation,alignment and dimensions	Major	Template, visual	100%	Manufacturing Drawng	ASME Sec.VIII Div. I	Log book	--	P	–	–	
1.2.6	**Weld quality for Pressure Parts**												
	[a] Root run	Surface defects	Major	Penetrant test / Visual	100%	ASME Sec.VIII Div. I / sec V	ASME Sec.VIII Div. I Appendix 8	Operation Process Sheet		P	–	–	
1.2.7	[a] Completed butt welds	1.Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div. I / sec V	ASME Sec.VIII Div. I Appendix 8	Inspection report	*	P	V	V	
		2.Sub-surface defects	Critical	Radiography test	10% of total weld length+ 100% T Joints.	ASME Sec.VIII Div. I / sec V	ASME Sec.VIII Div. I Appendix 4 / UW 52	Radiographs and inspection report	*	P	V	V	RT films will be reviewed by BHEL
	[b] Completed fillet welds	Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div. I / sec V	ASME Sec.VIII Div. I Appendix 8	Inspection report	*	P	V	V	

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Indicate : "P" - Perform, "W" - Witness and "V" - Verification

Manufacturer / Sub-Contractor	Contractor		Name & Sign. Of approving authority & Seal
Signature			

	Manufacturer's Name & Address P.O. No.			**STANDARD QUALITY PLAN** **Item :** DEBRIS FILTER		Vendor Q.P. NO. PACKAGE : DEBRIS FILTER Date : Page 04 of 10		BHEL Doc No.: PE-QP-999-165-N003 PROJECT: CUSTOMER: PURCHASER: CONSULTANT:					
Sl. No.	**Component / Operation**	**Characteristics Checked**	**Class**	**Type of Check**	**Quantum of Check**	**Reference Documents**	**Acceptance Norms**	**Format of Record**		**Agency**			**Remarks**
										M	**C**	**O**	
1	2	3	4	5	6	7	8	9		**	10		11
1.2.8	Pickling and Passivation	Protection Layer	Major	Visual	100%	IS : 10117	IS : 10117	Log Book	--	P	–	–	
1.2.9	Fabricated Shell (Prior to sand blasting)	1.Dimensions, Orientation	Major	Measurement by visual	100%	Manufacturing Drawing	Manufacturing Drawing	Inspection report	*	P	V	V	
		2. Hydro test	Critical	Hydrostatic Pr. @ 1.5 times of design pr.(positive) [Duration 30 minutes]	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1	Inspection report	*	P	V	V	
1.2.10	Final tests (completed equipments) - After assembly	1.Dimensions, orientation, workmanship & finish	Major	Measurement by visual	100%	G.A.drawing	G.A.drawing	Inspection report	*	P	V	V	
		2. Leak tightness for aasembly	Critical	Leak test @ design pr.(positive) [Duration 30 minutes]	100%	ASME Sec.VIII Div.1	No leakage	Inspection report	*	P	W	V	
		3.Dry function test for Debris filter	Critical	Operational test	100%	Approved PROC	Approved Procedure	Inspection report	*	P	W	V	
1.3.0	**Rubber Lining (Shell)**												
1.3.1	Rubber Formulation	Tensile, elongation & hardness	Major	Physical test	One per lot	Manufacturer's procedure	BS 6374/Equivalent	Manufacturers Test certificate	*	P	V	V	
		Polymer Identification	Major	Flame test	One per lot	For Semi Ebonite /Ebonite Polymer catches fire and on removal from fire continues to burn	For Semi Ebonite /Ebonite Polymer catches fire and on removal from fire continues to burn	Inspection report		P	V	V	
		% Change in weight after 24 hours of immersion in sea water at 70°	Major	Immersion test (bleeding test)	One per lot	ASTM D 471	+ / - 1%	Inspection report		P	V	V	
1.3.2	Surface preparation of items to be lined	Free from rust, scale,dust & grease	Major	Visual	100%	SA 2.5	SA 2.5	Manufacturers Internal Inspection report		P	–	–	
1.3.3	Vulcanising	Temperature, Pressure & Time	Major	Process monitoring	100%	Manufacturer's procedure	Manufacturer Procedure	Process Procedure		P	–	–	
1.3.4	Vulcanised Rubber Lined items	[a] Chip test	Major	Chip test	One per lot	Approved Drawing & BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V	
		[b] Adhesion, Visual defects, Thickness & Hardness	Major	Measurement, Visual Inspection	100% visual. Thickness/ hardness at random	Approved Drawing & BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V	
		[c] Spark test for Pin Holes at 5 kv/mm	Major	Spark test for Pin Holes	100%	Approved Drawing & BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V	

		LEGEND		
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	Manufacturer's Name & Address	STANDARD QUALITY PLAN		BHEL Doc No.: PE-QP-999-165-N003
		Item : Ball Valve	Vendor Q.P. NO.	PROJECT:
	P.O. No.		PACKAGE : DEBRIS FILTER	CUSTOMER:
			Date :	PURCHASER:
			Page 05 of 10	CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency			Remarks
										M	C	O	
1	2	3	4	5	6	7	8	9		**	10		11
2.0.0	**Ball valves**												
2.1.0	**Materials**												
2.1.1	Body and Tail end pieces	Chemical,Physical properties	Major	Chemical & Physical analysis	One Sample/Cast / heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's T.C.	*	P	V	V	
2.1.2	Ball	Chemical,Physical properties	Major	Chemical & Physical analysis	One Sample/Cast / heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's T.C.	*	P	V	V	
2.1.3	Stem	Chemical,Physical properties	Major	Chemical & Physical analysis	One Sample/Cast / heat	Approved drg/ Data sheet	Approved drg/ Data sheet	Manufacturer's T.C.	*	P	V	V	
2.2.0	**In-process inspection**												
2.2.1	Machining of body, end, pieces, ball	Dimension	Major	Measurement	100%	Approved drg/Data sheet	Approved drg/Data sheet	Log book	--	P	V	V	
2.2.2	Ball	a) Surface defects	Critical	Penetrant test	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1 Appendix 8	Inspection report	*	P	V	V	
		b) Hardness	Major	Hardness testing	Random	Approved drg/Data sheet	Approved drg/Data sheet	Inspection report	*	P	V	V	
2.3.0	**Assembly**	a) Dimensions	Major	Measurement	100%	EN ISO 17292	EN ISO 17292	Manufacturer's T.C.	*	P	V	V	
		b) Opening / Closing	Major	Operation	100%	---	As per approved data sheet	--	--	P	V	V	
2.4.0	**Testing**												
	[a] Body	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2/API 598/Appd data sheet	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[b] Seat test	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2/API 598/Appd data sheet	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[c] Seat	Leakage	Critical	Air test	100%	EN 12266-1&2/API 598/Appd data sheet	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	

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Manufacturer / Sub-Contractor	Contractor		Name & Sign. Of approving authority & Seal
Signature			

	Manufacturer's Name & Address	STANDARD QUALITY PLAN	BHEL Doc No.: PE-QP-999-165-N003
	P.O. No.	Item : Butterfly valve	Vendor Q.P. NO. PACKAGE : DEBRIS FILTER Date : Page 06 of 10	PROJECT: CUSTOMER: PURCHASER: CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency			Remarks
										M	C	O	
1	2	3	4	5	6	7	8	9		**	10		11
3.0.0	**Butterfly valves**												
3.1.0	**Materials**												
	Body and Disc	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
3.1.1	Shaft	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
3.1.2	Seat	_	Major	_	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
3.1.3	Stem	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
3.2.0	**Assembly**	a) Dimensions	Major	Measurement	100%	EN ISO 17292/Appd data sheet	EN ISO 17292/Appd data sheet	Manufacturer's T.C.	*	P	V	V	
		b) Opening / Closing	Major	Operation	100%	---	As per approved data sheet	--	*	P	_	_	
3.3.0	**Testing**												
	[a] Body	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2/API598	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[b] Seat test	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2/API598	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[c] Seat	Leakage	Critical	Air test	100%	EN 12266-1&2/API598	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	

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Manufacturer / Sub-Contractor	Contractor
Signature	

Name & Sign. Of approving authority & Seal

	Manufacturer's Name & Address	STANDARD QUALITY PLAN	BHEL Doc No.: PE-QP-999-165-N003
	P.O. No.	**Item : Pressure Gauge, DP Gauge, DP switch&DP Transmitter**	Vendor Q.P. NO. PACKAGE : DEBRIS FILTER Date : Page 07 of 10
			PROJECT: CUSTOMER: PURCHASER: CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency			Remarks
										M	C	O	
1	2	3	4	5	6	7	8	9		**	10		11
4.0.0	**Pressure Gauge, DP Gauge, DP switch & DP Transmitter**												
4.1.0	**In process quality control**	Make, Range and Model	Critical	Visual	100%	Approved Data Sheet	Approved Data Sheet	Manufacturer test certificate	*	P	V	V	
		Calibration	Critical	Calibration test	100%	Approved Data Sheet	Approved Data Sheet	Manufacturer test certificate	*	V	V	V	
		Degree of protection	Critical	_	Type test certificate	Approved Data Sheet	Approved Data Sheet	Manufacturer test certificate	*	V	V	V	

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Manufacturer / Sub-Contractor	Contractor
Signature	

Name & Sign. Of approving authority & Seal

	Manufacturer's Name & Address	STANDARD QUALITY PLAN		BHEL Doc No.: PE-QP-999-165-N003
	P.O. No.	**Item :** **Gear Motor Drive** **Worm Planetary Gear box** **Actuators**	Vendor Q.P. NO. PACKAGE : DEBRIS FILTER Date : Page 08 of 10	PROJECT: CUSTOMER: PURCHASER: CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency M	Agency C	Agency O	Remarks
1	2	3	4	5	6	7	8	9		**	10		11
5.0.0	**GEARED MOTOR DRIVE**	Running Test	Critical	Functional Test	100%	Approved Data Sheet	Approved Data Sheet	Manufacturer's compliance certificate	*	P	V	V	
		No load	Critical	Functional test	100%	Approved Data Sheet	Approved Data Sheet			P	V	V	
		Noise test	Critical	Functional test	100%	Approved Data Sheet	Approved Data Sheet			P	V	V	
		Oil leakage test	Critical	Functional test	100%	Approved Data Sheet	Approved Data Sheet			P	V	V	
		Visual	Critical	_	100%	Approved Data Sheet	Approved Data Sheet			P	V	V	
		Name plate verification	Critical	_	100%	Approved Data Sheet	Approved Data Sheet			P	V	V	
6.0.0	**Complete Unit of planetary gear**	No Leak Test	Critical	Functional test	One Sample/lot	Approved Data Sheet	Supplier Catalogue	Manufacturer's compliance certificate	*	P	V	V	
		Noise Level	Minor	Functional test	One Sample/lot	Approved Data Sheet	Approved Data Sheet			P	V	V	
		Visual Name plate Verification	Minor	_	100%	Approved Data Sheet	Approved Data Sheet			P	V	V	
7.0.0	**Actuators**	Functional test	Major	Electrical test	100%	Supplier catalogue/Appd data sheet	Supplier catalogue/Appd data sheet	Test certificate	*	P	V	V	
		Make, Range, Model	Major	Visual	100%	Supplier catalogue/Appd data sheet	Supplier catalogue/Appd data sheet	Inspection Report	_	P	_	_	
		Assembly check alongwith valves	Major	Visual	100%	Supplier catalogue/Appd data sheet	Supplier catalogue/Appd data sheet	Inspection Report	_	P	_	_	
		Functional Check along with settings / Auxillary Contacts	Major	Visual	100%	Supplier catalogue	Supplier catalogue/Appd data sheet	Inspection Report	_	P	_	_	Review of TC's

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Manufacturer / Sub-Contractor	Contractor		Name & Sign. Of approving authority & Seal
Signature			

	Manufacturer's Name & Address	STANDARD QUALITY PLAN	BHEL Doc No.: PE-QP-999-165-N003
	P.O. No.	Item : STARTER PANEL Vendor Q.P. NO. PACKAGE : DEBRIS FILTER Date : Page 9 of 10	PROJECT: CUSTOMER: PURCHASER: CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency			Remarks
										M	C	O	
1	2	3	4	5	6	7	8	9	D*	**	10		11
8.0.0	**Starter panel**												
8.1.0	**Incoming Material**												
8.1.1	Fabricated & Painted Panel	Dimension	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	_	P	--	--	
		Panel G.A.	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	_	P	--	--	
		Paint colour	Major	Visual	100%	Approved Drgs.	Approved Drgs.	Inspection report	_	P	--	--	
		Paint thickness	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	_	P	--	--	
		Paint Shade, Adhesion	Major	Visual	Sample	Approved Drgs.	Approved Drgs.	Inspection report	_	P	--	--	
8.1.2	Wire	Size / Colour / Rating / Surface Defects	Major	Visual / Dimension	Sample	IS 694	Specification / drawings	Inspection report	_	P	--	--	ISI Marked wire
8.1.3	Panel Mounting	Make, Functional, Type & Rating	Major	Visual / Electrical	100%	Approved BOM	Approved BOM	---		P	V	V	
8.2.0	**In Process Inspection**												
8.2.1	Name Plate, Component Mounting, Etc.	Workmanship, Finish, Correctness	Major	Visual	100%	Approved Drgs.	Approved drawings	Inspection report	_	P	--	--	
8.2.2	Electrical Wiring of Panels	Continuity, Colour of wires, Bunching and Grouping	Major	Visual	100%	Mounting Drawing	Approved drawings	Inspection report	_	P	--	--	
8.2.3	Ferruling of Cables	Start & End	Major	Visual	100%	Manufacturer's drawing	Manufacturer's drawing	Inspection report	_	P	--	--	
8.3.0	**Final Inspection**									P	--	--	
8.3.1	Workmanship, Finish & Paint shade / Thickness	Visual	Major	Visual	100%	G.A Drawing	Approved drgs.	Inspection report	*	P	W	V	
8.3.2	Overall Dimension, G.A of starter panel	Measurement	Major	Visual	100%	G.A Drawing	Approved drgs.	Test Certificate	_	P	W	V	
8.3.3	Component Identification	Visual	Major	Visual	100%	G.A Drawing	Approved drgs.	Inspection report	_	P	W	V	
8.3.4	Degree of Protection	Ingres Protection	Critical	Environmental	Verification	G.A Drawing	Approved drgs.	Inspection report		P	V	V	For enclosure
8.3.5	IR - HV - IR	Electrical	Critical	Electrical	100%	MFG. Procedure	MFG.. Pocedure	Inspection report	_	P	V	V	
8.3.6	Functional & Continuity	Functional	Major	Functional	100%	Appd Drawing	Appd Drawing	Inspection report	*	P	W	V	

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Manufacturer / Sub-Contractor	Contractor		Name & Sign. Of approving authority & Seal
Signature		Reviewed By	

		Manufacturer's Name & Address P.O. No.			**STANDARD QUALITY PLAN** **Item :** Fasteners All Components & Equipments		Vendor Q.P. NO. PACKAGE : DEBRIS FILTER Date : Page 10 of 10		BHEL Doc No.: PE-QP-999-165-N003 PROJECT: CUSTOMER: PURCHASER: CONSULTANT:				
Sl. No.	**Component / Operation**	**Characteristics Checked**	**Class**	**Type of Check**	**Quantum of Check**	**Reference Documents**	**Acceptance Norms**	**Format of Record**		**Agency**			**Remarks**
										M	**C**	**O**	
1	2	3	4	5	6	7	8	9		**	10		11
9.0.0	**Fasteners**												
9.1.0	**Internal Fasteners (Duplex SS)**	Chemical & Physical properties	Major	Chemical & Mechanical analysis	1 Per heat/HT Batch	Approved drg/Data sheet	Approved drg/Data sheet	Mfr 's TC / Lab Report	*	P	V	V	
		Visual & workmanship finish	Major	Visual	Sample	Approved drg/Data sheet	Approved drg/Data sheet	Inspection Report	_	P	V	V	
		Dimensions	Major	Measurement	Sample	Approved drg/Data sheet	Approved drg/Data sheet	Inspection Report	_	P	V	V	
9.2.0	**Main Fasterners**	Visual	Major	Visual	Sample	Approved drg/Data sheet	Approved drg/Data sheet	Inspection report / Mfr TC	*	P	V	V	
		Dimensions	Major	Measurement	Sample	Approved drg/Data sheet	Approved drg/Data sheet	Inspection report / Mfr TC	*	P	V	V	
		Chemical & Physical properties	--	Chemical & Physical test a) Tensile b) Yield c) Elongation d) Proof load	1 sample per heat	Approved drg/Data sheet	Approved drg/Data sheet	Mfr TC/Lab report	*	P	V	V	
10.0.0	**All Components / Equipments**	Painting Dry film thickness and	Major	Measurement	Random	Painting schedule	Painting schedule	Inspection report		P	V	V	
		Packing	Major	Measurement	100%	Packing Procedure	Packing Procedure	Inspection report		P	_	_	

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SUB-SECTION - IIB

STANDARD TECHNICAL SPECIFICATION (ELECTRICAL)

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

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.

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 mimimum 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: 4691and 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.

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**

4.9.1 Motors provided for similar drives shall be interchangeable.

4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.

4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.

4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.

4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.

4.9.6 Name plate with all particulars as per IS: 325 shall be provided

4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

5.0 INSPECTION AND TESTING

5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.

5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.

5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.

5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

a) OGA drawing showing the position of terminal boxes, earthing connections etc.
b) Arrangement drawing of terminal boxes.
c) Characteristic curves:
(*To be given for motor above 55 kW unless otherwise specified in Data Sheet*).

i) Current vs. time at rated voltage and minimum starting voltage.
ii) Speed vs. time at rated voltage and minimum starting voltage.
iii) Torque vs. speed at rated voltage and minimum voltage.
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

	TITLE	SPECIFICATION NO.
	LV MOTOR	**VOLUME II B**
	DATA SHEET - C	**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				REV.	
			SEAL		
NAME	SIGNATURE	DATE			

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 ≥ 55KW)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

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

BHEL	**PARTICULARS**	**BIDDER/VENDOR**
	NAME	
	SIGNATURE	

	QUALITY PLAN	CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
		BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION : TITLE :			
	SHEET 2 OF 2	SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10	10	10	11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	

NOTES:

1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON

2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

SUB-SECTION - IIC

STANDARD TECHNICAL SPECIFICATION (C &I)

(BLANK)

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER

	TITLE : SCHEDULE OF PERFORMANCE GUARANTEES FOR DEBRIS FILTER (DF)	SPEC. NO. PE-TS- 417/135-165-N003
		SECTION : III
		SUB SECTION : IIIA
		Sheet 1 of 1 Date- 11.10.18

S.NO.	DESCRIPTION	UNITS	5X800 MW YADADRI TPP
1.	Pressure drop across the Debris Filter (i.e. between inlet & outlet nozzle) under clean condition and Normal flow condition	MWC	

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

	TITLE : SCHEDULE OF PERFORMANCE GUARANTEES FOR DEBRIS FILTER (DF)	SPEC. NO. PE-TS- 417/135-165-N003
		SECTION : III
		SUB SECTION : IIIA
		Sheet 1 of 1 Date- 11.10.18

S.NO.	DESCRIPTION	UNITS	2X660 MW UDANGUDI STPP – STG I
1.	Pressure drop across the Debris Filter (i.e. between inlet & outlet nozzle) under clean condition and Normal flow condition	MWC	

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

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 shall be supplied on 'As Required Basis' and to be supplied at the time of commissioning of Debris Filter & 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 equipment, Trial run and Performance Testing at site shall be included by bidder in the base price itself.

h) The main flanges for DF shall be suitable for the forces and moments as per the specification.

i) The hydrostatic test pressure shall be 1.5 times the design pressure.

j) All sub - vendors shall be subject to BHEL/ Customer/Customer's Consultant approval in the event of order.

k) The Performance guarantees of equipments shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Customer/Customer's Consultant.

l) The orientation of piping around DF shall be finalised during detailed Engg.

m) 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 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.

- Switch gear panel should have suitable arrangement like bus coupler for providing redundancy to incoming supply feeder.

	Title	SPECIFICATION NO.
	DATA SHEET - B **DEBRIS FILTER** **(BACKWASH TYPE)**	PE-TS-XXX-165-N003
		SECTION: **C** SUB-SECTION: **IIIC**
		SHEET 1 OF 9

INSTRUCTION TO BIDDER
1. This data sheet shall be read in conjunction with Specification No. PE-TS-XXX-165-N003
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS
1.0	**General :**		
1.1	Number of Debris Filter being supplied.	Nos.	
1.2	Type & Model (on-line/off-line)		
1.3	Manufacturer		
1.4	Country of origin		
1.5	Capacity, each	M^3/hr	
1.6	Size		
	a) Inlet connection	mm	
	b) Outlet connection	mm	
1.7	Liquid to be filtered		
2.0	**Design :**		
2.1	Design Pressure	Bar (g)	
2.2	DesignTemperature	^oC	
2.3	Flow rate through the Filter : a) Normal b) Maximum allowable c) Minimum	M^3/hr	
2.4	Design differential pressure for filter section/ screen	bar (g)	
3.0	**Guaranteed Performance**		
3.1	Pressure drop across the Filter (i.e., between inlet and outlet connections) at normal flow rate a) Clean condition b) 50% chocked condition c) During flushing operation d) After flushing operation	Bar	
3.2	Debris discharge flow during flushing operation.	M^3/hr	
3.3	Flushing period	Minutes	

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

INSTRUCTION TO BIDDER
1. This data sheet shall be read in conjunction with Specification No. PE-TS-XXX-165-N003
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS
3.4	Minimum pressure differential to cause flushing/ backwashing		
3.5	Maximum size of Particle/ debris which can be safely handled by the filter.		
3.6	Power consumption during flushing	KW	
	a) Flushing Valves(s) b) Debris Discharge Valve c) Debris Extractor d) Water Injector Pump (if any) e) Any other f) Total		
4.0	Operation :		
4.1	Whether automatic flushing/ back-washing operation effected by the following		
	a) Differential pressure		YES/NO
	b) Adjustable timer		YES/NO
	c) Push button		YES/ NO
	d) Any other		YES/NO
4.2	Whether provision for manual flushing / backwashing operation is made in the event of control system failure.		YES/ NO
5.0	**Filter Housing Body :**		
5.1	Code/ Standard		
5.2	Outer diameter	mm	
5.3	Thickness	mm	
5.4	Materials		
	Housing/ Body		
	Internal Hardware		

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

	Title	SPECIFICATION NO.
	DATA SHEET - B **DEBRIS FILTER** **(BACKWASH TYPE)**	PE-TS-XXX-165-N003
		SECTION: **C** SUB-SECTION: **IIIC**
		SHEET 3 OF 9

INSTRUCTION TO BIDDER
1. This data sheet shall be read in conjunction with Specification No. PE-TS-XXX-165-N003
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS
	External hardware		
5.5	Lining materail (if applicable) and thickness		
5.6	Inspection Hole :		
	a) Type		
	b) Size	mm	
5.7	Whether sight glass is provided		YES/ NO
6.0	**Filter Section/ Screen Assembly :**		
6.1	Perforation/ mesh size	mm	
6.2	Free filter surface area	m^2	
6.2	Total surface area	M^2	
6.4	Thickness	mm	
6.5	Materails :		
	a) Filter section/ scree		
	b) Supporting cage		
	c) Hardware for fixing the filter section/ screen		
7.0	**Flushing/ Backwashing Unit :**		
7.1	Type		
7.2	Flushing Valves (if applicable)		
	a) Nos. provided	Nos.	
	b) Type		
	c) Materials • Body • Disc/ Flap • Shaft		
	d) Tag Number		

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

INSTRUCTION TO BIDDER
1. This data sheet shall be read in conjunction with Specification No. PE-TS-XXX-165-N003
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS
7.3	Debris Extractor (if applicable)		
	a) Type		
	b) Materials		
7.4	Debris discharge/ backwash outlet valves :		
	a) Type		
	b) Size	mm	
	c) Materials		
	♦ Body		
	♦ Disc/ Trim		
	♦ Shaft		
	d) Tag Number		
7.5	Size of Debris discharge/ backwash outlet valves is greater than pipe line size		YES/NO
7.6	Any water injection is required		YES/ NO
7.7	Whether Pump, valves and piping for water injection is included in the offer.		YES/ NO.
7.8	Debris discharge/ backwash outlet pipe		
	a) Material		
	b) O.D. and thickness	mm	
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		

SL.NO.	ITEM	UNIT	PARTICULARS
	f) No. of contacts	Nos.	
	g) Contact rating		
	h) Enclosure		
	i) Type of Mounting		
8.2	Whether differential Pressure gauge is provided for manual observation.		YES/ NO
8.3	Diffrential Pressure Gauge :		
	a) Type		
	b) Make and Model		
	c) Range		
	d) Accuracy		
	e) Material of sensing element		
	f) No. of contacts	Nos.	
	g) Dial size	mm	
	h) Enclosure		
	i) Mounting		
8.4	Whether built in flushing arrangement complete with flushing pump, valves, and associated piping, is provided.		YES/ NO
8.5	Whether remote seal type D.P. Transmitter		YES/ NO
9.0	**Timer for Flushing Operation**		
9.1	Timer make		
9.2	Range of duration setting		
10.0	**Actuators :**		
10.1	Actuators for flushing valves :		
	a) Type and make		

INSTRUCTION TO BIDDER
1. This data sheet shall be read in conjunction with Specification No. PE-TS-XXX-165-N003
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS
	b) Nos. provided		
	c) Motor rating	KW	
10.2	Actuators for debris discharge/ backwash outlet valves		
	a) Type and make		
	b) Motor rating	KW	
1.03	Actuator for Debris Extractor	KW	
	Type & make Nos. provided Motor rating		
10.4	Any other		
11.0	**Electric Drive Motors**		
11.1	Drive motor for water injection pump (if applicable)		
	a) Type and make		
	b) Rating	KW	
11.2	Drive motor for debris extractor		
	a) Type and make		
	b) Rating	KW	
11.3	Drive motor for differential pressure measure, measuring system flushing pump (if applicable).		
	a) Type and make		
	b) Motor rating	KW	
11.4	Any other		

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

	Title	SPECIFICATION NO.
	DATA SHEET - B **DEBRIS FILTER** **(BACKWASH TYPE)**	PE-TS-XXX-165-N003
		SECTION: **C** SUB-SECTION: **IIIC**
		SHEET 7 OF 9

INSTRUCTION TO BIDDER
1. This data sheet shall be read in conjunction with Specification No. PE-TS-XXX-165-N003
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS
12.0	**Counter Flanges for inlet & outlet** :		
12.1	Nos. provided	Nos.	YES/ NO
12.2	Type		
12.3	Size		
12.4	Rating		
12.5	Materials		
	a) Flanges b) Bolts and Nuts c) Gaskets		
12.6.	Code/ Standard		
12.7	Counter flanges for all other terminal points are provided.		YES/ NO
13.0	**Control Panel**		
13.1	Type		
18.2	Model & Manufacturer		
13.3	Operating Voltage/ frequency	V/ Hz	
13.4	Control Voltage/ frequency	V/ Hz	
13.5	Materials of housing and door		
13.6	Protections/ interlocks provided for :		
13.7	Alarms/ Annunciations provided for :		
13.8	Indicators provided for :		

Name of Bidder/ Vendor

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

INSTRUCTION TO BIDDER
1. This data sheet shall be read in conjunction with Specification No. PE-TS-XXX-165-N003
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS
13.9	Whether counterto register number of flushing operations, is provided.		YES/ NO
13.10	Whether interconnecting control and power cabling between the control panel and filter is included in the offer.		YES/ NO
14.0	Whether lifting lugs are provided.		YES/ NO.
15.0	Whether supports complete with foundation plates, bolts, nuts, etc. are included in the offer (wherever required).		YES/ NO
16.0	**Shop Inspection and Tests**		
16.1	Whether all the tests and inspections as detailed in the specification/ quality plan are carried out.		YES/ NO
16.2	Hydorstatic Test :		
	a) Test Pressure	Bar (g)	
	b) Test duration	Minutes	
17.0	**Painting :**		
17.1	External Surfaces :		
	a) Surface Preparation b) Primer c) Finish		
17.2	Internal Surfaces :		
	a) Surface Preparation b) Primer c) Finish		
18.0	**Weights :**		
18.1	Empty Weight	Kg.	
18.2	Operating	kg	

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

INSTRUCTION TO BIDDER
1. This data sheet shall be read in conjunction with Specification No. PE-TS-XXX-165-N003
2. Items which deviate from Specification shall be marked with an asterisk (*)

SL.NO.	ITEM	UNIT	PARTICULARS
19.0	Overall Dimensions		
	a) Debris Filter		
	b) Flushing skid		
	c) D.P. measuring system skid		
20.0	Weight of heaviest unit/ component to be handled.		
21.0	Space required for removal.		
22.0	Headroom required during installation at site.		
23.0	Other information (if any)		

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