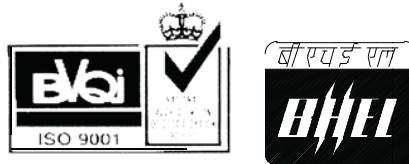


2 X 660 MW SURATGARH STPP


TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINERS (SCS)

Specification No. : PE-TS- 392-165-N003 (REV. 0)

VOLUME -IIB



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

	TITLE : TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINERS (SCS) PREAMBLE	SPEC. NO. PE-TS- 392-165-N003	
		VOLUME : II B	
		REV. NO. 0	DATE :22.04.14
		SHEET1 OF 2	

1.0 The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

1.1 **Volume -I CONDITIONS OF CONTRACT**

This consists of four parts as below :

Volume - I A : This part contains instructions to bidders for making bids to BHEL.

Volume - I B : This part contains general commercial conditions of the tender and include provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.

Volume - I C : This part contains special conditions of contract.

Volume - I D : This part contains commercial conditions for erection and commissioning site work, as applicable.

1.2 **Volume - II TECHNICAL SPECIFICATIONS**

Technical requirements are stipulated in Volume II which comprises of :

Volume - II A : General Technical Conditions

Volume - II B : Technical specification including drawings, if any

1.2.1 **Volume - II B :**

This volume is sub-divided into following sections:

Section - A : This section outlines the scope of enquiry.

Section - B : This section provides "Project Information"


Section - C : This section indicates technical requirements specific to the contract, not covered in Section-D.

Section - D : This section comprises of standard technical specifications of equipments complete with data sheet A, B & C.

Data sheet-A specifies data and other requirements pertaining to the equipment.

Data sheet - B specifies data to be filled by the bidder (Data Sheet B is contained in Volume - III)

Data sheet - C indicates data documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).

	TITLE : TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINERS (SCS) PREAMBLE	SPEC. NO. PE-TS- 392-165-N003	
		VOLUME : II B	
		REV. NO. 0	DATE :22.04.14
		SHEET2 OF 2	

1.2.2 **Volume - III TECHNICAL SCHEDULES**

- 1.0 This volume contains technical schedules and Data Sheets - B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per instructions given in Document No.PES-100-901 in Volume-III.
- 2.0 The requirements mentioned in Section C/Data Sheets-A of Section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section -D.



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-392-165-N003

VOLUME : II B

SECTION : A

REV. NO. 0

DATE :22.04.14

SHEET

1

of

1

INDEX

SECTION

TITLE

A

SCOPE OF ENQUIRY

B

PROJECT INFORMATION

C

SPECIFIC REQUIREMENTS

C1 SPECIFIC TECHNICAL REQUIREMENTS FOR SELF CLEANING STRAINERS.

C2 SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

C3 SPECIFIC TECHNICAL REQUIREMENTS (C&I)

D

STANDARD TECH. SPECIFICATIONS

D1 SELF CLEANING STRAINER

- ◆ STANDARD TECHNICAL
SPEC.NO. PE-TS-999-165-N002
- ◆ DATA SHEET-A
- ◆ DATA SHEET-C
- ◆ QUALITY PLAN

D2ELECTRICAL SYSTEMS

D3 CONTROL & INSTRUMENTATION SYSTEMS



TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)

SPEC. NO. PE-TS-392-165-N003

VOLUME : II B

SECTION : A

REV. NO. 0

DATE :22.04.14

SHEET

1

of

1

SECTION - A
SCOPE OF ENQUIRY



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-392-165-N001

VOLUME : IIB

SECTION : A

REV. NO. 0

DATE :22.04.2014

SHEET 1 of 2

1.00.0 SCOPE

This enquiry covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works properly packed for delivery of the items as follows:

1.01.0 Self Cleaning Strainers :

Self Cleaning Strainers (SCS) complete with all accessories as per the requirements specified in different sections of this specification for 2X660 MW Suratgarh STPP.

The bidder's scope also includes installation checks, commissioning, trial runs & PG Testing at site of SCS.

1.01.1 The bids shall be evaluated as per NIT.

2.00.00 GENERAL TECHNICAL INSTRUCTIONS:

2.01.00 It is not the intent to specify herein all the details of design and manufacture. However the equipment shall conform in all respects to high standard of design, engineering and workmanship, and shall be capable of performing the required duties in a manner acceptable to Engineer/ Owner, who will interpret the meaning of drawing and specifications, and shall be entitled to reject any component or material, which in his judgement is not in full accordance herewith.

2.02.00 The omission of specific reference to any component/ accessory necessary for the proper performance of the equipments shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of the equipments at quoted prices.

2.03.00 In case of any deviation from this Technical specification (Vol. IIB) and General Technical Conditions (Vol. IIC), the same shall be indicated in the schedule of deviations enclosed in Volume-III, Part-A. In the absence of duly filled schedules it will be assumed that the bid strictly conforms to the specification.

2.04.00 BHEL's/ Customer's representatives shall be given full access to the shop in which the equipments are being manufactured or tested and all test records shall be made available to him.

2.05.00 The equipments covered under this specification shall not be despatched unless the same have been finally inspected, accepted and shipping release issued by BHEL/ Customer

2.06.00 Un-priced copy of price bid shall be furnished alongwith the technical bid.



TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)

SPEC. NO. PE-TS-392-165-N003

VOLUME : II B

SECTION : C

REV. NO. 0

DATE :22.04.14

SHEET

1

of

1

SECTION – B

PROJECT INFORMATION

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME II SECTION – B
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan GENERAL PROJECT INFORMATION		SHEET 1 OF 3

1.0	Owner	Rajasthan Rajya Vidyut Utpadan Nigam Ltd., Jaipur
2.0	Consulting Engineer	TATA Consulting Engineers Ltd. 73/1, St. Marks Road, Bangalore – 560 001 Tel : 080 – 6622 6000 Fax : 080 – 22274874
3.0	Location of the plant	Prabat Nagar, Suratgarh Sriganganagar district, Rajasthan.
4.0	Latitude and longitude	Latitude : 29 deg. 10 min. N Longitude : 74 deg.01 min. E
5.0	Elevation above mean sea level	186 m (approximate)
6.0	Climatic conditions	
6.1	Temperatures : Monthly basis	
	Mean of daily max.	32.8 deg.C (in the month of May)
	Mean of daily min.	17.6 deg.C (in the month of Jan)
6.2	Temperatures : Annual basis	
	Mean of daily max.	32.3 deg.C
	Mean of daily min.	19.6 deg.C
	Highest temperature recorded	50 deg.C
	Lowest temperature recorded	(-) 2.8 deg.C
	Design Ambient Temperature for Electrical Equipment design	50 deg C
6.3	Relative humidity	Varies between 21% and 81%
6.4	Annual average rain fall	312 mm
6.5	Annual mean wind speed :	4 km / hr.
7.0	Wind load	

ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME II SECTION – B
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan GENERAL PROJECT INFORMATION		SHEET 2 OF 3

	Calculations for wind effect shall be in accordance with IS:875-1987(Part-3) taking into account the following:	
	a) Basic wind speed = 47 m/sec	
	b) Factor K1 = 1.07	
	c) Category of terrain = Category 2	
	d) K3 – as per IS 875	
8.0	Seismic data (As per IS: 1893 latest issue)	
	a) Zone	Zone II
	Designs & design coefficients shall be based on IS 1893:2002	
	Design condenser cooling water inlet temperature	33 Deg C
9.0	Auxiliary power supply:	
	Auxiliary electrical equipment to be supplied against this specification shall be suitable for operation on the following system:	
	a) For motors rated 160 kW and below.	415V AC, 3-phase, 3-wire effectively earthed.
	b) For motors rated above 160 kW and up to 1500 kW	6600V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
	c) For motors rated above 1500kW	11000V AC, 3-phase, 3-wire, 50 Hz, non-effectively earthed
	d) For motor control centres	415V AC, 3-phase, 3/4-wire effectively earthed.
	e) DC motor starters, DC solenoids, DC alarm control and protection	220 V DC, 2-wire unearthed
	f) AC control & protective devices	110 V 1 phase, 50Hz, 2 wire AC supply. The single phase 110V AC supply shall be derived by VENDOR by providing 415V / 110 V Control transformers of adequate rating with MCCB / MCB on both the primary and secondary sides.
	g) Uninterrupted power supply	230 V, 1-phase, 50 Hz, 2-wire, AC

ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME II SECTION – B
	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan GENERAL PROJECT INFORMATION		SHEET 3 OF 3

		supply (For all instrumentation and control system equipment and solenoid valves)
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g) Lighting fixtures and space heaters 240 V, 1 phase, 2 wire, 50Hz, solidly earthed system

h) Construction supply 415 V, 3 phase, 4 wire, 50Hz AC supply with neutral lead solidly earthed.

i) The above voltages may vary as follows :

All devices shall be suitable for continuous operation over the entire range of voltage and frequency indicated below without any change in their performance.

AC supply	Voltage variation $\pm 10\%$ Frequency variation $\pm 5\%$
DC supply	Combined voltage & frequency variation 10% Voltage variation $+10\%$, -15%

j) For instrument and control system of steam generator and steam turbine generator. 230 V $\pm 5\%$ AC UPS, 1-phase, 50 Hz, 2-wire. The 24 V DC required for control system shall be generated from this UPS.

10.0 All the electrical equipment shall be designed for 50° C reference ambient temperature.

ISSUE R1



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-392-165-N003

VOLUME : II B

SECTION : C

REV. NO. 0

DATE :22.04.14

SHEET

1

of

1

SECTION – C

SPECIFIC REQUIREMENTS

SECTION C1 : SELF CLEANING STRAINERS (MECHANICAL)

SECTION C2 : ELECTRICAL SYSTEMS

SECTION C3 : C&I SYSTEMS



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-392-165-N003

VOLUME : IIB

SECTION : D

REV. NO. 0

DATE :22.04.14

SHEET 1 of 1

SECTION C1

SELF CLEANING STRAINERS

(MECHANICAL DETAILS)



TITLE : TECHNICAL SPECIFICATION
FOR

SELF CLEANING STRAINERS(SCS).

SPEC. NO: PE-TS-392-165-N003

VOLUME : II B

SECTION:C1

REV. NO. 0

DATE :22.04.14

SHEET 1 OF 8

1.0 GENERAL

The Self Cleaning Strainers(SCS) complete with all accessories shall conform to the standard technical specifications (Section-D) and Data Sheet-A enclosed herewith. In addition the requirements of this section C shall also be complied with. However, wherever the details given in Section-D and Data Sheet-A are different, the requirements of Data Sheet-A shall prevail. Similarly in the event of contradictions between Section-C & Section-D/ Data Sheet-A, Section-C shall prevail.

Section C consists of 3 parts viz. Sec. C1, C2 and C3 for Mechanical, Electrical and C&I respectively, the requirements of all 3 sections shall be complied with.

2.0 DESCRIPTION OF EQUIPMENTS :

2.1 Self Cleaning Strainers (SCS) :

Self Cleaning Strainers per unit where specified shall be installed on the discharge side of ACW pumps. The water through the self cleaning strainers outlet shall be supplied to the Secondary side of Plate Heat Exchangers. The water analysis is indicated in project information in section B.

3.0 SCOPE OF SUPPLY UNDER THE SPECIFICATION IN THE BIDDER'S SCOPE FOR SELF CLEANING STRAINERS.

3.1 The scope of supply for Self Cleaning Strainers covered under this specification is as under.

The size, MOC's and other particulars of the equipments are detailed in Data Sheet A annexed with Section – D of the specification.

SL.NO.	PROJECT	SELF CLEANING STRAINERS
1.	2X660 MW – Suratgarh STPP	2 SETS PER UNIT VIZ. TOTAL 4 SETS FOR 2 UNIT.



TITLE : TECHNICAL SPECIFICATION
FOR

SELF CLEANING STRAINERS(SCS).

SPEC. NO: PE-TS-392-165-N003

VOLUME : II B

SECTION:C1

REV. NO. 0

DATE :22.04.14

SHEET 2 OF 8

3.2 SCOPE OF SUPPLY OF SCS INCLUDED IN THE BIDDER'S SCOPE :

The Qty of SCS covered under the specification shall be as per Data Sheet A of respective projects.

Each self cleaning strainer shall be complete with following accessories and auxiliaries.

- a) Flushing pump with drive Motor (as per manufacturer's design) - 1 No.
- b) Supply of complete debris disposal pipe work shall be in scope of Bidder. However bidder is to consider minimum 40 mtr. of debris disposal pipework and 5 numbers bends for each SCS in their scope of supply. In case actual piping comes out to be less than 40 mtrs. and number of bends less than 5 nos. still bidder has to supply 40 mtrs pipework and 5 nos. bends as minimum requirement. 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) Filter body/ housing Vent and Drain connections along with their isolating valves.
- d) SCS shall be supplied along with flanges as well as the Counter flanges, complete with bolts, nuts and gaskets.
- e) Differential pressure measuring system for SCS. DP measuring system shall comprise of 2 Nos. DPT + 1 No. DPG for SCS and shall be with *Remote seal* arrangement . Stubs for DPT and DPG shall be independent.
- f) Supporting arrangement complete with foundation plates, anchor bolts, nuts, sleeves, inserts, all installation materials, fixing bolts, clamps, saddle supports (if applicable) and other accessories etc for complete equipment supplied under this package.
- g) Set of commissioning spares, on "As required basis".
- h) The Electrical & C&I items/ accessories as specified in succeeding clause / respective sections herein.
- i) Scope of Starter Panel (Switch Gear Panel) shall be as follows:

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

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



TITLE : TECHNICAL SPECIFICATION
FOR

SELF CLEANING STRAINERS(SCS).

SPEC. NO: PE-TS-392-165-N003

VOLUME : II B

SECTION:C1

REV. NO. 0

DATE :22.04.14

SHEET 3 OF 8

- j) Power and Control cables between Starter Panel(Switch Gear Panel) and various drives in bidder's scope of supply.
- k) Control cables between field instruments and junction box / Starter Panel(Switch Gear Panel) .
- l) Set of mandatory spares as indicated in Data Sheet A.
- m) All the field instruments stipulated in this specification shall be in Bidder's scope.
- n) Finish paints for touch up painting of equipment after erection at site, in sealed containers.
- o) Set of special tools and tackles if required for maintenance and erection of the equipment supplied.
- p) 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.
- q) Local Control Panels & Instruments: Scope and Type as specified in C&I section wherever required.

Any item not specified but required to make SCS a complete package shall also be in bidders 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 SCS for respective projects

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

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

The no. of visits may be suitably assessed by bidders as per their experience with site stay periods on as required basis.

In the event of order no. of visits as follows shall be made as a minimum with



TITLE : TECHNICAL SPECIFICATION
FOR

SELF CLEANING STRAINERS(SCS).

SPEC. NO: PE-TS-392-165-N003

VOLUME : II B

SECTION:C1

REV. NO. 0

DATE :22.04.14

SHEET 4 OF 8

charges included in the bidder's base price itself.

- **For drawings/documents approval**

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

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

- **Site Visits :**

- No. of site visits for combined activities of erection checks and commissioning for SCS as applicable shall be one per unit - for both sets of equipments of one unit. Time duration for erection and commissioning shall be "on as required basis" with equipments run for trial operation thereafter for requisite period to demonstrate satisfactory operation.

However the no. of visits may be suitably assessed by bidders as per their experience with site stay periods on as required basis.

- Bidder shall demonstrate guarantees including pressure drops at site during subsequent visit for SCS of each unit.
- For trouble shooting on "as required basis".

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 with for packages/ projects under scope of this specification:

- 6.1 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.



TITLE : TECHNICAL SPECIFICATION
FOR

SELF CLEANING STRAINERS(SCS).

SPEC. NO: PE-TS-392-165-N003

VOLUME : II B

SECTION:C1

REV. NO. 0

DATE :22.04.14

SHEET 5 OF 8

6.2 Housing/ body of SCS 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 the thickness as specified in "Pipe size Table" enclosed in Data Sheet-A of SCS.

6.3 Adequate provision for future installation of Cathodic Protection for SCS (Sacrificial type shall be in Purchaser Scope) shall be kept by the bidder in the equipment.

6.4 Velocity in the pipe work shall be less than 1.5 m/ sec for pump suction and less than 2.2 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 Self Cleaning Strainers :

7.1.1 Performance Guarantee Parameters shall be as under :

- Pressure drop in Self Cleaning Strainers in clean condition viz. after backwashing.

7.1.2 Bidder to note that bids shall be evaluated on account of pressure drop across Self Cleaning Strainers (in clean condition) & liquidated damages on account of not meeting the same shall be in accordance with following :

A) Bid Evaluation Criteria and Liquidated Damages:

The bids received shall be evaluated for Pressure drop across Self Cleaning strainers :

- The permissible limit of pressure drop across self cleaning strainers in clean condition shall be 0.6 MWC.
- If the pressure drops quoted are higher than above limit, the bids shall be technically loaded @ Rate as mentioned in Data Sheet-A on pro-rata basis per **0.1 MWC** pressure drop (viz. per unit).
- However no advantage shall be given for pressure drops quoted less than above permissible limit.
- The maximum acceptable limit for pressure drop across self cleaning strainer (with technical loadings) shall be 1.0 MWC.
The bids will be technically rejected for pressure drops quoted higher than above maximum limit.
- The guaranteed pressure drops shall be demonstrated at site by vendors and if found higher shall be subject to LD @ twice the bid evaluation factor as above.



TITLE : TECHNICAL SPECIFICATION
FOR

SELF CLEANING STRAINERS(SCS).

SPEC. NO: PE-TS-392-165-N003

VOLUME : II B

SECTION:C1

REV. NO. 0

DATE :22.04.14

SHEET 6 OF 8

8.0 SPARES :

8.1 Recommended Spares :

The supply of spare parts as necessary recommended by the manufacture for three (3) years of reliable operation and maintenance of SCS of respective projects shall be supplied. List of such spares along with the unit price shall not be included in base price but indicated separately in the schedule of prices for recommended spares enclosed in Vol. -III.

8.2 Mandatory Spares

Mandatory Spares shall be as per Data Sheet-A, prices for same shall be included by bidder in the equipment base price itself.

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. Witness for all the test identified under agency "C" & "N" in Quality plan shall be by third party.

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 for each project shall be as per NIT.
- b. Drawings submission schedule shall be as per NIT/as advised by Project Group.

11.0 The makes of various bought out items shall be subjected to purchaser's 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" any thing 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.***



TITLE : TECHNICAL SPECIFICATION
FOR

SELF CLEANING STRAINERS(SCS).

SPEC. NO: PE-TS-392-165-N003

VOLUME : II B

SECTION:C1

REV. NO. 0

DATE :22.04.14

SHEET 7 OF 8

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

- Compliance certificate duly signed and stamped (Enclosed at Schedules).
- Guarantee schedule duly signed and stamped (Enclosed at Schedules).
- GA drawings of following with empty/ filled-ups.
 - GA of SCS (As applicable).
 - Debris Flushing pumps (if applicable)
 - Other equipments considered necessary for Layout/ Civil.
- Electrical Load Data (Enclosed at Vol. III of Specification)
- Schedule of Deviation (Enclosed at Schedules).

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

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



TITLE : TECHNICAL SPECIFICATION
FOR

SELF CLEANING STRAINERS(SCS).

SPEC. NO: PE-TS-392-165-N003

VOLUME : II B

SECTION:C1

REV. NO. 0

DATE :22.04.14

SHEET 8 OF 8

ANNEXURE-I

SELF CLEANING STRAINERS

SL.NO.	Projects	Size (NB)	Length of SCS (Including Counter Flange)	Scope of Counter Flange	Scope of nuts and bolts.
1.	2X660 MW – Suratgarh STPP	700 NB	2500 mm	In Bidder's Scope	In Bidder's Scope



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-392-165-N003

VOLUME : IIB

SECTION : D

REV. NO. 0


DATE :22.04.14

SHEET 1 of 1

SECTION C2

SELF CLEANING STRAINERS

ELECTRICAL DETAILS

	TITLE: ELECTRICAL EQUIPMENT SPECIFICATION FOR SELF CLEANING STRAINER 2X660 MW SURATGARH TPS, UNIT-7&8	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION: C
		REV NO. : 00 DATE: 04/04/2014
		SHEET: 1 OF 1

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per "Electrical Scope between BHEL and Vendor".
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipment's.
- d) Erection and commissioning spares.
- e) Erection & Maintenance tools & tackles.
- f) Electrical load requirement for SELF CLEANING STRAINER.
- g) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- h) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer /BHEL approval without any commercial and delivery implications to BHEL.
- i) Various drawings, data sheet as per required format, quality plans, calculations, Type test & Routine test reports & certificates, operation and maintenance manuals, Complete technical literature with catalogues etc shall be furnished as specified at contract stage. All documents shall be subject to customer /BHEL approval without any commercial implications to BHEL.
- j) Motor shall meet minimum requirement of motor specification.
- k) The sub-vendor list for various electrical items is subject to BHEL/Customer approval without any commercial implications.

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

Refer "Electrical Scope between BHEL and Vendor".

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated. In line with this, the bidder as technical offer shall furnish two signed and stamped copies of the following:
 - a) A copy of this sheet "Electrical Equipment Specification for SELF CLEANING STRAINER and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.
 - b) List of Erection and Commissioning spares.
 - c) List of Erection & Maintenance tools & tackles.
 - d) Electrical load requirement.
 - e) If there is any conflict, customer motor specification will prevail over BHEL motor specification.
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 LIST OF ENCLOSURES

- 4.1 Electrical scope between BHEL & vendor.
- 4.2 Technical specification for 11 kV, 6.6kV and 415V Electric Motors.
- 4.3 Motor data sheet-C
- 4.4 Quality Plan for motors.
- 4.5 Load data format.

ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE : SCS

PROJECT : 2X660MW SURATGARH STPS

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	1. 415 V AC (3 PHASE, 3 Wire) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract including power supply equipment (battery charger etc) required for the PLC/control panel (as applicable) for the system supplied by vendor. Further, the 415V AC (3 PHASE, 4 Wire) requirement / 240V AC requirement (if required by vendor) to be arranged/derived by vendor only. 2. Interposing relays (RE 302 of Jyoti make or equivalent), if required for PLC and microprocessor based systems, shall be provided by BHEL in MCCs. Requirement of these relays shall be furnished by vendor during detailed engineering stage . Located near the motor.
2	Local Push Button Station (for motors)	BHEL	BHEL	
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL Vendor BHEL	1. Sizes and quantity of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL). Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	Vendor	
5	Cable trays, accessories & cable trays supporting system	BHEL	BHEL	Local cabling from nearby tray to equipment terminal shall be through conduits
6	Cable glands and lugs for equipments supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power cables 3. Solder less crimping type heavy duty copper lugs for control cables.
7	Conduit and conduit accessories for cabling between equipments supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537. Makes of conduits shall be subject to customer/ BHEL approval at contract stage.

ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE : SCS

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
8	Lighting	BHEL	BHEL	
9	Equipment grounding & lightning protection	BHEL	BHEL	
10	Below grade grounding	BHEL	BHEL	
11	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
12	Mandatory spares	Vendor	-	Vendor to quote as per specification.
13	Recommended O & M spares, E & C spares, erection & maintenance tools & tackle.	Vendor	-	As per specification
14	Any other equipment/material/service required for completeness of system based on the system offered by vendor' to be added (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
15	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing (including soft copy) in the BHEL cable schedule in excel format (excel format shall be provided to vendor during contract stage) for C&I system for the package shall be submitted by the vendor during detailed engineering stage.
16	Equipment layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipments requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Electrical equipment layout drawing shall be to BHEL approval.
17	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

ANNEXURE – I TO SECTION – C : STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGE : SCS

NOTES:

1. Make of all electrical equipments/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. For skid mounted system, 2 nos. (1W+1S) supply of 415 V, 3 phase AC shall be provided by BHEL. Complete electrical distribution for the skid including changeover between feeder/starters/LCP/inter-locks/protection devices / any other supply etc. shall be in bidder's scope.



TITLE

LV MOTORS**DATA SHEET-A**

SPECIFICATION NO.

VOLUME II B

SECTION

D

REV NO. 00

DATE

04/04/2014

SHEET 1 OF 2

- 1.0 Design ambient temperature : 50 °C
- 2.0 Maximum acceptable kW rating of LV motor : <160KW
- 3.0 Installation (Indoors/ Outdoors) : As required
- 4.0 Degree Of Protection : IP55 - Outdoor
IP54 – Indoor
- 5.0 Cooling : TEFC
- 6.0 Details of supply system
- a) Rated voltage (with variation) : 415V \pm 10%
 - b) Rated frequency (with variation) : 50 Hz (Variation: +5% TO –5%)
 - c) Combined voltage & freq. variation : 10% (sum of absolute values)
 - d) System fault level at rated voltage : 50 kA for 1 sec
 - e) Short time rating for terminal box : 50 kA for 0.25 sec
 - f) LV System grounding : Solidly
- 7.0 Class of insulation : Class 'F', with temp rise limited to class B.
- 8.0 Minimum voltage for starting : 85% of rated voltage
(As percentage of rated voltage)
- 9.0 Power cables data : Shall be given during Detailed engg.
- 10.0 Earth Conductor Size & Material : Shall be given during Detailed engg.
- 11.0 Space heater supply(**30KW & ABOVE**) : 240 V, 1 Φ , 50 Hz
- 12.0 Rating up to which Single phase motor : Acceptable below 0.20 Kw
- 13.0 TYPE OF STARTER PROVIDED IN MCC : DOL
- 14.0 Locked rotor current
- a) Limit as percentage of FLC : 600% (inclusive of tolerance)
 - b) Permissible tolerance, if any : -
- 15.0 Additional tests : As per QP
- 16.0 Flame-proof motor
- a) Enclosure suitable (As per IS:2148) : As per requirement
 - b) Classification of Hazardous area : As per requirement
(As per IS: 5572 part-I)
 - c) Degree of protection : IP65
- 17.0 Makes : AS PER ANNEXURE-I
- 18.0 Terminal box : Suitable to rotate at 90 degrees



TITLE

LV MOTORS

DATA SHEET-A

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. 00 DATE 04/04/2014

SHEET 2 OF 2

19.0 Paint shade : Shade 631 of IS-5

LT motors for continuous duty (S1) operation & S3 (intermittent periodic duty) with a cyclic duration factor of 80% or higher, shall be energy efficient class IE-3 in line with IS -12615-2011. The starting current shall be in line with IS: 12615-2011, subject to IS tolerance (refer clause 14.1 of IS 12615).

- All LT motors shall be controlled as follows:
- a) Up to 50kW: - MPCB + Contactor (MPCB shall be with adjustable S/C and O/L protection).
 - b) 50kW to 90kW shall have MCCB+ contactor+ bimetallic relay.
 - c) 90Kw to 160kW shall have ACB +motor protection relay (MPR).

ANNEXURE-I

SUB-VENDOR LIST

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

S.No.	LIST OF LT MOTORS
1.	BHARAT BIJLEE LTD.
2.	CROMPTON GREAVES
3.	ASEA BROWN BOVERI
4.	KIRLOSKAR ELECTRIC CO LTD.
5.	NGEF
6.	SIEMENS
7.	MARATHON
8.	GE-POWER
9.	RAJINDRA ELECT INDUSTRIES
10.	LAXMI HYDRAULICS PVT. LTD

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

*** LT motors for continuous duty (S1) operation & S3 (intermittent periodic duty) with a cyclic duration factor of 80% or higher, shall be energy efficient class IE-3 in line with IS -12615-2011. The starting current shall be in line with IS: 12615-2011, subject to IS tolerance (refer clause 14.1 of IS 12615).**

PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 1 OF 7
<p>1.0 <u>AC & DC MOTORS</u></p> <p>1.1. HT motors of rating above 1500kW shall be suitable for 11kV, 3 phase, 50Hz power supply. Motors above 160kW and up to 1500kW shall be suitable for 6.6kV, 3 phase, 50Hz. Motors rated 160kW and below shall be suitable for 415V, 3 phase, 50 Hz power supply.</p> <p>1.2. All LT motors shall be energy efficient class – * in line with IS: 12615. However, the starting current shall be limited to 600% (inclusive of 20% tolerance) of full load current.</p> <p>1.3. The motor rating shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment, whichever is higher, considering highest system frequency. Motors shall be capable of starting and accelerating the load with the applicable method of starting without exceeding acceptable winding temperatures when supply voltage is 80% of the rated voltage for HT motors and 85% for LV motors. HT motors shall also be capable of satisfactory operation at full load at a supply voltage of 80% of the rated voltage for 5 min. commencing from hot condition. DC motors shall be suitable for the DC system voltage of 220V. Motor shall be capable of starting and accelerating the load with the applicable method of starting, without exceeding acceptable winding temperatures, when the supply voltage is in the range of 85% to 110% of rated motor voltage.</p> <p>1.4. Motors shall be capable of running for one second if the supply voltage drops to 70% of the rated voltage. If such operation is envisaged for a period of one second, the pull out torque of the motor shall be at least 205% of full load torque.</p> <p>1.5. Motors shall withstand for 1 second the voltage and torque stresses developed due to the vector difference between the motor residual voltage and the incoming supply voltage equal to 150% of the rated voltage during fast changeover of buses.</p> <p>1.6. Locked rotor current of the HT motors rated 1500 kW and below shall be limited to 600% (inclusive of 20% tolerance) of the full load current of the motors and motor rated above 1500 kW shall be limited to 450% (inclusive of 20% tolerance) of full load current of the motor.</p> <p>1.7. The locked rotor withstand time under hot condition at 110% rated voltage shall be more than the starting time at minimum permissible voltage specified above by at least three seconds or 15% of the accelerating time whichever is greater. Provision of speed switch shall be avoided to the extent possible.</p> <p>These motors shall be designed to withstand at least 5% harmonics in the supply voltage.</p> <p>1.8. The degree of protection for the motor enclosure (including terminal box) shall be IP-55 for outdoor. For single core cable termination, gland plates shall be of non-magnetic material. All motors located in hazardous area shall have flame proof enclosure.</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 2 OF 7
<p>1.9. All HT motors shall be provided with vibration pads for mounting vibration detectors. Vibration monitoring devices shall be provided on DE and NDE side in X & Y direction with remote DCS monitoring, alarms and tripping</p> <p>1.10. Motors rated 1000kW and above shall be provided with differential protection. These motors shall be provided with star connected stator windings. The 3 nos. current transformers, one for each phase shall be mounted in a separate compartment in the neutral side terminal box. The three phases shall be connected to form the star point after they pass through the CTs. The CTs shall be of relay accuracy and the CT characteristics shall be compatible with the differential relay. The additional 3 nos. CTs of identical characteristics shall be provided in the 11kV/6.6 kV switchgear panel.</p> <p>1.11. The terminal box of motor shall be of suitable size, suitable to terminate and maintain the cables easily. Terminal box shall be suitable to rotate at 90 degrees.</p> <p>1.12. The ring oiling system shall be adequate for starting and continuous operation of the motor for at least one half hour without pressure oiling system in operation.</p> <p>1.13. For 11kV & 6.6 kV motors, 6-nos. duplex RTD s for winding shall be provided for remote monitoring, alarm and tripping at DCS. Each bearing shall be provided with one duplex RTD for temperature remote monitoring, alarm and tripping at DCS. 6 nos. spare RTDs shall be provided for winding in HT motors.</p> <p>1.14. The maximum double amplitude vibrations for motors shall be as per IS 12075.</p> <p>1.15. Maximum noise level measured at a distance of 1.5 meter from the outer surface of the motor shall not exceed 85 db (A).</p> <p>1.16. Cable boxes of all 11kV & 6.6 kV motors shall be Phase segregated & shall be provided with quick disconnecting type terminal connectors to facilitate easy disconnection and removal of the motors without requiring unsealing or otherwise disturbing the external cable connections and leaving the phase segregated terminal box intact. The terminal boxes shall have fault withstand capacity equal to at least rated short circuit level of system voltage for 0.25 sec. The terminal boxes shall be reversible to suit cable entry from top or bottom and suitable for termination of FRLS, XLPE armoured cables.</p> <p>1.17. The star connection side terminal box should have sufficient capacity to accommodate CT's for differential protection for motor above 1000kW.</p> <p>1.18. The insulation system for 11000 V AC & 6600 V AC motors shall withstand the negative or positive 0.3 / 3.0 microsecond wave (2.7 pu rated peak line to earth operating voltage) switching surges originating from non-effectively earthed power system. All 11000V AC & 6600 V AC motors shall have BIL and power frequency withstand voltage as per relevant standards.</p> <p>1.19. Motor bearing shall be insulated wherever required.</p> <p>1.20. All HT motors shall be with VPI insulation or better</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 3 OF 7
<p>1.21. All HT motors / LT motors 15 kW and above shall be provided with external greasing arrangement</p> <p>1.22. CACW motor shall be provided with water leakage detector with remote alarms and tripping.</p> <p>1.23. All HT motors / LT motors 30 kW and above shall be provided with space heaters using 240 V AC supply. However, for all the actuators, irrespective of its rating, space heaters shall be provided using 240V AC supply.</p> <p>1.24. All motors below 15 kW shall be provided with sealed ZZ bearings</p> <p>1.25. Each motor shall have two earthing terminals.</p> <p>1.26. All motors for outdoor duty shall have detachable metal canopy.</p> <p>1.27. HT motors shall be designed for operation as follows:</p> <p style="margin-left: 40px;">a) Upto 1000kW – Vacuum circuit breakers/SF6.</p> <p style="margin-left: 40px;">b) Above 1000kW-Vacuum circuit breakers/SF6.</p> <p style="margin-left: 40px;">c) All motors shall be suitable for DOL starting.</p> <p>1.28. Separate terminal boxes to be provided for space heater, RTDs for windings/bearings, vibration monitors etc. All terminal boxes shall be provided with two earth studs for termination of protective earth conductor. Double compression type brass cable glands and crimping type copper lugs shall be provided for termination.</p> <p>1.29. Provision shall be made at DCS to monitor, integrate running hours, nos. of starts and stop recording for all motors.</p> <p>1.30. The terminals of all motors shall be suitable for terminating Aluminium conductor, XLPE insulated, armoured cables, the sizes of which will be intimated by the Purchaser.</p> <p>2.0 <u>ACTUATOR</u></p> <p>2.1. GENERAL TECHNICAL REQUIREMENT</p> <p>2.1.1. Actuator shall be weatherproof type with enclosure conforming to IP-64 degree of protection. It should be suitable for out-door use without the need for canopy. If the IP-68 degree of protection is required due to occasional submergence, the purchaser shall specify the depth and duration of such submergence.</p> <p>2.1.2. The actuator shall be suitable for installation in any position without lubrication leakage or other operational difficulty.</p> <p>2.1.3. All actuators shall be supplied with non integral starters for open & close. The main gearbox of the actuator shall be special grease filled.</p> <p>2.1.4. Each actuator should have a hand wheel for emergency manual operation. Clockwise operation of hand wheel shall cause clockwise movement of the</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 4 OF 7
<p>output drive. The hand wheel shall be clearly marked with an arrow and the word CLOSE.</p> <p>2.1.5. The hand wheel shall automatically disengage when the power to the motor is restored i.e. power drive shall have a preference over manual drive.</p> <p>2.1.6. The manual effort should not exceed 400 N (push / pull). A top bevel gear set (side mounted hand wheel) shall be employed to reduce the manual effort.</p> <p>2.1.7. Each actuator shall have a local mechanical position indicator. It should be suitable to indicate 0 - 100% position of the valve (continuous type).</p> <p>2.1.8. In order to minimise the amount of spare parts required, parts and sub-assemblies limit / torque switches, limit switch counter gear assembly, torque switch drive assembly, mechanical position indicator assembly etc. individually interchangeable / replaceable throughout the models selected.</p> <p>2.1.9. The actuator shall be painted with corrosion resistant epoxy resin paint. Paint shade shall be Grey (Shade 631) as per IS-5.</p> <p>2.1.10. In order to prevent condensation, a space heater shall be provided in the switch compartment, suitable for continuous operation. Actuator mounting dimensions shall be according to ISO-5210. For rising stem applications, the design must allow the removal of actuator from the output drive without disturbing the function of valve.</p> <p>2.2. LIMIT AND TORQUE SWITCHES</p> <p>2.2.1. Independent torque and limit switches shall be provided in the actuator. A minimum of two position limit switches and two torque switches, one each for each direction of travel, having 4 NO + 4 NC potential free contacts, shall be supplied. If called for in the data sheet, two additional limit switches shall be provided for intermediate positions.</p> <p>2.2.2. Torque switch dial shall be graduated directly in "kg-m" for easy setting to desired value within the range specified. Separate dials shall be provided for CLOSE and OPEN torque switches.</p> <p>2.2.3. Two additional limit switches with 2NO + 2NC contacts, each adjustable at any intermediate position, shall be provided in the actuator.</p> <p>2.2.4. The rating of both torque and limit switches shall be 240 V AC, 5 Amps. The switches shall individually be enclosed to a minimum of IP-64 protection class.</p> <p>2.2.5. Torque and limit switches shall have only stainless steel flaps for better protection against environmental condition.</p> <p>2.2.6. Limit switches shall be operated by gear driven cams, which are mechanically linked to the driving devices. The counter gear used for counting and tripping the limit switches shall be of metallic construction like brass etc. No plastic gearing shall be allowed.</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 5 OF 7

2.2.7. To guarantee proper function under high ambient temperatures, torque and limit switch sensing shall be of mechanical type.

2.3. ELECTRIC DRIVE FOR ACTUATOR (MOTOR)

2.3.1. All motors shall be specifically designed for valve actuator operation, which is characterised by high starting torque, low stall torque & low inertia. All motors shall be high starting torque type to facilitate 'unseating' of valve.

2.3.2. Motor shall be suitable for power supply of 415 V, 3 ph, 50 Hz, AC.

2.3.3. Motor shall be squirrel cage induction type and shall generally conform to IS-325.

2.3.4. Motor shall have minimum class 'F' insulation with temperature rise restricted to class 'B' under the design ambient temperature.

2.3.5. Motor shall be of totally enclosed surface cooled (TESC) type with IP-67 protection class after mounting on actuator.

2.3.6. Motor shall have three thermostats connected in series, one in each phase of stator winding, for protection against overheating.

2.3.7. Motor shall be suitable for operation under voltage variation of + 10%, frequency variation of + 5% and combined voltage & frequency variation of 10% absolute.

2.3.8. Motor shall be suitable for direct on-line (DOL) starting and starter shall be non integral to the motor.

2.3.9. It should be possible to separate the motor from the lubricant filled gearing of the actuator allowing easy replacement of motor without losing any lubricant regardless of mounting position.

2.3.10. Finish shall be provided on the motor body to ensure better heat dissipation.

2.3.11. It shall be possible to change the output rpm of the actuator, if required, at the site at a later date, without hampering the mounting arrangement and loss of any lubricant.

2.4. CODES & STANDARDS

All the equipment specified herein shall comply with the requirements of the latest issue of the relevant National & International standards.

The design and materials used for the components shall also comply with the relevant National & International standards.

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

Electric motor operated actuators:IS 9334

ISSUE
R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 6 OF 7
<p>Degrees of protection provided by enclosures at low:IS 2147 voltage switch gear and control gear</p> <p>Flame Proof enclosure at electrical apparatus:IS 2148 Specification for three phase induction motors:IS 325</p> <p>AC contactor for voltages not exceeding 1000 V:IS 2959</p> <p>Degree of protection provided by enclosures for :IS 4691 Rotating electrical machinery</p> <p>Specification for rotating electrical machines:IS 4722 For other code refer Section D28.</p> <p>2.5. OTHER REQUIREMENTS OF ACTUATOR.</p> <p>2.5.1. Common potential free contact shall be available to annunciate the fault condition to the remote control station or DCS.</p> <p>2.5.2. The following individual relay / potential free contacts shall be provided for the remote indication:-</p> <ul style="list-style-type: none"> – Actuator OPEN. – Actuator CLOSE – Actuator fault feed-back – Thermal overload relay shall be provided to trip the actuator in case of overload <p>2.6. The DC and AC actuator shall be provided with accessories viz., Torque limit switch, end of travel switch, adjustable limit switch, hand wheel motor, thermostat, etc. Complete actuator shall be tested at factory as per IS 9334. All actuators should have minimum 2 limit switches for each position, and should have position transmitters wherever required.</p> <p>3.0 TESTS</p> <p>3.1. All routine & acceptance tests as per relevant IS shall be conducted on motors. For all AC and DC motors of rating below 100kW, type test certificates shall be furnished. If the test reports are not found in order by Purchaser then these tests shall be conducted by the Vendor without any cost implication.</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan MOTOR & ACTUATOR	SHEET 7 OF 7
<p>3.2. Type test shall be carried out on one no. of each type and rating of motor of rating 100kW and above, which shall be witnessed by Purchaser.</p> <p>3.3. Efficiency and loss measurements shall be done for all LT motors as per relevant standard (Being energy efficient motors.) as routine test.</p> <p>3.4. For 11000V AC & 6600V AC motors, in addition to all the tests specified above, polarisation index test shall be carried out as a routine test on each motor (the minimum value of polarisation index for all motors shall be 2 when determined according to IS: 7816).</p> <p>3.5. Noise level measurement test shall be conducted on one motor of each type.</p> <p>3.6. Vibration measurement shall be taken for each motor of 45kW & above.</p> <p>3.7. Dielectric tests to establish the insulation withstand level of motors as indicated above shall be performed on a sample coil (identical to those to be used in the motor quoted for) for each type of motor. These tested sample coils shall not be used in the motors to be supplied.</p> <p>4.0 For technical particulars refer datasheet-A.</p>		
		ISSUE R1

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan DATA SHEET-A MOTOR & ACTUATOR	SHEET 1 OF 6

Sr. No.	Descriptions	Unit	Client specification
1.	Applications		*
2.	Manufacturer		*
3.	Frame Size		*
4.	Quantity		*
5.	Model No. of motor		*
6.	Supply Conditions		*
	(a) Allowable variation in		*
	(i) Voltage AC/DC	%	$\pm 10/ +10\%$ to -15%
	(ii) Frequency	%	± 5
	(iii) Combined	%	10
	(b) Permissible unbalance in supply voltage		*
7.	Speed	rpm	*
8.	Rated voltage a)HT motors b)LT motors c)UPS supplied d)Single phase e)DC motors		a)11000V & 6600V AC b)415V AC c)230V AC d)240V AC e)220V DC
9.	Number of phase		3-Phase
10.	Rated frequency for AC motor	Hz	50
11.	Normal winding connection	Star / Delta	*
12.	Method of starting a)AC motors b) DC motors		a)DOL (preferably) b) Resistance start
13.	Temperature rise above ambient of 50 deg. by Resistance method	Deg. C	HT motors – Shall be limited to Class B LT motor – Class B

REV. NO.	R0	R1	JOB NO.	CLIENT : RRVUNL
PPD. BY :	UM	SK	TCE -	
CKD. BY :	MSVM	MSVM	5750A	
DATE	NOV'2009	JUN'2012		PROJECT : 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan

SPEC. NO. TCE.5750A-H-500-001		TATA CONSULTING ENGINEERS LIMITED		VOLUME IV SECTION: D13
PART B		RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan DATA SHEET-A MOTOR & ACTUATOR		SHEET 2 OF 6

Sr. No.	Descriptions	Unit	Client specification
14.	Type of rotor (Slip ring/ squirrel cage)		Squirrel cage
15.	Type of duty		*
16.	Duty designation		*
17.	Synchronous speed a) Constant speed b) Variable speed (for VFD)		*
18.	Starting time at specified minimum starting voltage	Sec	*
19.	Starting torque	% of FLT	*
20.	Pull out torque	% of FLT	*
21.	Class of insulation		HT motors- Class F LT motors including actuator motors-Class F.
22.	Ref. Ambient temperature	deg. C	50
23.	Location considered – Hazardous area division		*
24.	Installation		
24.1.	Location		Indoor/Outdoor
24.2.	Hazardous area division (IS:5572 or equivalent)		*
24.3.	Atmosphere considered- Chemical/Dusty/Salt laden		*
25.	Type of cooling (IS: 6362) LT motors HT motors		TEFC TEFC / TETV / CACW

REV. NO.	R0	R1	JOB NO. TCE - 5750A	CLIENT : RRVUNL
PPD. BY :	UM	SK		PROJECT : 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan
CKD. BY :	MSVM	MSVM		
DATE	NOV'2009	JUN'2012		

SPEC. NO. TCE.5750A-H-500-001		TATA CONSULTING ENGINEERS LIMITED		VOLUME IV SECTION: D13																																																																	
PART B		RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan			SHEET 3 OF 6																																																																
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SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan DATA SHEET-A MOTOR & ACTUATOR	SHEET 4 OF 6

Sr. No.	Descriptions	Unit	Client specification
32.5.	Knee point voltage	KPV	*
32.6.	MAX. R.C.T. secondary winding resistance	OHMS	*
32.7.	MAX. exciting current AT 1/2 KPV		*
32.8.	Class of Insulation		*
33.	Whether vibration detectors required		*
34.	Details of winding / space heaters		*
35.	Guaranteed Efficiency of motor a) At full load b) At duty point c) At no load		*
36.	Guaranteed Power factor of motor a) At full load b) At duty point c) At no load		*
37.	Current at a) Starting b) Full load c) Duty point d) Full load & 70 % of rated supply voltage.		*
38.	Quantity & type of temperature detectors for all HT motors a) Winding hot spot b) Bearing		Minimum 6 Duplex RTD Minimum two thermocouple per bearing.
39.	Details of accessories a) Fans		*

REV. NO.	R0	R1	JOB NO.	CLIENT : RRVUNL
PPD. BY :	UM	SK	TCE -	
CKD. BY :	MSVM	MSVM	5750A	
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SPEC. NO. TCE.5750A-H-500-001		TATA CONSULTING ENGINEERS LIMITED		VOLUME IV SECTION: D13
PART B		RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan DATA SHEET-A MOTOR & ACTUATOR		SHEET 5 OF 6

Sr. No.	Descriptions	Unit	Client specification
	b) Temperature gauge c) Bearing d) Cooling motors e) Cooling water parameters f) Heaters g) Lube oil system details		
40.	Maximum size & number of cables that can be accommodated in motor terminal box.		*
41.	Thermal capability curve to be attached		*
42.	Relay co-ordination guide to be attached.		*
43.	Min. voltage required under starting conditions to accelerate driven equipment to rated speed.	Volts	*
44.	Locked rotor current withstand time (safe stall time) at 110 % rated voltage a) At rated temp. (hot) b) When cold	sec sec	*
45.	Stator thermal time constant	sec	*
46.	Permissible no. of equally spread starts per hour a) Normal service conditions b) In quick succession with cold M/C at room temp. c) Hot restarts		*
47.	Method of Starting and maximum starting current inclusive of tolerances AC HT Motors a) DOL		450 % above 1500 kW & 600 % all other.

REV. NO.	R0	R1	JOB NO. TCE - 5750A	CLIENT : RRVUNL
PPD. BY :	UM	SK		
CKD. BY :	MSVM	MSVM		
DATE	NOV'2009	JUN'2012		PROJECT : 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D13
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan DATA SHEET-A MOTOR & ACTUATOR	SHEET 6 OF 6

Sr. No.	Descriptions	Unit	Client specification
	b) Soft starters		*
	AC LT Motors		
	c) DOL		600 %
	d) Star Delta		200 %
	e) Star Delta with series resistance		200%
	f) Soft Starters		*
	DC Motors		
	a) Resistance starting		200%
	b) Soft starters		200%
	c) Any other		*

REV. NO.	R0	R1	JOB NO.	CLIENT : RRVUNL
PPD. BY :	UM	SK	TCE -	
CKD. BY :	MSVM	MSVM	5750A	
DATE	NOV'2009	JUN'2012		PROJECT : 2 x 660 MW, Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D15
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan CONTROL PANELS / STARTER PANEL /JB / PB	SHEET 1 OF 4

1.0 **CONTROL PANELS & CABINETS AND MISCELLANEOUS ELECTRICAL EQUIPMENT**

1.1. Indoor control panels provided for control of miscellaneous systems in the plant viz., CW System, Coal Handling System, Ash Handling System, RW System, DM Plant, Compressor control, cooling control system, lube oil system, EOT crane and Hoist electrics, trolley lines and power supply arrangement, Electrics for ventilation, air-conditioning, DG AMF Panel, etc. as applicable shall comply with the requirements outlined under clause 1.8 below.

1.2. All the meters provided on the panel shall be digital type meters in 96 W x 48H with accuracy class better than 1.

1.3. For motor circuits, ammeters shall have a suppressed extended scale to indicate the motor starting current.

1.4. The facia annunciation windows if provided on the panel, shall conform to requirements outlined under instrumentation and control section.

1.5. All live parts shall be provided with at least phase to phase & phase to earth clearances in air of 25mm & 20mm respectively.

1.6. The required 240 V, 1 phase AC supply required for panel illumination and receptacle shall be derived in the control panel itself. However 240V, 1 Phase AC supply for space heating of panel shall be fed from a separate 1-Phase ACDB.

1.7. **Technical Requirements**

SI. NO.	DESCRIPTION	REQUIREMENTS
1.0	Location	Indoor/Outdoor depending on location
2.0	Type of mounting	Wall/Floor
3.0	Cable entry	Top/bottom depending on layout
4.0	Paint Finish: Outside/Inside	Siemens Grey RAL 7032/ /Glossy white.
5.0	Supply voltage	415V, 3 phase, 3 wire/4 wire
6.0	Control transformer	By Vendor to derive 110V control supply
7.0	Space heater, lighting supply voltage	240V, 1 phase AC
8.0	Degree of protection of	Non-AC rooms-IP 54 class

ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D15
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan CONTROL PANELS / STARTER PANEL /JB / PB	SHEET 2 OF 4

	Enclosure for Electrical panels/cabinet enclosure	AC rooms- IP 42 class Outdoor-IP 55 class plus canopy
9.0	Sheet steel thickness	Cold rolled sheet steel not less than 2.5mm for front & rear & 2mm for side, top & bottom portion with gland plate of 3mm thick.
10.0	Name plate	Black letter engraved on stainless steel plate. Should indicate the tag number and description of the service.
11.0	Door/Cover	Shall be pad lockable.
12.0	Safety	All live parts shall be shrouded. No live parts shall be accessible after opening the door/cover. Danger warning plates to be provided. Doors shall be pad lockable and interlocked with Power switch.
13.0	Earthing	2 earthing terminals to be provided for connection to the grid.
14.0	Wiring	Refer specification , Section on panel wiring

2.0 Following miscellaneous equipment shall be included in BIDDER's scope.

- 2.1. Starter Panel for DC Motors
- 2.2. Local push button stations.
- 2.3. Junction boxes (JBs)
- 2.4. Danger boards
- 2.5. Rubber mats

3.0 **STARTER PANEL FOR DC MOTORS**

- 3.1. Starter panel when included in motor Bidder's scope shall meet the following requirements.
- 3.2. The constructional features of these panels shall be as per cl.no.1.8 above. Please also refer to Section D.10.

4.0 **LOCAL PUSH BUTTON STATIONS (LPB)**

- 4.1. Local push button station shall be provided for all the drive motors of the plant (415V motors & 6.6kV/11kV motors) (start / stop push buttons for unidirectional motors, start/stop/reverse push buttons for bi-directional motors & only start push button for emergency motors) as per scheme requirement.

ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D15
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan CONTROL PANELS / STARTER PANEL /JB / PB	SHEET 3 OF 4
<p>4.2. Start/ Forward/ Open PBs shall have green coloured actuator and Stop/Reverse/Close PBs shall have Red coloured actuator.</p> <p>4.3. The degree of protection of LPBs shall be IP65 with both canopy and lid for outdoor and IP54 with lid and hinged door for indoor applications.</p> <p>4.4. All PBs shall be push to actuate type.</p> <p>4.5. Emergency local stop push button should be lockable in the STOP position. Emergency push buttons shall be stay put type</p> <p>4.6. All push buttons shall be provided with 2 nos. NO and 2 nos. NC contacts for various interlocking purposes. One contact of stop PB shall be directly wired to the switchgear module for direct tripping and another contact to control system.</p> <p>4.7. Terminal block of stud type are to be provided in the LPB station. Terminals to be suitable for 2 cores of 2.5 sq mm conductors with 20% spare terminals.</p> <p>4.8. All LPBs shall be of Poly Carbonate/ FRP/Di-cast aluminium.</p> <p>4.9. Name plate with Tag number and description of the service controlled by the LPB shall be provided on the front.</p> <p>4.10. LPBs shall be suitable for wall/column mounting. Covers shall be provided with captive screws.</p> <p>4.11. The Cable size to be used for LPB connection shall take in to account the voltage drop in the cable between the LPB and the Switchgear/MCC/DCS.</p> <p>5.0 <u>JUNCTION BOXES (JBs)</u></p> <p>5.1. Junction boxes as required for the power plant shall be supplied :</p> <p>5.2. The JBs used in outdoor areas shall be weatherproof type and coated with epoxy paint. enable running a large core cables from (JB/MB) to control panels, terminal cabinets, etc.</p> <p>5.3. All JBs, shall be of polycarbonate /FRP/ Di-cast aluminium.</p> <p>5.4. Danger boards shall be provided in line with the statutory requirements.</p> <p>5.5. Rubber mats shall be provided to meet the safety and other statutory requirements.</p> <p>5.6. Spacing of 250 MM between two rows of Terminal blocks and between the gland plate and the bottom most terminal block to be provided.</p> <p>5.7. Gland plate to be of removable type and made out of 3 mm thick sheet steel.</p> <p>6.0 <u>TESTING</u></p> <p>The following testing shall be conducted on all equipments at works and necessary test certificates shall be furnished.</p> <p>(a) IR (Insulation resistance) test before and after HV test.</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D15
PART B	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Units 7 & 8, at Suratgarh, Rajasthan CONTROL PANELS / STARTER PANEL /JB / PB	SHEET 4 OF 4
<div style="padding-left: 40px;"> <p>(b) HV test at 2.5kV for 1 Minute.</p> <p>(c) Electrical Functional test.</p> <p>(d) Mechanical operation of the components.</p> <p>(e) Visual check for compliance as per approved drawings.</p> <p>Note: The international standards such as IEC, which are equivalent to IS, may also be applicable for the above mentioned testing.</p> </div> <div style="border: 1px solid black; width: 100px; float: right; padding: 5px; margin-top: 20px;"> ISSUE R1 </div>		

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 1 OF 9
<p>1.0 CABLES</p> <p>1.1 H T POWER CABLES</p> <p>System cables shall be 11kV (UE) and 6.6 kV (UE) grade suitable for use in medium resistance earthed system, stranded & compacted aluminium conductor, extruded semi conducting screen over conductor, XLPE insulated, semi-conducting followed by copper tape screened, extruded PVC Type ST – 2 inner sheathed, aluminium/GS wire armoured, overall FRLS PVC outer sheathed, conforming to IS 7098 (Part II), IEC-502 for constructional details and tests.</p> <p>1.2 L T POWER CABLES</p> <p>LV Power Cables shall be 1100 V grade, single / multi core, stranded aluminium conductor, XLPE insulated, with PVC inner sheath, armoured and outer sheath made of FRLS PVC compound, generally conforming to IS 7098 (for XLPE). The cables used for DC system shall be of single core type. Minimum conductor cross section of power cables shall be 6-sq. mm for aluminium cables.</p> <p>1.3 CONTROL CABLES</p> <p>Control cables shall be 1100 V grade, multi core, minimum 1.5 sq. mm cross section, stranded copper conductor having minimum 7 strands, PVC insulated, PVC inner sheathed / galvanised steel wire armoured, overall FRLS PVC outer sheathed generally conforming to IS 1554 Part-I. In situations where accuracy of measurement or voltage drop in control circuit warrants, higher cross sections as required shall be used.</p> <p>1.4 INSTRUMENTATION CABLES</p> <p>The instrumentation cables shall be Annealed, tinned stranded copper conductor, 0.5 sq mm , twisted into pairs, overall screened (I1 type) for digital signals, individual and overall screened (for I2 type) for low level analog signals, individual triplet and overall screened (type I3), PVC insulated , inner PVC sheathed, GS wire armoured and overall sheathed with FRLS PVC. The insulation shall be strippable manually as well as by mechanical stripping devices without damage to the conductor.</p> <p>1.5 TRAILING POWER AND CONTROL CABLES FOR MOBILE EQUIPMENT.</p> <p>11 kV(UE) and 6.6 kV (UE) and 1100V-(E) grade power & control flexible trailing, annealed tinned copper conductor, EPR insulated, EPR inner sheathed, CSP outer sheathed and shall have conductor screen of rubber. Cables shall conform to IS requirements and any other applicable standards.</p> <p>1.6 FIRE SURVIVAL CABLES</p> <p>1.6.1 Power and control, single/multi, stranded copper conductor fire survival cables complying with IEC-60331 shall be provided for following systems as per CEA guidelines.</p>		
		ISSUE R1

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 2 OF 9
<p>(a) DC emergency lube oil pumps</p> <p>(b) DC seal oil pumps</p> <p>(c) DC emergency lighting cables for main building</p> <p>(d) Batteries to chargers and DC distribution boards</p> <p>(e) Turbine lube oil pumps</p> <p>(f) Jacking oil pumps</p> <p>(g) Emergency turbine trip by pushbutton in control room</p> <p>(h) Boiler Turbine: Generator inter trip which includes the interconnecting cables between:</p> <ul style="list-style-type: none"> – Boiler master fuel trip and turbine trip relays – Generator trip relays and turbine trip relays – Generator trip relays and 400kV breakers – Generator trip relays and generator field breakers – Generator trip relays and ST and UT breakers <p>1.6.2 FS cables shall have following properties:</p> <p>(a) Excellent fire resistance characteristics</p> <p>(b) Cables shall have features of nontoxic and low smoke generation</p> <p>(c) Flame non-propagation property</p> <p>(d) Ability to withstand burning & continue to function during and after fire</p> <p>(e) Low smoke emission & low halogen property to maintain circuit integrity to essential services under severe fire condition.</p> <p>1.6.3 Construction of FS cables</p> <p>(a) Conductor- Copper stranded</p> <p>(b) Fire proof layer- heat barrier based</p> <p>(c) Insulation- elastomer rubber</p> <p>(d) Fire proof layer- same as 2 above but optional – natural or synthetic, fibre or elastomer</p> <p>(e) Filler- suitable filler optional</p> <p>(f) Binder tape – two layers of glass fibre tape</p> <p>(g) Inner sheath- HOFR FRLS elastomer (heat & oil flame retardant)</p> <p>(h) Armouring/screening – suitable wire</p> <p>(i) Over all sheath – HOFR FRLS</p>		
		ISSUE R1

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 3 OF 9
<p>1.7 Cables for the fire detection and alarm system and communication system shall be as described else where.</p> <p>2.0 <u>CABLE PROPERTIES</u></p> <p>2.1 All single core power cables shall have wire / strip armouring of aluminium, whereas multi core power cable shall have galvanised steel wire / strip armouring.</p> <p>2.2 The sheath shall be resistant to water, UV radiation, fungus, termite and rodent attack.</p> <p>2.3 The outer sheath of FRLS PVC compound shall meet the following performance requirements:</p> <p>(a) The critical oxygen index value shall be minimum 29 when tested at $27 \pm 2^{\circ}\text{C}$ as per ASTM-D-2863-77 and the temperature index shall be minimum 250°C at oxygen index value of 21 when tested as per ASTM-D-2863.</p> <p>(b) The maximum acid gas generation as determined by titration method shall be less than 20% by weight when tested as per IEC-60754-1 (1994). Halogen acid content in outer sheath in FS cables shall not be more than 2%.</p> <p>(c) Flammability</p> <p>(i) Cables shall pass tests under fire condition as per IS-10810-Part-53.</p> <p>(ii) Cables shall also pass tests as per IS-10810 Part-61 & Part-62. Category group shall be considered as Category 'A'.</p> <p>(iii) Fire survival cables in addition to tests (i) and (ii) above shall pass tests as per IEC-331.</p> <p>(d) The smoke generation under fire shall have maximum smoke density rating of 60% when tested as per ASTM-D-2843-77 (1977). Smoke density in FS cables shall not exceed 20%.</p> <p>(e) The cables shall pass the ultraviolet tests as per DIN 53387.</p> <p>(f) The cables shall pass the tests for Water absorption tests as per IS 10810.</p> <p>2.4 The finished cable shall pass the flammability test as per IEC-322-1 (1993) and IEEE-383. In addition, it shall also pass flammability test as per Class F3 of Swedish Standard SS-424-1475 (1977).</p> <p>2.5 In addition, cables for devices mounted on or near hot surfaces of Steam Generators, Turbine Generators, Main steam etc shall have heat resistance type outer sheath.</p> <p>2.6 All LT cable shall have embossing at interval of 1 meter for owner name, size/ core type and length.</p>		
		ISSUE R1

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 4 OF 9
<p>2.7 All cables shall be embossed with the name of RVUNL in addition to what is specified in the standards.</p> <p>3.0 <u>DESIGN CRITERIA FOR CABLE SIZING</u></p> <p>3.1 POWER CABLES</p> <p>Power cable sizes shall be selected on the following basis:</p> <p>3.1.1 Power cables shall carry the full load current of the circuit continuously under site conditions considering the condition listed below:-</p> <ul style="list-style-type: none"> (a) Ambient design temperature 50 deg. C. (b) Maximum allowable temperature under normal full load condition and under short circuit condition based on material selected (XLPE). (c) Maximum short circuit fault current. (d) Ambient temperature for underground cables, 50 deg. C. (e) De-rating factors as per IS/IEC and manufacturer's standard catalogues. <p>3.1.2 Power cables shall withstand the fault current of the circuit for the duration not less than the maximum time taken by the primary protective system to isolate the fault. Fault clearing times for ties between two 6.6 kV switchgears shall be considered as 1 sec. Fault clearing times for ties between two 415V switchgears shall be considered as 0.5 sec.</p> <p>3.1.3 For the cables to 415 V motors and feeders protected by fuses, the cross section shall be chosen according to the cut-off current of the fuse and its fusing time.</p> <p>3.1.4 Voltage drop from transformer secondary to motor terminals during starting of motors will be limited to the following values:</p> <ul style="list-style-type: none"> (a) For HV motors (except MDBFP motor) – 15% of the rated voltage (b) For MDBFP motors – 20% of the rated voltage (c) For LV motors – 15% of the rated voltage. <p>3.1.5 Voltage drop in feeder cables shall be limited to 3% during full load running condition. Voltage drop from transformer secondary to motor terminals during full load running of motors shall be limited to 5 % of rated voltage.</p> <p>3.1.6 For power supply to valve actuator motors, actuators of various isolating and regulating dampers and exhaust fans, 3 core 2.5 sq. mm stranded copper conductor cable may be used in view of ease of termination. These cables shall be in other respects similar to cables described in Clause 1.2 above.</p> <p>3.1.7 Design Calculation for arriving at cable size shall be submitted for purchaser's approval.</p> <p>3.1.8 DC System Cables:-</p>		
		ISSUE R1

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 5 OF 9
<p>3.1.8.1 1100 V grade, single core cables as specified in LT power cables shall be used from batteries/ battery chargers to main DCDB, between main Distribution Board, from main Distribution Board to sub distribution board, main DC supply to various system cabinets/panels, Switchgears etc and for critical auxiliaries. Flexible cables with PVC insulation shall be used where termination of XLPE/PVC insulated cables is difficult.</p> <p>3.1.8.2 Voltage drop in cables between battery to DCDB and battery charger to DCDB shall be limited to 2%. Voltage drop in cables between DCDB and loads shall be limited to 3%.</p> <p>3.1.8.3 Design Calculation for arriving at cable size shall be submitted for purchaser's approval.</p> <p>3.2 <u>CONTROL CABLES</u></p> <p>3.2.1 Current transformer leads shall be checked for the lead burden vis-a-vis the current transformer VA capacity. In case 2.5 sq. mm conductor impose unacceptably high burden on CTs, 4.0-sq. mm conductor shall be used. The conductor material shall be copper.</p> <p>3.2.2 Voltage transformer leads shall be checked for voltage drop which shall be limited to within 1% for all cases other than tariff metering. For tariff metering the voltage drop shall be limited to 0.2%. In case the voltage drop with 2.5 sq. mm conductors exceed this value, higher conductor sizes shall be used.</p> <p>3.3 <u>INSTRUMENTATION CABLE</u></p> <p>3.3.1 Element identification : As per IEC-60189-2</p> <p>3.3.2 Core wrapping : By non-hygroscopic material by taping or by extrusion</p> <p>3.3.3 Element screening : By copper tape of minimum 0.04mm thickness or by copper laminated plastic tape</p> <p>3.3.4 Rip cord : Non-metallic rip cord under the core wrapping</p> <p>3.3.5 Drain wire : A tinned copper drain wire of minimum 0.05 mm² cross section in contact with each screen of cabling element.</p> <p>Cabling elements shall be any one of the following:</p> <p>A 'Pair' of two insulated conductors twisted together designated by alphabet 'p' printed on a binding tape at 200 mm intervals.</p> <p>A 'Triple' of three insulated conductors twisted together designated by alphabet 't', printed on a binding tape at 200 mm intervals.</p> <p>Maximum length of lay in the finished cable shall be 120 mm.</p> <p>3.3.6 <u>Units</u></p> <p>Cables shall be bunched together in units of twenty cabling elements or sub units of five or ten elements, stranded in concentric layers. The units or sub</p>		
		ISSUE R1

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 6 OF 9
<p>units shall be designated by p1, p2, p3,. t1, t2, t3...,q1, q2, q3, .., or Q1, Q2, Q3 ..., etc. depending on the combination.</p> <p>3.3.7 <u>Overall screening and armouring</u></p> <p>Cables shall have an overall screen made up of copper/aluminium tape of 0.04 mm thickness or copper/aluminium of 0.008 mm thickness laminated with plastic tape with a minimum overlap of 15%.A drain wire of tinned copper with minimum 0.5 mm² cross section shall be provided in continuous contact with the screen.</p> <p>3.3.8 <u>Inner and Outer Sheath</u></p> <p>The inner and outer sheaths shall consist of black PVC compound.</p> <p>3.3.9 <u>Insulation Resistance</u></p> <p>Minimum insulation resistance per km shall be 500 mega Ohm.</p> <p>3.3.10 <u>Mutual Capacitance</u></p> <p>Mutual capacitance of any pair of conductors shall not exceed 120 nF/km.</p> <p>3.3.11 <u>Capacitance Unbalance</u></p> <p>The capacitance unbalance between any two pairs shall not exceed 400 pF for 500 metre length of cable.The construction, performance and testing of cables except as mentioned above shall generally comply with the following standards :</p> <p>IEC-60189 - Part-1 : Low frequency cables and wires with PVC insulation and sheath. General test and measuring methods</p> <p>IEC-60189 - Part-2: (-do- Cables in pairs and triples).</p> <p>4.0 <u>CABLE TERMINATIONS</u></p> <p>4.1 Cables shall be laid in trays /trenches/ conduits by the Bidder. Also joint markers shall be provided at each joint.</p> <p>4.2 All 1100V termination for XLPE/PVC power cables and control cables shall be by Double compression weather proof type cable glands. Heavy duty, tinned, long barrel copper lugs shall be used for termination.</p> <p>5.0 <u>CABLE JOINTS</u></p> <p>Cable joints shall be avoided to the extent possible. If joints are unavoidable due to circuit length, in excess of permissible maximum drum length, they shall be heat shrinkable types having a short circuit with stand capacity value as specified in clause 3.1.2 above. Lugs shall be heavy duty, tinned copper, long barrel type. All cable glands shall be double compression, weather proof.</p> <p>6.0 <u>POWER RECEPTACLES</u></p>		
		ISSUE R1

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 7 OF 9
<p>3 phase, 5 pin, 63A power receptacles with switch shall be provided . The receptacle shall be industrial heavy duty type and shall have suitable interlock facility for safety. The receptacle shall conform to IS 1293 and the switch to IS 4064.</p> <p>7.0 <u>CABLE CARRIER SYSTEM</u></p> <p>7.1 The cable carrier system shall be designed considering the following :</p> <ul style="list-style-type: none"> (a) Facility for easy laying of cables. (b) Access to maintenance. (c) Neat and aesthetic appearance. (d) Safety of equipment & personnel. (e) Ground water seepage. (f) Drainage system for oil and water. <p>7.2 Cables shall be laid in prefabricated ladder (for power and control) / perforated (instrumentation) type trays and in conduits. Also joint markers shall be provided at each joint. The cable trays shall be laid vertical in boiler and ESP area, coal handling and ash handling area.</p> <p>7.3 Cable trays and supporting structures in chemically corrosive area like battery room and water treatment plant shall be mild steel painted trays finished with chlorinated rubber based paint/epoxy paint.</p> <p>7.4 Cable trenches will be avoided to the extent possible inside Fuel oil pump house, water treatment plan where possibility of oil and water collection exists and Boiler & ESP areas.</p> <p>7.5 No direct underground burial cables shall be laid except lighting tower, street lighting. For some exceptional case like isolated individual equipments it shall be allowed after approval by the owner /consultant.</p> <p>8.0 <u>CABLE INSTALLATION AND ACCESSORIES</u></p> <p>8.1 All material and accessories required for cable installation like cable trays, tray covers, support steel, etc., shall be hot dip galvanized. Conduits/pipes shall also be hot dip galvanized steel. The racks/trays, conduits/pipes, trenches required to route the cables to individual equipment shall be supplied and installed by the BIDDER.</p> <p>8.2 Separate trays shall be provided for LV Power (AC&DC)/Control & Instrumentation cables.</p> <p>8.3 After laying all the cables, BIDDER shall dress all cables by clamping at every metre, so that the cables are securely held and aesthetically good.</p> <p>8.4 Cable trays shall be avoided very close to the pipes carrying high temperature steam. When they are inevitable, it shall be laid after OWNER approval and</p>		
		ISSUE R1

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 8 OF 9
<p>suitable insulation material shall be provided between the cable trays and pipes.</p> <p>8.5 1100 V cables up to 120-sq. mm. can be laid in two layers. Control and Instrumentation cables can be laid in three layers.</p> <p>8.6 One spare conduit shall be provided for cable of center / outer drive in clarifier.</p> <p>8.7 Power and control cables for critical / emergency drives / equipment like DC EOP / JOP shall be kept away and routed in separate cable trays</p> <p>8.8 All cable entries to the buildings to be sealed by fire proof & water proof cement after cable installation.</p> <p>8.9 One drum (500m) spare LT power/control of each size of cable shall be included.</p> <p>9.0 <u>CABLE TRAYS AND COVERS</u></p> <p>9.1 All outdoor cable trays are to be provided with covers. All vertical cable tray race ways are to be provided with covers all round. Cable trays shall be of ladder / perforated type complete with all necessary coupler plates, elbows, tees, bends, reducers, stiffeners and other accessories. Cable trays of ladder and perforated types and the associated accessories such as coupler plates, tees, elbows, etc., shall be fabricated from 12 gauge (2.5 mm thick) mild steel sheets. Cable tray covers shall be provided for all cable trays and raceways. The cable tray accessories like trays, elbows, bends, etc., shall be fabricated and galvanized before bringing to site. Cable tray covers shall be fabricated from 16 gauge (1.7 mm thick) MS sheets. All the sheet steel shall be hot dip galvanized.</p> <p>9.2 1100 V rated cables of sizes 120-sq. mm and above shall be laid in single layer. Single core cables used for 3-phase AC power circuits shall be laid in Trefoil form with suitable PVC aluminum clamps to hold the cables.</p> <p>9.3 The sizing of cable trays from TG building to other areas shall consider para 9.2 above an additionally to avoid crowding and criss crossing of cables, especially in boiler area where vertical risers are to be provided for various power, control and instrumentation cables to higher elevations of boiler.</p> <p>9.4 Slotted angles shall not be used for cabling. In all locations smaller size cable trays of 50 mm / 100 mm wide shall be used for one or two cables.</p> <p>10.0 <u>FIRE-PROOF SEALING OF CABLE PENETRATION</u></p> <p>Cables / cable tray openings in walls and floors or through pipe sleeves from one area to another or one elevation to another, between the units and within the same unit, shall be sealed by a fire-proof sealing system. The fireproof sealing system (FPSS) shall effectively prevent the spread of fire from the flaming to the non-flaming side, in the event of a fire. The FPSS shall conform to the following requirements:</p>		
		ISSUE R1

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan CABLE & CABLE CARRIER SYSTEM	SHEET 9 OF 9
<p>(a) FPSS shall have a fire rating of two hours.</p> <p>(b) The FPSS shall be subjected to fire endurance test, hose stream test, temperature measurement of non-flaming side as per ASTM-E119. 'Standard method of fire tests of building construction and materials'.</p> <p>(c) The FPSS will also conform to the in-combustibility test carried out in accordance with IS: 3144-1992.</p> <p>(d) Under fire condition, the FPSS material shall not emit excessive smoke or any corrosive or toxic fumes.</p> <p>(e) FPSS shall have minimum life of 25 years.</p> <p>11.0 FIRE BREAK</p> <p>11.1 Fire break shall be provided by applying a suitable fire-resistant coating on cables for the required length to meet the fire rating of 30 minutes.</p> <p>11.2 Fire break shall be provided at an interval of 15 metres in the straight portion of each of the cable tray above ground, at intervals of 30 metres in cable trenches and at 5M for all vertical trays. All cable inter section and tee offs shall be provided with firebreaks.</p> <p>11.3 When pipe sleeves are provided for cables from outdoor areas to indoor areas, the pipe opening at the outdoor side shall be sealed by fire proof sealing material, which is also continuously waterproof. The indoor side of the pipe opening shall also be sealed by continuous fire proof sealing materials. The duct banks in outdoor areas also need to be sealed by water proof seals. It is necessary to explore possibility of applying waterproof coating on fireproof sealing.</p> <p>12.0 TESTS</p> <p>All routine tests and FRLS tests as per relevant standard shall be performed on each size of cable. If same size is supplied in different lots, inspection shall be done for each lot. If same cable is supplied by different agencies, test shall be carried out on cables supplied by each agency. These tests shall be carried out as per relevant standards as applicable.</p> <p>Routine and acceptance test shall be carried out on FPSS.</p> <p>Type test certificates for type tests conducted on identical design and size of the Cables shall be submitted for review. If type tests have not been done or the certificates are found to be not in order by purchaser then these type tests shall be conducted on Cables to be supplied for this project at no extra cost to Purchaser.</p> <p>13.0 For technical particulars refer datasheet-A.</p>		
		ISSUE R1

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED		VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan DATA SHEET-A CABLE & CABLE CARRIER SYSTEM		SHEET 1 OF 2

Sr. No.	Description	unit	Client specification
1.0	Name of manufacturer		*
2.0	Make of cable		
3.0	Conductor No. core x Size Form- circular/segmented Effective cross sectional area sq. mm		*
4.0	Whether cores identification numbers for cables with 5 cores and above to be provided		Yes
5.0	Whether incremental running lengths are marked on cable		Yes
6.0	Finished cable a) Diameter under armour in mm b) Diameter over armour in mm c) Overall diameter in mm		*
7.0	Cable drums a) Whether cable drums confirm to IS : 10417 b) Length of cables in drum & tolerance c) Weight of cable drum without cables d) Weight of cable drum with cables e) Type of end sealing		*
8.0	FRLS cables a) Critical oxygen index value at 250 deg C when tested for temperature index test as per ASTM-		Ref. Clause 2.3

REV. NO.	R0	R1	JOB NO. TCE - 5750A	CLIENT : RRVUNL PROJECT : 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan
PPD. BY :	UM	SK		
CKD. BY :	MSVM	MSVM		
DATE	NOV'2009	JUN'2012		

SPEC. NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME IV SECTION: D16
PART B	RRVUNL, 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan DATA SHEET-A CABLE & CABLE CARRIER SYSTEM	SHEET 2 OF 2

Sr. No.	Description	unit	Client specification
	<p>D-2863</p> <p>b) Total acid gas generation by weight when tested as per IEC – 754-1 in %</p> <p>c) Percentage of light transmission under fire for assessment of smoke generation when tested as per ASTM – D – 2843-77</p> <p>d) Will the cables offered against this specification pass the flammability tests as per</p> <p>1) Class – F3 – Swedish standard S5-424- 1475</p> <p>2) IEC 60332 – 1C</p> <p>3) IEC 60331 – 1</p>		
9.0	Maximum dielectric loss of cable per KM at normal voltage and frequency	Watt/km	*
10.0	Short circuit capability for 1 Sec (HT & LT Power Cable)	kA rms	Minimum 40kA and 50 kA for HT and LT respectively and shall be in line with requirements of the switchgear and protection.
11.0	Maximum dielectric stress at core screen	KV/cm	*
12.0	Max. overall diameter of cables	mm	*

‘*’ indicated above shall be filled by BIDDER.

REV. NO.	R0	R1	JOB NO.	CLIENT : RRVUNL
PPD. BY :	UM	SK	TCE -	
CKD. BY :	MSVM	MSVM	5750A	
DATE	NOV'2009	JUN'2012		PROJECT : 2 x 660 MW Super-Critical TPS, Stage- V, Units 7 & 8, at Suratgarh, Rajasthan



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-392-165-N003

VOLUME : IIB

SECTION : D

REV. NO. 0

DATE :22.04.14

SHEET 1 of 1

SECTION C3
SELF CLEANING STRAINERS
C&I DETAILS

C&I SCOPE MATRIX FOR SCS - 2X660 MW SURATGARH PROJECT

S.NO.	PROJECT	SURATGARH
1.00	SYSTEM	SCS
2.00	COMMON / PER UNIT	REFER NOTE -03
3.00	CONTROL SYSTEM	DCS (STN C&I)
3.10	PROCESSOR CONFIGURATION FOR PLC SYSTEM	NA
4.00	LOCATION OF CONTROL SYSTEM	CCR
4.10	CONTROL SYSTEM SCOPE (BIDDER/ BHEL/ CUSTOMER)	BHEL
5.00	HARDWIRED INTERFACE WITH DCS (Y/N)	NA
6.00	SOFTLINK TO DCS (Y/N)	NA
7.00	CONTROL FROM PB's ON LCP	NA
8.00	ACTUATOR WITH INTEGRAL STARTER (Y/N)	N
9.00	ANNUNCIATION ON LCP (Y/N) -- IF Y, MIN NO. OF HARDWIRED ALARMS / INDICATIONS	NA
9.10	MIMIC ON LCP (Y/N)	NA
10.00	CONTROL FROM DCS IN CCR (Y/N)	Y
11.00	TYPE OF SOFTLINK (TP/OFC)	NA
12.00	SIZE OF OWS/ CRT OR LCD	NA
13.00	NO. OF PRINTER	NA
14.00	POWER SUPPLY AVAILABLE FOR BALL MONITOR (24V DC / 110 V AC UPS / 230 V AC UPS)	240 V AC UPS
14.10	REDUNDANT FEEDERS (R) / NON-REDUNDANT (NR) FEEDERS FOR POWER SUPPLY	R
15.00	PG/ DPG/ PS/ DPS/ PT/ DPT per Balls Collecting Strainer 	DPT = 02no DPG= 1 no. (ACROSS EACH)

16.00	<p>NOTES:</p> <ol style="list-style-type: none"> THE ABOVE SCOPE IS APPLICABLE FOR SCS (DCS CONTROLLED SYSTEMS). BIDDER TO TERMINATE ALL INSTRUMENTATION AND CONTROL ELEMENTS IN JUNCTION BOXES FOR FURTHER CABLING TO DCS BY BHEL/CUSTOMER. BIDDER TO PROVIDE INPUT/OUTPUT LIST, DRIVES LIST, JUNCTION BOX SCHEDULE AND TERMINATION DETAILS, RECOMMENDED CONTROL LOGICS / WRITE-UP ETC. DURING DETAILED ENGINEERING FOR SCS 2 SETS OF SCS SHALL HAVE ONE COMMON STARTER PANEL (SWITCH GEAR PANEL). COLOUR OF STARTER PANEL SHALL BE AS PER IS-5 SHADE 631 OR EQUIVALENT.THIS SHALL BE DECIDED DURING DETAIL ENGINEERING INSTRUMENT RACK AND JUNCTION BOXES SHALL BE IN BIDDER'S SCOPE OF SUPPLY. BIDDER TO FURNISH ELECTRICAL LOAD DATA DURING DETAILED ENGINEERING. BIDIRECTIONAL VALVES ARE NON-INTERGRAL STARTER TYPE.
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LEGEND:

DCS- DISTRIBUTED CONTROL SYSTEM

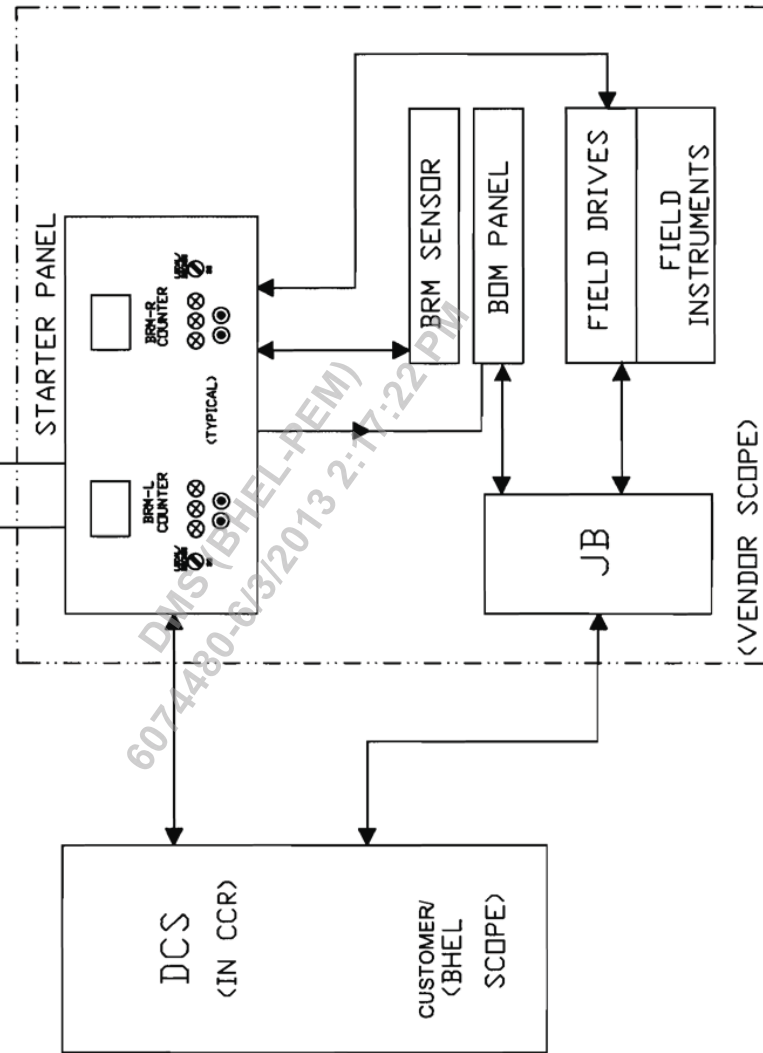
SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION : D5.4
Package: EPC	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT SPECIFICATION FOR INSTRUMENTATION & CONTROL EQUIPMENT	SHEET 1 OF 42
<p>1.0 SPECIFICATIONS FOR INSTRUMENTS TO BE SUPPLIED ARE AS FOLLOWS.</p> <p>1.1 Pressure Indicators/DP indicators</p> <p>Direct reading, pipe mounted Pressure gauges of die-cast aluminium body, with 6 inch(150mm) phenolic dial (white dial with black numerals), 316 SS/304 SS Bourdon tube for high pressure application and 316SS Diaphragm/bellow for low pressure applications, AISI 304 movements and micrometer type adjustable aluminium pointer an accuracy of +/-1.0% of span including accessories like siphons for steam services, snubbers for pump discharge applications and chemical diaphragm for corrosive and oil services and name plate, etc. Material of accessories shall be SS. IP65 or equivalent degree of protection for enclosure. Over range protection shall be 50% above maximum pressure. Armoured capillary of 10 M shall be provided as required. Process connection shall be 1/2"NPT (F).</p> <p>1.2 Pressure Switches/DP Switches</p> <p>Non indicating type, field mounted Pressure Switches of aluminium casing (epoxy coated), and 316 SS element and repeatability of +/-1% of span, including accessories like siphons for steam services, snubbers for pump discharge applications and chemical diaphragm for corrosive and oil services, name plate & mounting brackets. Material of accessories shall be SS. Auto reset micro switch with internal adjustment for set values with 2 SPDT contacts rated for 0.2 A at 220 V DC. IP 65 or equivalent degree of protection for enclosure. Over range protection 50% above maximum pressure. Scale for setting shall be provided. Piston actuated for high pressure applications and diaphragm/bellows for low pressure/vacuum. Process connection 1/2" NPT (F).</p> <p>1.3 Pressure Transmitters/DP Transmitters/Flow transmitters(DP type/Level transmitters/DP type (SMART))</p> <p>Micro-processor based 2 wire indicating type (LCD display), rack mounted with accuracy of +/-0.075% of span, external zero and span adjustment, self diagnostics, temperature sensor for compensation. Power supply 24 V DC; output signal of 4-20 mA DC. IP 65 or equivalent degree of protection. Aluminum housing with epoxy coating, Accessories like snubbers for pump discharge applications and chemical diaphragm. 10 m PVC covered SS armoured capillary for corrosive and oil services, three way manifold, nameplate etc. Material for accessories shall be SS. Turn down ration 30:1. Load impedance 700 ohm (min).Process connection-1/2"NPT (F). 2 valve manifold for absolute pressure, 3 valve manifold for gauge/vacuum and 5 valve manifold for DP/level/flow measurements. For HFO, LFO applications, SS capillary with ANSI RF flanged ends shall be provided.</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION : D5.4
Package: EPC	RRVUNL, 2 x 660 MW, Super-Critical TPS, Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT SPECIFICATION FOR INSTRUMENTATION & CONTROL EQUIPMENT	SHEET 7 OF 42
<p>coloured LCD or fluorescent tube with user selectable span; programmability (selection of input & scan/storage rate) shall be through Front panel keyboard; the recorder shall have the capability of being drawn out from the front side of the housing for maintenance and shall have electrical connection of plug-in type; material of casing shall be die-cast aluminium with epoxy coating and with a non-glare shatter proof Glass; enclosure shall be IP32 The quantity of Hybrid recorders shall be 4 nos.</p> <p>1.21 Pressure and Differential Pressure Transmitter Racks</p> <p>Open type transmitter racks to mount all pressure, differential pressure and flow transmitters with vibration dampener: air supply lines and header shall be provided with bulk head fittings to receive impulse lines; Also provided with blow down/drain header. The material of accessories shall be SS. Drains shall be connected upto suitable Owner / Project Manager's drain header. The quantity shall be as required for the specified Pressure and Diff. Pressure transmitter.</p> <p>1.22 Junction Boxes (JB)</p> <p>All JB's shall be Galvanised. Wall/column mounted junction boxes having 32 (2x16) terminals and cable entry only at the bottom and sealed with fireproof compound; Screwed terminal type; IP 65 or equivalent degree of protection for enclosure. Separate terminal blocks shall be used for analog and digital signal and also for signals with different voltages. Removable gland plate shall be supplied. JB shall have single lockable door with gasket, able to open side ways, with common keys. Painting inside shall be glossy white & outside - IS-5 shade 631. Shield bus for screw connection shall be provided. Terminal size shall be suitable for 0.5 sq.mm to 2.5 sq.mm wire. Terminal blocks shall be vertical. JB shall have provision to add 10% additional terminals. Accessories like metal tag (SS), clamps, fixtures, bolts (SS), nuts (SS), gaskets (neoprene), lock & key, fireproof compound for sealing, etc. shall be supplied. The grouping of instruments in JB's is subject to Owner / Project Manager's approval. All the field Junction boxes shall have single doors and provision for locking. The doors shall not have screwed type of locking, but turnable hinge based. The JB's are subject to approval prior to manufacturing All JB's shall be provided with individual canopies to avoid ingress of water. All the TB's used shall be 6.6polymide to withstand corrosion and the metallic portion shall be coated against rust / corrosion.</p> <p>1.23 Programmable Logic controller (PLC)-Refer Cl.no. 9.0 & Table-15</p> <p>1.24 Interposing Relays (IPR)</p> <p>Electro magnetic type IPRs with plug-in type connections, suitable for channel/rail mounting in cabinets; coil rating 24V D.C; 2 set of silver plated Change over contacts rated for 0.2A 220 V DC. Freewheeling diode across relay coil (copper) and self reset type status indicator flag (electronic) shall be provided. All relays</p>		
		ISSUE R1

STANDARD BLOCK DIAGRAM FOR SCS PACKAGE WITH DCS CONTROL

415V AC, 3P, 4WIRE
REDUNDANT FEEDER (BY CUSTOMER/BHEL)

CONFIGURATION A:
WITH STARTER PANEL IN VENDOR SCOPE



PE-DG-999-145-I274A(a)



TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)

SPEC. NO. PE-TS-392-165-N003

VOLUME : IIB

SECTION : D

REV. NO. 0

DATE :22.04.14

SHEET 1 of 1

SECTION – D

STANDARD TECHNICAL SPECIFICATION

SECTION D1 : SELF CLEANING STRAINERS

SECTION D2 : ELECTRICAL SYSTEMS

SECTION D3 : C&I SYSTEM



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-392-165-N003

VOLUME : IIB

SECTION : D

REV. NO. 0

DATE :22.04.14

SHEET 1 of 1

SECTION D1

STANDARD TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINERS



**TITLE : TECHNICAL SPECIFICATION
FOR MOU
SELF CLEANIGN STRAINER (SCS)**

SPEC. NO. PE-TS-XXX-165-N001

VOLUME : III

SECTION :

REV. NO. 0

DATE : 12.06.2012

SHEET 1 of 1

SECTION D1

STANDARD TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINER

DMS (BHEL-PE-XXX-165-N001)
6169430-2014/04/12

	TITLE :	SPEC. NO. PE-TS- 999-165-N002
बि.एस.एम.	STANDARD TECHNICAL SPECIFICATION	VOLUME : II B
	SELF - CLEANING FILTERS	SECTION : D
		REV. NO. 0 DATE : 02.12.2009
		SHEET 1 OF 10

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 Self-cleaning 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 self-cleaning 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 self cleaning filter shall be supplied.

3.01.02 The self-cleaning 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.

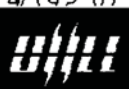
3.01.03 Suitable corrosion allowance shall be provided wherever necessary.

3.01.04 Unless otherwise specified in Data Sheet-A, the inlet and outlets of the filter shall be co-axial without any off set between the centre lines of inlet and outlet pipes.

3.02.00 Performance Requirements

The self-cleaning filter with all accessories shall be designed and guaranteed to meet the following requirements :-

3.02.01 The self - cleaning 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,

	TITLE :	SPEC. NO. PE-TS- 999-165-N002
वि.सं.सं.	STANDARD TECHNICAL SPECIFICATION	VOLUME : II B
	SELF - CLEANING FILTERS	SECTION : D
		REV. NO. 0 DATE : 02.12.2009
		SHEET 2 OF 10

wood pieces etc. The performance of the filter shall be continuous with minimum number of flushing / backwashing operations.

3.02.02 The self-cleaning filter shall be designed such that the pressure drop across the filter (i.e., between inlet and outlet connections) under clean conditions and partially (50%) choked 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%) choked condition.

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

3.03.00 Operational Requirement

The self-cleaning 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
- ◆ 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 self-cleaning filter housing/body shall be designed and manufactured as per the applicable codes for pressure vessels. However in no case thickness of housing/ body shall not be less than connecting pipe thickness as specified in Data Sheet-A. It shall house the filter section / screen assembly and shall have flanged inlet, outlet, flushing / debris discharge openings and pressure measuring tapings etc.

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

3.04.03 The filter shall be provided with inspection hole with bolted cover.

	TITLE :	SPEC. NO. PE-TS- 999-165-N002
	STANDARD TECHNICAL SPECIFICATION	VOLUME : II B
	SELF - CLEANING FILTERS	SECTION : D
		REV. NO. 0 DATE : 02.12.2009
		SHEET 3 OF 10

3.04.04 The 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 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 filter section shall not be more than that specified in Data Sheet-A.

3.05.03 The arrangement of the filter section shall be such that there shall be no forced accumulation of debris.

3.06.00 **Differential Pressure Measuring System**

3.06.01 The self-cleaning 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 separate differential pressure transmitter for normal automatic flushing operation and separate DP Switch as a backup in the event of DPT failure, a differential pressure gauge for manual observation with adequate no. of tapplings with isolating valves and equalizing valves.

3.06.02 The contacts for differential pressure transmitter, differential pressure switch 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 also be equipped with built in flushing arrangement consisting of flushing pump, valves and associated piping, to prevent blockage of the system with any debris. Unless otherwise specified in Section C, water required for flushing the differential pressure measuring system shall be taken from downstream side of the strainer/ screen.

3.07.00 **Flushing / Backwash Unit. :**

3.07.01 The self-cleaning 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 from pump glands.

3.07.3 The flushing backwash unit shall be either fixed type with actuator operated

	TITLE :	SPEC. NO. PE-TS- 999-165-N002
वि. एच. डी. एम.	STANDARD TECHNICAL SPECIFICATION	VOLUME : II B
	SELF - CLEANING FILTERS	SECTION : D
		REV. NO. 0 DATE : 02.12.2009
		SHEET 4 OF 10

flushing valves or electric motor driven (through reduction gear) backwash rotor. In case of backwash rotor, it shall be fitted with removable shoes for smooth and close running contact with the filter section/screen and to prevent the unfiltered water from bypassing to waste.

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 with necessary pump, valves and piping for water injection supplied by the bidder.

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. The debris discharge/backwash outlet valve shall be larger than the debris discharge/backwash outlet pipe.

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 self-cleaning 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 Other Accessories.

3.10.01 Counter flanges, flat faced slip on type, 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.

3.10.02 Self-cleaning filter shall be provided with suitable lifting arrangement for handling during erection and maintenance.

3.10.03 Necessary supporting arrangement (wherever applicable) complete with foundation plates, bolts, nuts etc., shall be provided.

	TITLE :	SPEC. NO. PE-TS- 999-165-N002
	STANDARD TECHNICAL SPECIFICATION	VOLUME : II B
	SELF - CLEANING FILTERS	SECTION : D
		REV. NO. 0 DATE : 02.12.2009
		SHEET 5 OF 10

3.11.00 Material of Construction

Material of self-cleaning filter and other accessories shall be corrosion resistant and consistent with the fluid handled. However material specification for various components shall be equal or superior to those specified in Data Sheet-A.

4.00.00 PAINTING

4.01.00 The surface preparation of the filter housing / body and other parts shall be done as per the standard mentioned in Data Sheet-A and shall include the following :

- a) Removal of oil, grease, dirt and swarf etc.
- b) Removal of rust and scale etc.
- c) Sand blasting/shot blasting.

4.02.00 All internal surfaces of the filter which are subject to immersion or water spray and which are not made of stainless steel or other corrosion resistant materials after surface preparation, shall be coated with adequate coats (minimum 200 to 250 microns thick) of epoxy paint of approved make and quality over a coat of zinc chromite primer, unless otherwise specified in Data sheet-A.

4.03.00 The external surfaces of the filter and other accessories after surface preparation, shall be coated with adequate coats (minimum 175 to 200 microns thick) of synthetic enamel paint of approved make and quality over two coats of red oxide primer, unless otherwise specified in Data Sheet-A.

5.00.00 SHOP INSPECTION AND TESTS


5.01.00 General :

5.01.01 Manufacturer shall conduct all tests and stage inspections as per the approved quality plan to ensure that the self-cleaning filter and other accessories shall conform to the requirements of this specification and of the applicable codes/ standards.

5.01.02 All materials used for manufacture/fabrication of the 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.

5.01.03 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.

5.01.04 Qualification of welding procedures and welders shall be as per ASME B&PV

	TITLE :	SPEC. NO. PE-TS- 999-165-N002
	STANDARD TECHNICAL SPECIFICATION	VOLUME : II B
	SELF - CLEANING FILTERS	SECTION : D
		REV. NO. 0 DATE : 02.12.2009
		SHEET 6 OF 10

- Code, Section-IX / applicable codes.
- 5.02.00 **Filter Housing / Body**
- 5.02.01 Chemical analysis, mechanical tests shall be carried out on housing/body material.
- 5.02.02 All butt welded joints shall be subjected to radiographic / ultrasonic testing as per applicable codes. However all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.
- 5.03.00 **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.
- 5.04.00 **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.
- 5.05.00 **Flushing / Backwash Unit**
- 5.05.01 Material of various components of the flushing/Backwash Unit shall be tested for chemical and mechanical properties.
- 5.05.02 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.
- 5.06.00 **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.
- 5.07.00 **Flanges**
- 5.07.01 In case of fabricated flanges, all the welds shall be subjected to 100% radiography as per ASME B&PV code, section VIII, Division-1.
- 5.07.02 In case of forged flanges, ultrasonic testing shall be carried out as per ASTM-E 388.
- 5.07.03 If the thickness of the plate used for flanged is 40mm or more the same shall be checked ultrasonically as per ASTM-A 435 to demonstrate the absence of lamination and lack of fusion etc.
- 5.07.04 Chemical and mechanical test certificates shall furnish for flange materials.
- 5.07.05 Flanges shall be checked for edge preparation, fit up and satisfactory working with

	TITLE :	SPEC. NO. PE-TS- 999-165-N002
वि.सं. ११	STANDARD TECHNICAL SPECIFICATION	VOLUME : II B
	SELF - CLEANING FILTERS	SECTION : D
		REV. NO. 0 DATE : 02.12.2009
		SHEET 7 OF 10

5.08.00 matching parts.
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.

5.09.00 **Dimensional Checks**

Dimensional checks of various components of the filter shall be carried out as per the drawings approved by BHEL.

5.10.00 **Hydrostatic Test**

Hydrostatic test shall be conducted on the filter housing/body at a pressure of 2 times the design pressure. The duration of the test shall be minimum 30 minutes.

5.11.00 **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.

5.12.00 **Functional Tests**

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

5.12.01 Smooth and free operation of all movable parts.

5.12.02 Interlocks and sequential operation.

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


6.00.00 **TESTING AT SITE**

After completion of installation at site, the self cleaning 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.

7.00.00 **PERFORMANCE GUARANTEE**

7.00.00 **PERFORMANCE GUARANTEE & Bid evaluation criteria**

The Self cleaning strainer shall be guaranteed to meet the performance requirements specified in Section-D , Data Sheet A and Guarantee schedule and also for trouble free operation after commissioning. Schedule of performance guarantees (enclosed in

	TITLE :	SPEC. NO. PE-TS- 999-165-N002
	STANDARD TECHNICAL SPECIFICATION	VOLUME : II B
	SELF - CLEANING FILTERS	SECTION : D
		REV. NO. 0 DATE : 02.12.2009
		SHEET 8 OF 10

Volume III) duly filled and signed shall be furnished with the bid.

The Performance guarantees of equipments shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Customer. If the guarantee period specified in the Commercial Specification is higher, same shall prevail.

- 7.01.00 Performance Guarantee Parameters shall be as under :
- Pressure drop in Self cleaning strainer in clean condition viz. after backwashing.

- 7.02.01 Bidder to note that bids shall be evaluated on account of pressure drop across Self cleaning strainer (in clean condition) & liquidated damages on account of not meeting the same shall be in accordance with following :

A) Bid Evaluation Criteria and Liquidated Damages:

The bids received shall be evaluated for Pressure drop across Self cleaning strainer:

- The permissible limit of pressure drop across Self cleaning strainer in clean condition shall be 0.6 MWC.
- If the pressure drops quoted are higher than above limit, the bids shall be technically loaded @ Rate as mentioned in Data Sheet-A for respective projects per 1 MWC pressure drop (viz. per unit).
- However no advantage shall be given for pressure drops quoted less than above permissible limit.
- The maximum acceptable limit for pressure drop across self cleaning strainer (with technical loadings) shall be 1.0 MWC

The bids will be technically rejected for pressure drops quoted higher than above maximum limit.

- The guaranteed pressure drops shall be demonstrated at site by vendors and if found higher shall be subject to LD @ twice the bid evaluation factor as above.


8.00.00 QUALITY ASSURANCE & QUALITY PLAN

- 8.01.00 The self - cleaning filter and other accessories to be supplied shall have assured quality and workmanship.

- 8.02.00 Typical quality plans (Q.P. No. PEM-MSE-SQP-07) 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.

9.00.00 NAME PLATE AND TAG NUMBERS

- 9.01.00 The filter shall be provided with a permanently attached brass or stainless steel plate indicating the following details:-

	TITLE :	SPEC. NO. PE-TS- 999-165-N002
बी एच ई एल	STANDARD TECHNICAL SPECIFICATION	VOLUME : II B
	SELF - CLEANING FILTERS	SECTION : D
		REV. NO. 0 DATE : 02.12.2009
		SHEET 9 OF 10

- a) Design flow
- 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

9.02.00 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) Engineer's Tag Number

Tag numbers will be indicated on the drawing submitted for approval during contract stage.

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

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

10.00.00 **DRAWINGS, DATA & INFORMATION TO BE SUBMITTED WITH THE BID**

The bidder shall furnish the following drawings, data and information alongwith the bid without which the offer will be deemed incomplete.


10.01.00 Data sheet-B with all particulars / data duly filled in.

10.02.00 General arrangement / installation drawings of the self-cleaning filter with all accessories, incorporating the principal dimensions and weights of equipment offered, size and location of various nozzle connections, supporting arrangement (if applicable) and scope of supply etc.


10.03.00 Cross-sectional / detailed drawings of filter housing / body, filter section / screen assemblies, flushing / backwashing unit, differential pressure measuring system, actuators, motors, control panel etc., indicating bill of quantities and materials of construction.

10.04.00 Flow and control logic diagrams for complete filter during normal and flushing / backwashing operations.

10.05.00 Performance evaluation procedure at site.

	TITLE :	SPEC. NO. PE-TS- 999-165-N002
	STANDARD TECHNICAL SPECIFICATION	VOLUME : II B
	SELF - CLEANING FILTERS	SECTION : D
		REV. NO. 0 DATE : 02.12.2009
		SHEET 10 OF 10

- 10.06.00 Control panel layout and list of instruments provided on control panel.
- 10.07.00 List of annunciations, protections and interlocks provided.
- 10.08.00 Write-up on operation, control, monitoring, interlocks and protection of filter.
- 10.09.00 Manufacturer's descriptive and illustrative literature on the equipments / components being offered.
- 10.10.00 A detailed experience list about the successful installations of similar equipment of equal or higher inlet / outlet sizes and flow capacities for similar application.
- 10.11.00 A comprehensive write-up on the testing facilities, tests to be conducted inspection methods and QA system adopted by the manufacturer.
- 10.12.00 Quality plan for the self-cleaning filter and for all its accessories.
- 11.00.00 **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.

	TITLE :	SPECIFICATION NO. PE-TS-317/326-165-N002	
	DATA SHEET - C	VOLUME : II - B	
	SELF - CLEANING FILTER	SECTION : D	
	(Backwash Type)	REV. NO. 02	DATE : 02.12.2009
		SHEET 1 OF 2	

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 as per the distribution schedule given in Section -C.

1.01.00 Within 3 (three) weeks of the date of LOI, the following shall be submitted :

1.01.01 Data Sheet -B duly revised conforming to accepted bid.

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 self-cleaning 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 **With in 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.

1.02.02 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 annunciators, protections and interlocks provided.


	TITLE :	SPECIFICATION NO. PE-TS-317/326-165-N002
	DATA SHEET - C	VOLUME : II - B
	SELF - CLEANING FILTER	SECTION : D
	(Backwash Type)	REV. NO. 02 DATE : 02.12.2009
		SHEET 2 OF 2

- 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.


DMS (BHEL-PEM)
6169430-2013/07/04


<div><div><div>સાવિત્રી</div><div>SAVITRI</div></div></div>		TITLE : DATA SHEET – A2 OR SEL CLEANING STRAINERS SCS		SPECIFICATION NO. SPEC. NO. PE-TS-392-165-N003	
				VOLUME : II B SECTION : D	
				REV. NO. 00 DATE : 22.04.14	
				Page 1 of 9	
S. No.		DESCRIPTION	UNITS	2X660MW Suratgarh STPP	
1.0	GENERAL				
1.1	Type of Strainers/ Filters		-	Self Cleaning Strainers	
1.2	No. of Strainers/ Filters required		Nos.	Total 4 Sets for 2 units viz. i.e.(1 Working + 1 Standby) per unit	
1.3	Inlet connection		mm Nb	700	
1.3	Outlet connection		mm Nb	700	
1.4	Filter type/ duty		-	On line / continuous	
1.5	Location		-	ACW Pump discharge Header (Outdoor)	
1.6	Liquid handled		-	Clarified Water as per analysis attached in Project information in section-B	
2.0	DESIGN DATA				
2.1	Operating pressure		Bar (g)	3.5 to 4.5	
2.2	Design pressure		Kg/cm ²	7	
2.3	Design temperature		Deg. C	60	
2.4	Flow rate through filter				
	a) Normal			3100	
	b) Maximum			4030	


<div></div>		TITLE :		DATA SHEET – A2 OR SEL CLEANING STRAINERS SCS		SPECIFICATION NO. SPEC. NO. PE-TS-392-165-N003	
						VOLUME : II B SECTION : D	
						REV. NO. 00 DATE : 22.04.14	
						Page 2 of 9	
S. No.		DESCRIPTION		UNITS		2X660MW Suratgarh STPP	
2.5	Design differential pressure for filter section/ screen	Bar (g)	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				
2.7	Differential pressure measuring system set pressure <ul style="list-style-type: none">For initiating flushing/ backwashingFor alarm/ annunciation	mbar mbar	110 160				
2.8	Filter section/ screen perforation size	mm	2 mm (Max)				
2.9	Free flow area in the screen basket	-	At least 120 % of pipe inlet area				
3.0	GUARANTEED PERFORMANCE REQUIREMENT						
3.1	Pressure drop across the filter (i.e. between inlet and outlet connection) at normal flow	-					


<div>  </div>		TITLE : DATA SHEET – A2 OR SEL CLEANING STRAINERS SCS		SPECIFICATION NO. SPEC. NO. PE-TS-392-165-N003	
S. No.		DESCRIPTION	UNITS	VOLUME : II B SECTION : D REV. NO. 00 DATE : 22.04.14 Page 3 of 9 2X660MW Suratgarh STPP	
		a) Clean condition	mbar	Refer Section – C of specification	
		b) Partially (50%) choked condition	mbar		
3.2		Debris discharge flow during flushing period	Cub m/ Hr.	Not to exceed 2.5% of total flow rate	
4.0		MATERIALS OF CONSTRUCTION			
4.1		Filter body/ housing	-	IS:210 Gr. FG 260 or ASTM –A-515 Gr. 75/IS:2062 with epoxy painted inside	
4.2		Filter screen/ section	-	SS-316	
4.3		Shaft	-	SS-316	
4.4		Supporting cage	-	SS-316	
4.5		Differential measuring system	-	SS-316	
4.6		Flushing/ backwashing unit	-	SS-316	
4.7		Backwash rotor shoes	-	Neoprene	
4.8		Any other internal hardware /pipes etc.	-	SS-316 or eq.	

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		VOLUME : II B SECTION : D	
		REV. NO. 00 DATE : 22.04.14	
		Page 4 of 9	
S. No.	DESCRIPTION	UNITS	2X660MW Suratgarh STPP
4.9	Valves	-	
4.9.1	Check Valves (all sizes)		
	a) Body & Bonnet	-	CI, IS 210 Gr. FG 260/ BS 1452 Gr. 14, Flanged ends
	b) Seating surface & rings	-	13% Chromium Steel
	c) Disc for Check Valve	-	CI, IS 210 Gr. FG 260/ BS 1452 Gr. 14
	d) Hinge Pin for Check Valve	-	AISI - 316
	e) Backseat for check valve		13% Chromium Steel
4.9.2	Globe Valves 50 Nb & Below		
	Body, Bonnet & trim		SA 351 CF8M (SS-316)
4.9.3	➤ BF Valves (65 Nb & above)		
	➤ Body & Disc		2% Ni CI as per IS 210, FG 260B, epoxy coated
	➤ Shaft		AISI SS 410/ BS 970 431 S-291
	➤ Seal		Nitrite Rubber
	➤ Sealing, Retaining segment & internals		18-8-SS
	➤ Bearings		Self Lubricating
	➤ Companion Flange		CS:IS 2062, Gr. B

TITLE :		DATA SHEET – A2 OR SEL CLEANING STRAINERS SCS		SPECIFICATION NO. SPEC. NO. PE-TS-392-165-N003	
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				SECTION : D	
				REV. NO. 00 DATE : 22.04.14	
				Page 5 of 9	
S. No.	DESCRIPTION	UNITS	2X660MW Suratgarh STPP		
	C) Ball valves i) Body ii) Ball iii) Stem		SA 351 CF8M SA 351 CF8M SS 316		
4.10	Piping	-	By Bidder		
	Material a) upto 150 Nb		• Carbon steel ERW, IS:1239 (Heavy Grade)		
	a) 200 Nb and above		• carbon steel (IS:2062), Rolled & Welded confirming to IS:3589		
5.0	COUNTER FLANGES		In Bidder's Scope		
5.1	Material				
	Flanges		IS 2062, Gr. B, epoxy painted		
5.2	Drilling Standard	-	BS 4504 or equivalent		
6.0	Connecting pipe size (OD & Thk)	mm	711 X 10		
7.0	PAINTING				
7.1	External Surface	-			
	a) Surface preparation	-	SA 2.5 of Swedish Specification SIS 05.5900.197		


		TITLE : DATA SHEET – A2 OR SEL CLEANING STRAINERS SCS		SPECIFICATION NO. SPEC. NO. PE-TS-392-165-N003	
				VOLUME : II B SECTION : D	
				REV. NO. 00 DATE : 22.04.14	
				Page 6 of 9	
				2X660MW Suratgarh STPP	
S. No.	DESCRIPTION	UNITS			
	b) Primer		Epoxy based Zinc Phosphate		
	Intermediate		Epoxy based TiO2 pigmented coat		
	c) Final paint d)		Synthetic enamel paint to achieve DFT of 175 to 200 microns. Colour code shall be as per IS-1904 (Appendix-A)		
7.2	Internal Surface				
	a) Surface preparation		SA 2.5 of Swedish Specification SIS 05.5900.197		
	b) Primer		One coat of epoxy resin based primer		
	c) Final paint		Applicable no. Of coats of coal tar epoxy paint to achieve total DFT of 200 to 250 microns		
8.0	SHOP TEST				
8.1	Hydrostatic test				
	a) Test Pressure	bar (g)	1.5 times design pressure		
	b) Test duration	min.	30		
8.2	Leakage test				
	a) Test Pressure	bar (g)	Design Pressure		
	b) Test duration	min.	30		
# Bidder to note that electrical power supply shall be provided by purchaser based on electrical load list of bidder furnished at tender stage and any changes or additional requirement of electrical load by bidder during contract stage shall be provided by BHEL(purchaser) with cost repercussions to the bidder					

TITLE : <div></div>		DATA SHEET – A2 OR SEL CLEANING STRAINERS SCS		SPECIFICATION NO. SPEC. NO. PE-TS-392-165-N003	
				VOLUME : II B SECTION : D	
				REV. NO. 00 DATE : 22.04.14	
				Page 7 of 9	
		2X660MW Suratgarh STPP			
S. No.	DESCRIPTION	UNITS	2X660MW Suratgarh STPP		
9.0	Adequate provision for future installation of cathodic protection required				
10.0	Flow straightener for streamlining the ACW flow in SCS				
11.0	Performance Guarantee & Bid Evaluation				
11.1	Performance Parameters to be Guaranteed				
	❖ Pressure drop SCS				
11.2	Bid evaluation Criteria & Liquidated damages				
11.3	Bid evaluation rate				
11.4	Liquidated damages				
12.0	Whether automatic flushing/ back- washing operation effected by the following :				
	i. Differential pressure ii. Adjustable timer iii. Push button				
			If required as per bidder's design – the same to be incorporated by bidder in its constructional feature.		
			As per Guarantee schedule of bidder		
			As per clause no. 8.00.00 of section C1		
			@ Rs 3.0 Lacs per 0.1 MWC pr. Drop across each SCS		
			Twice the bid evaluation rate		
			YES		
			YES		
			YES		

<div>  </div>		TITLE :		SPECIFICATION NO. SPEC. NO. PE-TS-392-165-N003	
		SEL CLEANING STRAINERS SCS		VOLUME : II B SECTION : D	
				REV. NO. 00 DATE : 22.04.14	
				Page 8 of 9	
S. No.		DESCRIPTION	UNITS	2X660MW Suratgarh STPP	
13.0		Whether provision for manual flushing / backwashing operation is made in the event of control system failure.		YES	
14.0		Whether built in flushing arrangement complete with flushing pump, valves, and associated piping, is provided.		YES (if required)	
15.0		Mandatory Spare to be supplied under this specification			
15.1.		Mandatory Spares (C&I Items)			
		Field Instruments/ Elements /Equipment (Gauges, Switches, transmitters etc.)		Quantity for both units	
1		Local gauges (including PG, DPG etc.)		10 %For each type,size and range or minimum 2 No. whichever is higher.	
2		Field Switches (including PS, DPS etc)		10 % For each type,size and range or minimum 2 No. whichever is higher.	
3		Transmitters (incl PT, DPT etc.)		10 % For each type,size and range or minimum 2 No. whichever is higher.	
4		Junction Box		10 % For each type,size and range or minimum 2 No. whichever is higher.	
5		Panels, local panels, System/Marshalling cabinets			
5.1		Fuses		100 Nos. of each type and rating	

<div><div><div>ગુજરાત સર્વોચ્ચ</div><div>મહાવિદ્યાલય</div></div><div><div>મહાવિદ્યાલય</div><div>મહાવિદ્યાલય</div></div></div>		TITLE : DATA SHEET – A2 OR SEL CLEANING STRAINERS SCS		SPECIFICATION NO. SPEC. NO. PE-TS-392-165-N003	
				VOLUME : II B SECTION : D	
				REV. NO. 00 DATE : 22.04.14	
				Page 9 of 9	
S. No.		DESCRIPTION	UNITS	2X660MW Suratgarh STPP	
5.2		Miniature Ckt.Breaker(MCB)		20 Nos. of each type and rating	
5.3		Male/Female parts of pre-fabricated cables		12 Nos. of each type	
5.4		Space Heater		10 % For each type,size and range or minimum 2 No. whichever is higher.	
5.5		Smoke detector		10 % For each type,size and range or minimum 2 No. whichever is higher.	
5.6		Terminal Blocks		20 % of total quantity	
5.7		Terminals in Terminal blocks		20 Nos. of each type	
5.8		Cable clamps		10 Nos. of each type	
5.9		Blowers		2 No	
5.10		Cabinet Cooling Fans		8 Nos. of each type/rating	
Note: Wherever % is indicated for mandatory spares, the quantity shall be calculated for % of supply for total quantity for 2 units of 2x660 MW Suratgarh, unless otherwise specified. The quantity to be reckoned for % indicated shall 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 it is 5.1 then quantity supplied shall be 6.					
15.2		Mandatory Spares (Electrical Items)			
1		LT Motors(AC/DC)		Quantity for both units	
1.1		Motor		1 No of each type	
1.2		Bearings		1 Set of each type	
1.3		Cooling fan		3 Nos. of each type	

Pipe Size Table (Refer Cl. No. 6.2, Section C1, Vol-IIB)		
NB	Pipe CS	Thick
	OD	
15	21.80	3.2
25	34.20	4.0
50	60.80	4.5
100	115.00	5.4
150	166.50	5.4
200	219.10	6.3
250	273.00	6.3
300	323.90	6.3
350	355.60	7.1
700	711.00	10.0
800	813.00	10.0
900	914.00	10.0
1000	1016.00	10.0
1100	1118.00	12.0
1200	1219.00	12.0
1400	1422.00	14.0

		Manufacturer's Name & Address		STANDARD QUALITY PLAN		BHEL Doc No.: PE-V4-XXX-165-N08	
P.O. No.		Item : Self Cleaning Strainer		Vendor Q.P. NO.		PROJECT:	
				PACKAGE : SELF CLEANING STRAINER		CUSTOMER:	
				Date : Page 01 of 12		PURCHASER:	
						CONSULTANT:	
		SL. NO.		DESCRIPTION		PAGE NOS.	
		1		SELF CLEANING STRAINER		2-4	
		2		BALL VALVES		5	
		3		BUTTERFLY VALVES		6	
		4		PRESSURE GAUGE, DP GAUGE, DP SWITCH, DP TRANSMITTER		7	
		5		GEAR MOTOR DRIVE & WORM PLANETARY GEAR BOX		8	
		6		ACTUATORS		9	
		7		STARTER PANEL		10	
		8		FASTENERS		11	
		9		ALL COMPONENT / EQUIPMENT		12	
				ANNEXURES			
				DRY RUN TEST PROCEDURE		2	
				HYDRO TEST PROCEDURE		2	
				HYDRO STATIC LEAK TIGHTNESS TESTING PROCEDURE		2	
				PACKING PROCEDURE		1	
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 Signature		Contractor				Name & Sign. Of approving authority & Seal	


BHEL Logo		Manufacturer's Name & Address		STANDARD QUALITY PLAN				BHEL Doc No.: PE-V4-XXX-165-N08	
P.O. No.		Item :		Vendor Q.P. NO.				PROJECT:	
		Self Cleaning Strainer		PACKAGE : SELF CLEANING STRAINER				CUSTOMER:	
				Date :				PURCHASER:	
				Page 02 of 12				CONSULTANT:	
Sl. No.	Component / Operation	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency	Remarks
								M C O	
1.0.0	SELF CLEANING STRAINER							10	11
1.1.0	Raw Material								
[a]	Housing, Shell, Nozzle flanges & Main flanges/Coupler Flange	Major	Chemical Analysis	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab report / raw material flow sheet	P	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
	Surface Defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / Inspection Report	P	V
	Sub Surface Defects	Major	Ultrasonic Test	100%	ASME A 435/A609	ASME A 435/A609	Inspection report	P	V
									Plates > 20mm Thk only
[b]	Nozzle Pipes	Major	Chemical Analysis	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab flow sheet	P	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
	Surface defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / Inspection Report	P	V
	Leak tightness	Major	Hydrostatic test	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / Inspection Report	P	V
[c]	Screen basket, Nozzle flanges	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
	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
	Surface Defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / Inspection Report	P	V
	Sub-surface defects	Major	Ultrasonic test	100%	ASME A 745	ASME A 745	Inspection report	P	V
	Corrosion Resistance	Major	IGCI	One/Heat	ASTM A 262	Practice E of ASTM A 262	Test Report	P	V
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, "V" - Witness and "V" - Verification									
Manufacturer / Sub-Contractor Signature									
Contractor Signature									
Name & Sign. Of approving authority & Seal									

Manufacturer's Name & Address			STANDARD QUALITY PLAN			BHEL Doc No.: PE-V4-XXX-165-N08				
Item :			Vendor O.P. NO.			PROJECT:				
Self Cleaning Strainer			PACKAGE : SELF CLEANING STRAINER			CUSTOMER:				
P.O. No.			Date :			PURCHASER:				
			Page 04 of 12			CONSULTANT:				
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency	Remarks
1	2	3	4	5	6	7	8	9	M C O	11
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 2. Hydro test	Major Critical	Measurement by visual Hydrostatic Pr. @ 1.5 times of design pr.(positive) (Duration 30 minutes)	100%	Manufacturing Drawing ASME Sec.VIII Div.1	Manufacturing Drawing	Inspection report Inspection report	P P	V V
1.3.0	Final tests (completed equipments) - After assembly	1.Dimensions, orientation, workmanship & finish 2. Leak tightness for assembly	Major Critical	Measurement by visual Leak test @ design pr.(positive) (Duration 30 minutes)	100%	G.A.drawing ASME Sec.VIII Div.1	G.A.drawing	Inspection report Inspection report	P P	V W
1.4.0	Rubber Lining (Shell)	3.Dry function test for debris filter	Critical	Operational test	100%	Approved Procedure	Approved Procedure	Inspection report	P	V
1.4.1	Rubber Formulation	Tensile, elongation & hardness Polymer Identification	Major	Physical test Flame test	One per lot One per lot	Manufacturer's procedure For Semi Ebonite For Semi Ebonite /Ebonite Polymer/Ebonite Polymer catches catches fire and on removal from on removal from fire continues to burn	BS 6374/Equivalent	Manufacturers certificate Inspection report	P P	V V
1.4.2	Surface preparation of items to be lined	% 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
1.4.3	Vulcanising	Free from rust, scale,dust & grease Temperature, Pressure & Time	Major	Visual	100%	SA 2.5	SA 2.5	Manufacturers Inspection report	P	-
1.4.4	Vulcanised Rubber Lined items	[a] Chip test [b] Adhesion, Visual defects, Thickness & Hardness [c] Spark test for Pin Holes at 5 kv/mm	Major Major Major	Process monitoring Chip test Measurement, Visual inspection	100% One per lot 100%	Manufacturer's procedure Approved Drawing & BS 6374/Equivalent Approved Drawing & BS 6374/Equivalent	Manufacturer Procedure BS 6374/Equivalent BS 6374/Equivalent	Process Procedure Inspection report Inspection report	P P P	- V V
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 Signature Contractor Name & Sign. Of approving authority & Seal										

Manufacturer's Name & Address		STANDARD QUALITY PLAN		BHEL Doc No.: PE-V4-XXX-165-N08						
Item :		Vendor Q.P. NO.		PROJECT :						
P.O. No.		PACKAGE : SELF CLEANING STRAINER		CUSTOMER:						
		Date :		PURCHASER:						
		Page 06 of 12		CONSULTANT:						
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency	Remarks
1	Butterfly valves		4	5	8	7	8	9	M C O	11
3.0.0	Materials									
3.1.0	Body and Disc	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved dpg/Data sheet	Approved dpg/Data sheet	Manufacturer's T.C.	P V V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved dpg/Data sheet	Approved dpg/Data sheet	Manufacturer's T.C.	P V V	
3.1.1	Shaft	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved dpg/Data sheet	Approved dpg/Data sheet	Manufacturer's T.C.	P V V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved dpg/Data sheet	Approved dpg/Data sheet	Manufacturer's T.C.	P V V	
3.1.2	Seat		Major		One Sample/Cast / heat	Approved dpg/Data sheet	Approved dpg/Data sheet	Manufacturer's T.C.	P V V	
3.1.3	Stem	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved dpg/Data sheet	Approved dpg/Data sheet	Manufacturer's T.C.	P V V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved dpg/Data sheet	Approved dpg/Data sheet	Manufacturer's T.C.	P V V	
3.2.0	Assembly	a) Dimensions	Major	Measurement	100%	EN 12266-1&2/API 598 & 17292/Appd data sheet	ISO EN 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									
		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	
		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	
		Leakage	Critical	Air test	100%	EN 12266-1&2/API 598 Appd. Data sheet	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	P V V	
LEGEND * Records 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 Signature		Contractor		Name & Sign. Of approving authority & Seal						

BHEL Logo		Manufacturer's Name & Address		Item : Actuators		Manufacturing Quality Plan		BHEL Doc No.: PE-V4-XXX-165-N08		
P.O. No.		Vendor Q.P. NO.		PACKAGE : SELF CLEANING STRAINER		PROJECT:		CUSTOMER:		
Date :		Date :		Date :		PURCHASER:		PURCHASER:		
Page 09 of 12		Page 09 of 12		Page 09 of 12		CONSULTANT:		CONSULTANT:		
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency	Remarks
1	6.0.0 Actuators	Functional test	Major	Electrical test	100%	Supplier catalogue/Appd data sheet	Supplier catalogue/Appd data sheet	Test certificate	P V V	11
		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 / Auxiliary Contacts	Major	Visual	100%	Supplier catalogue/Appd data sheet	Supplier catalogue/Appd data sheet	Inspection Report	P -	Review of TC's
<p align="center">LEGEND</p> <p>* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.</p> <p>** M : Manufacturer/ Sub-contractor</p> <p>C : CONTRACTOR O : OWNER</p> <p>Indicate : 'P' - Perform, 'W' - Witness and 'V' - Verification</p>										
Manufacturer / Sub-Contractor Signature		Contractor								Name & Sign. Of approving authority & Seal

Manufacturer's Name & Address		Manufacturing Quality Plan				BHEL Doc No.: PE-V4-XXX-165-N08					
Item : Fasteners		Vendor Q.P. NO.	CUSTOMER:		PROJECT:						
P.O. No.		PACKAGE : SELF CLEANING STRAINER	PURCHASER:		CONSULTANT:						
		Date :	Page 11 of 12								
Sl. No.		Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency M C O	Remarks
1		8.1.0 Internal Fasteners - SS	3	4	5	6	7	8	9	10	11
8.1.1	Stainless Steel Fasteners	Chemical properties	Major	Chemical analysis	1 Per heat/HT Batch	Approved Drawing	Approved Drawing	Test certificate/Compliance certificate	--	P V	V
		Physical properties	Major	Physical test	1 per heat	Approved Drawing	Approved Drawing	Test certificate/Compliance certificate	--	P V	V
		Visual and Workmanship finish	Major	Visual	Sample	Approved Drawing	Approved Drawing	Inspection report	--	P V	V
		Dimensions	Major	Measurement	Sample	Approved Drawing	Approved Drawing	Inspection report	--	P V	V
8.2.0	Carbon steel fasteners	Visual	Major	Visual	Sample	Approved Drawing	Approved Drawing	Manufacturer's certificate / Lab Report	--	P V	V
		Dimensions	Major	Measurement	Sample	Approved Drawing	Approved Drawing	Manufacturer's certificate / Lab Report	--	P V	V
		Physical properties	--	Physical test	1 sample per heat	IS : 1367	IS : 1367	Manufacturer's certificate / Lab Report	--	P V	V
				a) Tensile							
				b) Yield							
				c) Elongation							
				d) Proof load							
LEGEND * Records identified with "STAR" shall be essentially included by contractor in QA Documentation. ** M : Manufacturer/ Sub-contractor C : CONTRACTOR O : OWNER Indicate : "P" - Perform, "W" - Witness and "V" - Verification											
Manufacturer / Sub-Contractor Signature		Contractor		Name & Sign. Of approving authority & Seal							

		Manufacturer's Name & Address P.O. No.		Item : All components / Equipments		Manufacturing Quality Plan Vendor O.P. NO.		BHEL Doc No.: PE-V4-XXX-165-N08					
						PACKAGE : SELF CLEANING STRAINER		PROJECT:					
Component / Operation 2		Class 4		Type of Check 5		Quantum of Check 6		Reference Documents 7		Date :		PURCHASER:	
										Page 12 of 12		CONSULTANT:	
Characteristics Checked 3		Painting Dry film thickness and Major		Measurement Major		Random 100%		Painting schedule Packing Procedure		Acceptance Norms 8		Format of Record 9	
9.0.0 All Components / Equipments Painting Dry film thickness and Packing		Major		Measurement		Random		Painting schedule Packing Procedure		Inspection report Inspection report		P V V P - -	
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		Contractor		Signature		Name & Sign. Of approving authority & Seal							



TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)

SPEC. NO. PE-TS-392-165-N003

VOLUME : IIB

SECTION : D

REV. NO. 0

DATE :22.04.14

SHEET 1 of 1

SECTION D2

**STANDARD TECHNICAL SPECIFICATION
FOR
ELECTRICAL SYSTEMS**

CLAUSE NO.	LT SWITCHGEAR (Starters Panel)
1.00.00	<p>CODES AND STANDARDS</p> <p>IEC 947, IS 13947</p>
2.00.00	<p>TYPE</p> <p>Circuit Breakers Shall be air break, three pole, spring charged, horizontal drawout type, suitable for electrical operation.</p> <p>Switchgear Fully drawout type single front</p> <p>MCC Fully drawout type single front/Double front.</p> <p>ACDB/DCDB Fixed type single front</p>
3.00.00	<p>SYSTEM PARAMETERS</p> <p>415VAC $\pm 10\%$ (SOLIDLY GROUNDED)</p> <p>50 Hz $\pm 3\%$-5%</p> <p>45KA RMS / 1 SEC (FAULT LEVEL)</p> <p>220V DC NOMINAL (190V DC-240V DC) ISOLATED TYPE</p>
4.00.00	<p>TEMPERATURE RISE</p> <p>The temperature rise of the horizontal and vertical busbars and main bus link including all power drawout contacts when carrying 90% of the rated current along the full run shall in no case exceed 55 deg. C with silver plated joints and 40 deg. C with all other types of joints over an ambient of 50 deg C.</p>
5.00.00	<p>OPERATIONAL REQUIREMENTS</p>
5.01.00	<p>Breakers</p>
5.01.01	<p>Breakers shall have anti-pumping feature.</p>
5.01.02	<p>The incomer and bus coupler breakers for switchgear shall be electrically operated with over current releases or relays.</p>
5.01.03	<p>Breakers shall have inherent fault making and breaking capacities. They shall have shunt trip coils. In case releases are offered, the same shall have contact for energisation of lockout relay. All breakers shall have built in interlocks for equipment and personnel safety.</p>
5.01.04	<p>Paralleling of two supplies shall be avoided by interlocking except for switchgear where auto-changerover is provided. Breaker contact multiplication, if required, shall be through latch relay.</p>

Clause NO.	LT SWITCHGEAR
01.05	Mechanical tripping shall be through red 'Trip' push button outside the panels for breakers, and through control switches for other circuits.
01.06	Provision of mechanical closing of breaker only in 'Test' and 'Withdrawn' position shall be made. Alternatively, mechanical closing facility should be normally inaccessible, accessibility rendered only after deliberate removal of shrouds. It shall be possible to close the door with breaker in test position.
01.07	Clear status indication for each circuit shall be provided through lamps, switch positions or other mechanical means.
01.08	Supervision relay shall be provided for trip coil monitoring.
02.00	Switches, Contactors and Fuses
02.01	Incomers for MCCs and DBs rated upto 630A could be load break isolators.
02.02	Motor starter contactors shall be of air break, electromagnetic type suitable for DOL starting of motor, and shall be of utilisation category AC-3 for ordinary and AC-4 for reversing starters. DC contactor shall be of DC-3 utilisation category.
02.03	Fuses shall be HRC type with operation indicator. Isolating switches shall be of AC 23A category when used in motor circuit, and AC 22A category for other applications. Fuse switch combination shall be provided wherever possible.
02.04	Isolating switches and MCCBs shall have door interlocks and padlocking facility.
02.05	Panels
02.06	All switchgears, MCCs, DBs, panels, modules, local starters and push buttons shall have prominent engraved identification plates.
02.07	Local push button stations shall have metal enclosure of die cast aluminium or rolled sheet steel of 1.6mm thickness & shall have DOP of IP-55. Push buttons shall be of latch type with mushroom knobs.
02.08	Where breaker/starter module front serves as compartment cover, suitable blanking covers, one for each size of modules per switchboard shall be supplied for use when carriage is withdrawn.
02.09	All non-current carrying metal work of boards/panels shall be effectively bonded to earth bus of galvanised steel, extending throughout the switchboard/MCC/DB. Positive earthing shall be maintained for all positions of chassis and breaker frame.
02.10	Suitable trolley arrangement shall be provided for breaker/starter modules. Two trolleys per switchgear room shall be provided so that top most breaker module of all types, sizes and rating can be withdrawn on trolley and lowered for maintenance purpose.
02.11	The incoming connection to transformer of more than 1000KVA and inter-connecting sections between switchboards shall preferably be of busducts. The busduct enclosure

CLAUSE NO.	LT SWITCHGEAR
	<p>shall be made of minimum 3mm thick aluminium alloy. The section of the busduct should have adequate strength to withstand internal and external forces resulting from the various operating conditions. Aluminium sheet hood shall be provided for outdoor busduct enclosure joints to provide additional protection against water ingress. The busduct top shall be sloped to prevent retention of water. The busduct shall have DOP of IP55.</p>
5.03.07	It should be possible to carryout maintenance on a feeder with adjacent feeders alive
5.04.00	Control, Protection & Metering Requirements
5.04.01	Control circuits shall operate at suitable voltage of 110V AC or 220V DC. Necessary control supply transformers having primary and secondary fuses shall be provided for each MCC, 2 x 100% per section. However the breakers shall operate on 220V DC. The auxiliary bus bars for control supply shall be segregated from main bus bars. The control supplies shall be monitored.
5.04.02	Contractor shall fully co-ordinate overload and short circuit tripping of breaker with up-stream and down stream breakers/fuses/MCCBs motor starters. Various equipments shall meet requirement of Type-II class of coordination as per IEC.
5.04.03	All relays and timers shall operate on available DC supply and not have any inbuilt batteries. They shall be provided with hand-reset operation indicator (flags) or LEDs with pushbuttons for resetting.
5.04.04	All equipments shall have necessary protections. However, following minimum protections shall be provided:
	<ol style="list-style-type: none"> 1) Contactor controlled motor feeders (Motors up to 160 kW) <ol style="list-style-type: none"> a) Instantaneous short circuit protection on all phases through HRC cartridge type fuses rated for 80 kA rms (prospective breaking capacity at 415V). b) Thermal overload protection. c) Single phasing protection for motors protected by fuses. 2) Breaker controlled motors feeders (motors rated above 160kW) <ol style="list-style-type: none"> a) Instantaneous short circuit protection on all phases b) Overload protection on two phases c) Over load alarm on third phase d) Earth fault protection e) Under voltage protection

CLAUSE NO.	LT SWITCHGEAR
	<ul style="list-style-type: none"> f) hand reset lockout relay with a blue lamp for monitoring
	3) Incomers/bus coupler/outgoing breaker feeders other than motor feeders <ul style="list-style-type: none"> a) Definite time delay short circuit protection b) Hand reset lockout relay with a blue lamp
	4) Incomer From DG Set. <ul style="list-style-type: none"> a) Differential Protection (87) - Three Pole b) Reverse Power Protection. c) Overload Alarm on one phase d) Earth Fault Detection Relay (64) e) Voltage controlled overcurrent relay e) Generator under/over voltage Protection f) Hand Reset/Lockout Relay with a blue lamp. g) 3 Phase Energy Meter having accuracy of 1.0 class.
5.04.05	<p>Meters / instruments</p> <p>All meters/ instrument shall be flush mounted on front panel, at least 96 sq.mm. size with 90 degree linear scales and accuracy class of 2.0.</p>
5.04.06	<p>All motors of 30kW and above shall have an Ammeter. Bus-section shall have bus VT, voltmeter with selector switch, and other relay and timers required for protection. Adequate control and selector switches, push buttons and indicating lamps shall be provided. Thermostatically controlled space heaters with switches shall be provided to prevent condensation.</p>
5.04.07	<p>In case of remote controlled breaker panels, following shall be ensured.</p> <p>Each feeder shall have local/remote selector switch. Closing from local shall be possible only in test position whereas closing from remote shall be possible in either service or test position. Tripping from local shall be possible only when local/remote selector switch is in local position. Tripping from remote shall be either breaker in service position or selector switch being in remote position</p>
05 00	<p>Control from Remote</p> <p>Necessary hardware shall be provided in the switchgear panel like coupling relays(24V DC, with max burden 2.5VA), auxiliary relays, current & voltage transducers(4-20 mA, dual output) etc. to effect interlocks, exchange information / status and exercise control from remote.</p>

CLAUSE NO.	LT SWITCHGEAR
6.00.00	DESIGN AND CONSTRUCTIONAL FEATURES
6.01.00	<p>All 415V switch gear motor control centers (MCCs), AC & DC distribution boards (DBs), etc shall have following features :</p> <ol style="list-style-type: none"> 1) Shall be of metal enclosed, indoor, floor mounted and free standing type. 2) All frames and load bearing members shall be fabricated using mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness not less than 2mm. 3) Frame shall be enclosed in cold rolled sheet steel of thickness not less than 1.6mm. Doors and covers shall also be of cold rolled sheet steel of thickness not less than 1.6 mm. Stiffeners shall be provided wherever necessary. Removable gland plates of thickness 3mm (hot/cold rolled sheet steel) or 4 mm (non-magnetic material) shall be provided for all panels. 4) All switchboards/panels shall be of dust and vermin proof. All cutouts shall have synthetic rubber gaskets. 5) For motors above 160kW, remote controlled electrical circuit breakers, and for smaller motors, switch-fuse contactor feeders shall be provided. The other outgoing feeders would be switch-fuse units or moulded case circuit breakers. 6) All switchboards, MCCs and DBs shall have following distinct vertical sections. <ol style="list-style-type: none"> a) Completely enclosed bus bar compartment for horizontal and vertical bus bars. b) Completely enclosed switchgear compartments (one for each circuit housing circuit breakers, motor starter or switch-fuse feeder). c) Compartment for cable alley or cable box for power and control cables In case of cable box, they shall be segregated with complete shrouding for individual feeders at the rear for direct termination of cables. d) For cable connection to circuit breaker, a separately enclosed cable compartment shall also be acceptable. e) Compartment for relays and other control devices associated with a circuit breaker, wherever necessary. f) The switchboards/MCC/DBs of 1600A & above rating shall be of DOP IP42 & of IP52 for less than 1600A rating g) All 415V switchgears, MCC's, AC & DC distribution boards etc. shall be painted by powder coating process. Paint shade shall be as follows

CLAUSE NO.	LT SWITCHGEAR	
	(i) Front & Back	: RAL 9002
	(ii) Extreme end covers	: RAL 5012
7)	Busbars shall be of high conductivity aluminium alloy or copper.	
8)	Minimum air clearance in air between phases and phase-earth shall be 25 mm for busbars and cable terminations. For all other components, the Clearances shall be at least 10mm. Wherever above is not possible except for horizontal and vertical busbars, insulation shall be provided by anti tracking sleeving or barriers. However for horizontal and vertical busbars, clearances specified above shall be maintained even when busbars are insulated/sleeved. In case of DC DBs/ fuse boards, the busbar system shall be insulated or physically segregated with barriers to prevent interpole short circuit.	
9)	Busbar insulators shall be of track-resistant high strength non-hygro-scoptic, non-combustible type and suitable to withstand stresses due to over-voltages and short circuit current. Insulators and barrier of inflammable material such as Hylam shall not be accepted.	
10)	All types of relays and timer shall be subject to Employer's approval. They shall be flush mounted with connections from inside, and shall have transparent & dust tight cover, removable from front, drawout construction for easy replacement and testing facility. The auxiliary relays and timer may be provided in fixed cases.	
11)	Maxi terminal /cage clamp type terminal blocks shall be provided for signals to be interfaced with DDCMIS/PLC.	
12)	The switchgears/MCC shall be designed to offer adequate level of safety to operating/maintenance personnel. Means shall be provided to prevent access to the live part to avoid accidents during service as well as maintenance period. Bidder shall bring out the safety means provided to achieve above. A detailed instruction plate suitable for wall mounting shall be provided for each switchgear/MCC room describing various safe operating procedure/safety precautions for safe operation and maintenance of switchgear/MCC.	
13)	All current and voltage transformers as required for metering & protection specified shall be completely encapsulated, cast resin insulated type. Incomers from transformers shall have CTs for transformer REF protection. All current and voltage transformers as required for metering and protection specified shall be completely encapsulated, cast resin insulated type. Incomers from transformers shall have CTs for transformer restricted earth fault protection. The accuracy shall be as follows:	
	CTs	PTs
Protection	5P20	3P
Metering	1.0	1.0
REF	PS	

CLAUSE NO.	LT SWITCHGEAR
6.02.00	Indicating lamps shall be cluster LED type.
6.03.00	20% spare feeders of each type & rating used in the MCC with a minimum one (1) number on each bus section shall be provided.
7.00.00	<p>TYPE TESTS</p> <p>(a) All equipments to be supplied shall be of type tested quality. The Contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last five years from the date of bid opening. These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.</p> <p>(b) In case the Contractor is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract free of cost to the Owner and submit the reports for approval.</p> <p>(c) All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.</p>
7.01.00	<p>L. T. SWITCHGEAR</p> <p>The following type test certificates on each type & rating of L.T. Switchgear, MCC panel and distribution boards shall be submitted.</p> <p>(a) Short time withstand test with circuit breaker mounted inside the switchgear panel.</p> <p>(b) Temperature rise test.</p> <p>(c) Type II - Short circuit co-ordination test for any three ratings of MCC module as selected by the Employer.</p> <p>(d) Test sequence -1 & combined test sequence shall be carried out on each rating of circuit breaker mounted inside the panel.</p> <p>(e) Degree of protection tests</p>

CABLES SPECIFICATIONS

POWER CABLES:

1.1 kV grade, power cables with stranded compacted Aluminium conductor, XLPE insulated, PVC type ST2 extruded inner sheathed (no inner sheath for single core cables), Galvanised steel single layer round wire/ formed wire (non magnetic hard drawn aluminium single layer round wire H4 grade for single core cables) as per IS : 3975 (where applicable) and extruded PVC Type ST2 outer sheath with FRLS properties, generally conforming to IS:7098 (Part-1).

CONTROL CABLES:

1.1 kV control cables with stranded plain annealed copper conductor, PVC Type-A insulation, core identification by colour coding (upto five cores)/ number marking (more than five cores), distinct extruded inner sheath of PVC type ST1 material, GS formed/round wire armour as per IS: 3975 (where applicable), and extruded PVC Type ST1 outer sheath with FRLS properties, generally conforming to IS: 1554 (Part-1).

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TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS


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

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

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

1.0

INTENT OF SPECIFIATION

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

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

2.0

CODES AND STANDARDS

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

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

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

3.0

DESIGN REQUIREMENTS

3.1

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

3.2

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

3.3


Starting Requirements


3.3.1


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

3.3.2

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

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 2 OF 4
<p>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.</p>		
<p>3.3.3 The following frequency of starts shall apply</p> <p>i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.</p> <p>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)</p> <p>iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor</p>		
<p>3.4 Running Requirements</p>		
<p>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.</p>		
<p>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.</p>		
<p>3.5 Stress During bus Transfer</p>		
<p>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.</p>		
<p>3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.</p>		
<p>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.</p>		
<p>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.</p>		
<p>4.0 CONSTRUCTIONAL FEATURES</p>		
<p>4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy</p>		
<p>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.</p>		
<p>Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled</p>		
<p>4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.</p>		

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 29/08/2005
		SHEET : 3 OF 4
4.4.	Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.	
4.5	Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.	
4.6	<p>In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.</p> <p>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.</p>	
4.7	Terminals and Terminal Boxes	
4.7.1	<p>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.</p> <p>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".</p>	
4.7.2	unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.	
4.7.3	Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.	
4.7.4	Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.	
4.7.5	Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.	
4.7.6	Degree of protection for terminal boxes shall be IP 55 as per IS 4691.	
4.7.7	Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.	
4.7.8.	Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.	
4.7.9	Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.	
4.8	Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.	
4.9	General	

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



DOCUMENT TITLE

CONDUITS AND PIPES

SPECIFICATION NO. PES-507-27

VOLUME II B

SECTION D

REVISION 0

DATE: 27/10/2010

SHEET 1 OF 6

**GENERAL TECHNICAL REQUIREMENTS
OF
CONDUITS AND PIPES
SPECIFICATION NO. PES-507-27
REV 0**



DOCUMENT TITLE

CONDUITS AND PIPES

SPECIFICATION NO. PES-507-27

VOLUME II B

SECTION D

REVISION 0

DATE: 27/10/2010

SHEET 2 OF 6

1.0 GENERAL

- 1.1 This specification covers the manufacture, inspection & testing at vendor's works and delivery to site of conduits, pipes and their fittings for electrical installation.

2.0 CODES AND STANDARDS

- 2.1 The material, constructional features and various processes involved in manufacture shall comply with currently applicable Indian Standards.
- 2.2 The following Indian Standards shall be applicable, in general. However if Data Sheet A specifies conformance to other international standards, the equivalent IEC/BS/other standards shall be considered.

- a) IS:9537 (All Parts) Conduits for electrical installation.
- b) IS:3480 Flexible steel conduits for electrical wiring.
- c) IS:6946 Flexible non-metallic conduits for electrical installation.
- d) IS:1239 Mild steel tubes, tubulars and other wrought steel fittings.
(for size above 63mm dia of rigid conduits)
- e) IS:2667 Fittings for rigid steel conduits for electrical wiring.
- f) IS:3837 Accessories for rigid steel conduits for electrical wiring.
- g) IS:3419 Fittings for rigid non-metallic conduits.
- h) IS:6005 Code of practice for phosphating iron & steel.
- i) IS:2629 Recommended practice for hot dip galvanizing on iron and steel.
- j) IS:4759 Specification for hot dip zinc coatings on structural steel and allied products.
- k) IS:6745 Methods for determination of mass of zinc coating on zinc coated iron and steel articles.

3.0 DESIGN REQUIREMENTS AND CONSTRUCTIONAL FEATURES

The conduit and conduit accessories shall include conduit plugs & caps, gaskets and box cover etc in addition to any specific requirement given in Data Sheet A. The diameter of conduits and accessories shall be uniform throughout the length.

3.1 Rigid Conduits and Fittings

- 3.1.1 Rigid conduits shall generally conform to the requirements of IS:9537 (Part I & Part II). However conduits above 63mm diameter shall conform to the requirements of IS:1239. Unless specified otherwise in Data Sheet A, all conduits and pipes shall be of medium duty.



DOCUMENT TITLE

CONDUITS AND PIPES

SPECIFICATION NO. PES-507-27

VOLUME II B

SECTION D

REVISION 0

DATE: 27/10/2010

SHEET 3 OF 6

- 3.1.2 The rigid conduits shall be hot dip galvanized inside and outside. Weight of zinc shall be as per IS:4759. Conduits shall be thoroughly cleaned and pretreated, conforming to IS:6005.
- 3.1.3 Conduits shall be supplied in approximate length as specified below
- a) Rigid Conduits 5 metres
 - b) Flexible Conduits 10 - 30 metres
- 3.1.4 Each end of conduit length shall be threaded. The ends of conduits shall be sealed with protective caps to prevent damage to threaded portions and entrance of moisture and foreign material.
- 3.1.5 The inside surface of all conduits shall be smooth and suitable for pulling insulated cables and wires without damage.
- 3.1.6 Conduit fittings shall be made out of tube or cast to the shape as to match with corresponding conduit sizes and meet their purpose without any special adjustment.
- 3.1.7 All fittings shall be screwed type and hot dip galvanized inside and outside.
- 3.2 Flexible Metallic Conduits and Fittings
- 3.2.1 Flexible metallic conduits shall generally conform to the requirements of IS:3480.
- 3.2.2 Flexible conduits shall be made of strip steel which shall be of cold rolled mild steel. The strip shall be of uniform width and thickness throughout.
- 3.2.3 The strip shall be electro galvanized to a minimum thickness of 25 microns as specified in IS:3480. The surface of the strip shall be thoroughly cleaned before application of protective coating. Pretreatment, before galvanization, shall conform to IS:6005.
- 3.2.4 The strip for making flexible conduit shall be wound tightly and so overlapped in subsequent helicals that no openings are seen in normal position.
- 3.2.5 Flexible conduits shall be lead coated for application in high temperature zones, if specifically mentioned in Data Sheet A.
- 3.2.6 The conduit shall have uniform diameter throughout its length. The internal surface of all conduits shall be smooth and suitable for pulling insulated cables and wires without damage.
- 3.3 PVC Conduits
- 3.3.1 PVC conduits shall generally conform to the requirements of IS:9537(Part I & Part III).
- 4.0 INSPECTION
- 4.1 The following stages of manufacture shall be stage inspected by Purchaser or his duly authorized representative.
- 4.1.1 Inspection of manufacturing processes such as shearing, punching, bending, welding, galvanizing etc.
 - 4.1.2 Inspection of packing material and procedure.



DOCUMENT TITLE

CONDUITS AND PIPES

SPECIFICATION NO. PES-507-27

VOLUME II B

SECTION D

REVISION 0

DATE: 27/10/2010

SHEET 4 OF 6

4.1.3 Inspection of finished product.

4.2 The inspection will be carried out as per agreed quality plan.

5.0 TESTING

5.1 Rigid Conduits

- a) Acceptance Tests
 - as per IS:9537 Part 1 & 2 upto 63mm OD
 - as per IS:1239 above 63mm OD
- i) Dimension checks
- ii) Bending test (below 32mm OD)
- iii) Compression test
- b) Special Tests (as acceptance test) as applicable to galvanizing.

5.2 Flexible Steel Conduits

- a) Acceptance Tests
 - as per IS:3480
- i) Dimension checks
- ii) Linear breaking test
- iii) Test for flexibility
- iv) Bend fracture test
- v) crushing test
- b) Special Tests (as acceptance test) as applicable to galvanizing.

5.3 PVC Conduits

- a) Type Tests
 - as per IS : 9537 (Part 1 & 3)
- i) Dimension checks
- ii) Bending test
- iii) Compression test
- iv) Impact test
- v) Collapse test
- vi) Resistance test
- vii) Resistance to burning



DOCUMENT TITLE

CONDUITS AND PIPES

SPECIFICATION NO. PES-507-27

VOLUME II B

SECTION D

REVISION 0

DATE: 27/10/2010

SHEET 5 OF 6

viii) Electrical Characteristics

b) Acceptance tests - as per IS:9537 (Part 1 & 3)

i) Dimension checks

ii) Bending test

iii) Compression test

iv) Collapse test

v) Resistance to burning

vi) Electrical characteristics

5.4 Sampling for the tests shall be done as per applicable standards mentioned above.

5.5 The testing shall be carried out as per agreed quality plan.

6.0 PACKING

6.1 The material shall be packed as per manufacturer's standard. Packing procedure shall be to the purchaser's approval.

7.0 DRAWING, DATA AND DOCUMENTS REQUIRED

7.1 The following information shall be furnished within two weeks of award of contract, for purchaser's approval.

a) Manufacturing drawings/details.

b) Recommended Field quality plan covering site handling, storing, laying etc.

c) Final quality plan.

7.3 The following information shall be furnished after testing and inspection

Type Test, routine test and special test certificates in bound volume in requisite number.



DOCUMENT TITLE

CONDUITS AND PIPES

SPECIFICATION NO. PES-507-27

VOLUME II B

SECTION D

REVISION 0

DATE: 27/10/2010

SHEET 6 OF 6

DATASHEET A

SPECIFIC TECHNICAL REQUIREMENTS

- 1.0 APPLICABLE STANDARDS: IS:9537,IS: 1239, IS:3480
- 2.0 RIGID STEEL CONDUITS & STEEL PIPES
- a) Material: Cold rolled mild steel to IS:226
 - b) Applicable standard
 - i) Upto 63mm OD: IS:9537 Part I & II
 - ii) Above 63mm OD: IS:1239
 - c) Surface treatment: Hot dip galvanizing inside & outside as per IS:2629
 - d) Wt. of zinc: as per IS 4759
 - e) Duty: Medium
 - f) Fittings: Screw type as per IS:2667
- 3.0 FLEXIBLE CONDUITS:
- a) Material: Strip steel cold rolled and annealed
 - b) Standard applicable: IS: 3480
 - c) Surface treatment: Electro galvanized as per IS: 3480
 - d) Whether lead coated: YES
 - e) Minimum thickness: 25 microns
of zinc coating
- 4.0 PVC CONDUITS
- a) Material: PVC
 - b) Applicable standard: IS: 9537 (Part I & III)



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-392-165-N003

VOLUME : IIB

SECTION : D

REV. NO. 0

DATE :22.04.14

SHEET 1 of 1

SECTION D3

**STANDARD TECHNICAL SPECIFICATION
FOR
C&I SYSTEMS**



DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE

SPECIFICATION NO.:	
VOLUME	
SECTION	
REV. NO.	DATE:
SHEET 1	OF 2

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

TECHNICAL REQUIREMENTS FOR PRESSURE / DIFFERENTIAL
PRESSURE GAUGE

TO BE FILLED-UP /CONFIRMED
BY BIDDER

(TO BE FILLED BY PURCHASER)

=GENERAL	MANUFACTURER		
	MODEL NUMBER		
TECHNICAL	SENSING ELEMENT	<input type="checkbox"/> BOURDON <input type="checkbox"/> DIAPHRAGM (BOURDON FOR HIGH PRESS AND DIAPHRAGM FOR LOW PRESS APPLICATION)	
	MATERIAL	SENSING ELEMENT – AISI 316 SS MOVEMENT – AISI 304 SS CASING – <input type="checkbox"/> DIE CAST AL <input checked="" type="checkbox"/> SS	
	ENCLOSURE	CLASS: <input type="checkbox"/> IP-55 <input checked="" type="checkbox"/> IP-65 <input type="checkbox"/> EXPL PROOF PAINT: <input type="checkbox"/> ENAMEL <input type="checkbox"/> EPOXY	
	DIAL	SIZE: 150 MM COLOR: WHITE NUMERALS: BLACK SCALE: LINEAR, 270° ARC GRADUATED IN METRIC UNITS	
	CASE	COLOUR : BLACK	
	SPAN/ ZERO ADJUSTMENT	INT. MICRO SCREW	
	RANGE SELECTION	SHOULD COVER 125% OF OPERATING PARAMETER	
	OVER RANGE PROTECTION	1.5 TIMES OF FSD	
	BLOW OUT DISC	REQUIRED	
	SWITCHING FACILITY (IF APPLICABLE)	NOT REQUIRED	
	TYPE	<input type="checkbox"/> MICRO SWITCH <input type="checkbox"/> OTHER	
	NO. / TYPE OF CONTACTS	2 NOS. SPDT	
	CONTACT RATING	5A 230V AC, 0.25A 220V DC	
SETTING RANGE	FIELD ADJUSTABLE OVER FULL RANGE		
REPEATABILITY	± 1% OF FSR		
POWER SUPPLY	<input type="checkbox"/> 230V AC <input type="checkbox"/> 110V AC		
PERFORMANCE	ACCURACY	± 1% OR BETTER OF FULL SCALE DEFLECTION	
CONNECTION	PROCESS	<input type="checkbox"/> M20 x 1.5 (M) <input type="checkbox"/> ½" NPT (M) <input checked="" type="checkbox"/> ½" NPT (F) <input type="checkbox"/> OTHER	
	LOCATION	BOTTOM	
ACCESSORIES	NAME PLATE / METAL TAG	SS	
	OTHER	SIPHON FOR STEAM, SNUBBER FOR PUMP DISCHARGE, CHEMICAL SEAL DIAPHRAGM FOR CORROSSIVE, OIL SERVICES and SLURRY APPLICATION TO BE PROVIDED	
OTHER REQUIREMENT	INSTRUMENT LIST	INSTRUMENT LIST COMPRISING OF TAG NO., SERVICE, DESIGN/OPERATING PRESSURE & TEMPERATURE TO BE ATTACHED	
QUALITY REQUIREMENT	CHECK LIST FOR PG/DPG	REFER CHECK LIST NO PE-CL-999-145-I 026-0	



TITLE

TYPICAL INSTALLATION DIAGRAM FOR PRESSURE GAUGE

SPECIFICATION NO. PES-145-26A

VOLUME IIB

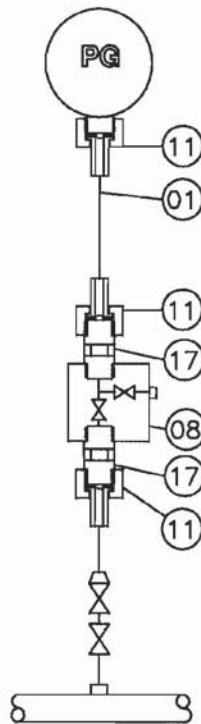
SECTION D

REV. NO. 02

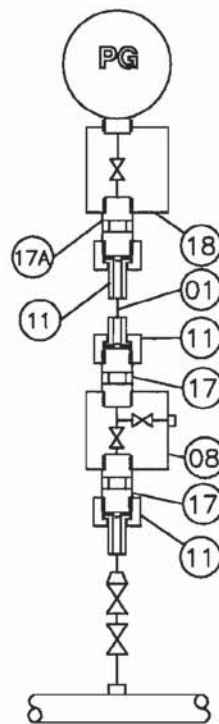
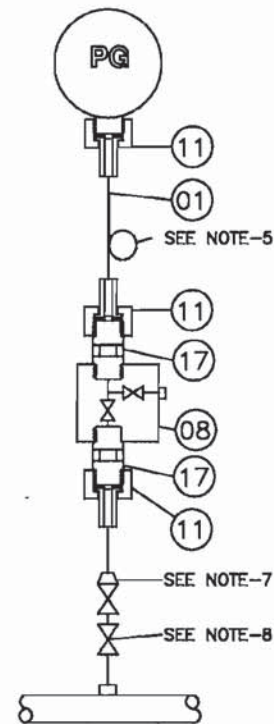
DATE 20.08.97

SHEET 3

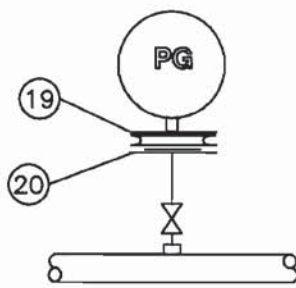
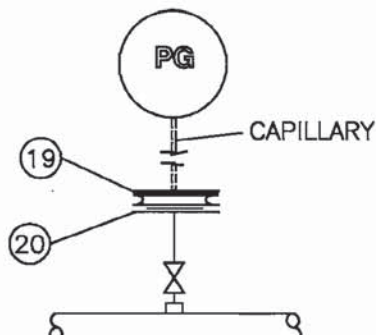
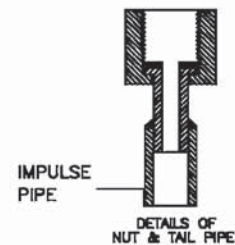
OF 4



WATER SERVICE

PULSATING FLUID
SERVICE

STEAM SERVICE

VISCIOUS FLUID SERVICE
(PIPE MOUNTED)VISCIOUS FLUID SERVICE
(REMOTE PLACE MOUNTED)IMPULSE
PIPEDETAILS OF
NUT & TAIL PIPE

ITEM NO	ITEM/DESCRIPTION	MATERIAL	SIZE	QTY			
				WATER	PULSATING	STEAM	VISCIOUS
01	SEAMLESS STEEL IMPULSE PIPE	ASTM A106/A335	1/2" / 15NB	1.5M	1.5M	1.5M	
08	TWO VALVE 3-WAY MANIFOLD	STAINLESS STEEL SS316	1/2" NPT(F) ENDS	01	01	01	
17	MALE CONNECTOR	STAINLESS STEEL SS316	1/2" NPT(M)x M20x1.5(M)	02	02	02	
17A	MALE CONNECTOR	STAINLESS STEEL SS316	M20x1.5(M) ENDS		01		
18	SNUBBER	STAINLESS STEEL SS316	M20x1.5(F) ENDS		01		
19	CHEMICAL SEAL	STAINLESS STEEL SS316	2" ANSI 300				01
20	MATING FLANGE	ASTM A105	2" ANSI 300				02
11	M20x1.5 SS NUT WITH ANNEALED COPPER WASHER & 100mm LONG TAIL PIPE TO SUIT 1/2" NB PIPE	STAINLESS STEEL SS316	M20x1.5x 1/2" NB	03	03	03	



TITLE

TYPICAL INSTALLATION DIAGRAM FOR PRESSURE GAUGE

SPECIFICATION NO. PES-145-26A

VOLUME IIB

SECTION D

REV. NO. 02 DATE 20.08.97

SHEET 4 OF 4

NOTES :-

- IMPULSE PIPES SHALL BE OF SEAMLESS AND ANNEALED CARBON STEEL OR ALLOY STEEL (CONFORMING TO ANSI B36.10) IN LINE WITH THE MAIN PIPE MATERIAL. STAINLESS STEEL TUBES SHALL BE USED FOR ANALYTICAL MEASUREMENTS.
- ALL IMPULSE PIPES AND FITTINGS SHALL BE OF RATING TO SUIT THE ASSOCIATED PROCESS PARAMETERS IN THIS REGARD THE GENERAL GUIDELINES ARE GIVEN BELOW

SERVICE	IMPULSE PIPE		PIPE FITTINGS	
	MATERIAL	SCHEDULE	MATERIAL	CLASS
i) MAINSTM/HP BYPASS UPSTREAM/ UPSTREAM OF AUX PRDS FROM MS	SA335 Gr P22	SCH.160	ASTM A182 Gr F22	6000
ii) FEED & SPRAY WATER	SA106 Gr C	SCH.160	ASTM A105	6000
iii) HRH/ LP BYPASS STEAM	SA335 Gr P22	SCH.80	ASTM A182 Gr F22	6000
iv) CRH TILL HPBP/HPBP DOWN STREAM/ EXTRN TO HPH5	SA106 Gr B	SCH.40	ASTM A105	3000
v) CRH LINE AFTER HPBP/EXTRN/ HEATER DRAINS/CONDENSATE AND OTHER LOW PRESS LINES	SA106 Gr B	SCH.40	ASTM A105	3000

- PIPE FITTINGS SHALL BE OF FORGED MATERIAL CONFORMING TO ANSI B16.11-1991.
- SNUBBER SHALL BE PROVIDED FOR PUMP DISCHARGE PRESS MEASUREMENTS AND CHEMICAL SEAL DIAPHRAGM FOR HEAVY FUEL OIL SERVICES.
- IN CASE OF STEAM SERVICE SYPHON SHALL BE MADE BY BENDING THE TUBE OR PIPE.
- VALVE MANIFOLDS & SNUBBER SHALL BE OF FORGED SS-316.
- 25NB x 15NB WELDED REDUCER SHALL BE USED FOR ROOT VALVE OF 25NB SIZE.
- ROOT VALVES AND REDUCERS (IF APPLICABLE) SHALL BE IN THE SCOPE OF AGENCY SUPPLYING THE MAIN PIPE/EQUIPMENT. THE SELECTION CRITERIA FOR ROOT VALVES SHALL BE AS FOLLOWS :-

OPERATING PRESS Kg/Cm2	OPERATING TEMP DEG. C	SIZE NB	BODY MATERIAL	QUANTITY NOs.
< 40	< 425	15	FCS	01
40-60	< 425	15	FCS	02
> 60	< 425	25	FCS	02
--	> 425	25	FAS	02

- INSTALLATION FOR DIFF. PRESS GAUGE SHALL BE SIMILAR TO PRESS GAUGE EXCEPT THE FOLLOWING
 - IT SHALL HAVE TWO LIMBS FOR PROCESS CONNECTIONS AND EACH CONNECTION SHALL BE SIMILAR TO THAT SHOWN FOR PRESS GAUGE
 - IT SHALL HAVE FIVE VALVE MANIFOLD IN PLACE OF THREE WAY MANIFOLD



**CHECK LIST FOR
PRESSURE / DIFFERENTIAL PRESSURE GAUGE
(Mechanical Auxiliary Packages)**

SPECIFICATION NO.:

VOLUME

SECTION

REV. NO.

DATE:

SHEET 2 OF 2

Data Sheet No.: **PE-CL-999-145-1026-0**

SL NO	TESTS/CHECKS	QUANTM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS	AGEN CY			REMARKS
				P	W	V	
1.0	CHECK FOR		APPROVED TECHINCAL REQUIREMENT/ DATA SHEET				MFR TO CARRY OUT ROUTINE TEST ON 100%. WHEN MATL CORELATION ARE NOT AVAILABLE MFR'S COMPLIANCE TO BE PROVIDED
	1.1 DIAL SIZE	100%		M	C	C	
	1.2 MODEL NO/TAG NO	100%		M	C	C	
	1.3 RANGE/SCALE	100%		M	C	C	
	1.4 END CONNECTION	100%		M	C	C	
	1.5 SWITCH CONTACT RATING & NOS	100%		M	C	C	
2.0	CALIBRATION						
	2.1 ACCURACY	100%		M	C	B	
	2.2 REPEATABILITY (FOR SWITCH)	100%		M	C	B	
	2.3 SET POINT ADJUSTMENT FOR SWITCH	100%		M	C	C	
3.0	OVER PRESSURE & LEAK TEST	100%		M	C	C	
4.0	OPERATION OF PR. RELEIF DEVICE	ONE PER TYPE		M	C	C	
5.0	REVIEW OF T.C. FOR MATERIAL OF--						
	5.1 SENSOR	FOR LOT		-	-	B	
	5.2 MOVEMENT			-	-	B	
	5.3 PROCESS CONNECTION			-	-	B	
	5.4 HOUSING			-	-	B	
6.0	REVIEW OF T.C. FOR DEGREE OF PROTECTION	TYPE TEST		-	-	B	
7.0	REVIEW OF T.C. FOR CONTACT RATING OF SWITCH	ONE PER TYPE		-	-	B	
8.0	ACCESSORIES AS APPLICABLE	100%		M	C	C	

LEGEND:

M: MANUFACTURER/ SUB CONTRACTOR, C: CONTRACTOR/ NOMINATED INSP AGENCY, B: BHEL. P: PERFORM, W: WITNESS, V: VERIFICATION.

NOTE:

CONTRACTOR TO PROVIDE COMPLIANCE CERTIFICATE FOR TESTS/CHECKS VERIFIED BY CONTRACTOR AND SUBMIT THE SAME ALONGWITH TEST CERTIFICATES TO BE VERIFIED BY BHEL.



DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER

SPECIFICATION NO.:

VOLUME

SECTION

REV. NO.

DATE:

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)

GENERAL	MANUFACTURER		
	MODEL NUMBER		
TECHNICAL	TYPE (SMART TRANSMITTER)	<input type="checkbox"/> INDUCTANCE <input type="checkbox"/> CAPACITANCE <input type="checkbox"/> STRAIN GAUGE	
	POWER SUPPLY	24V DC	
	TRANSMITTER MEASUREMENT	<input type="checkbox"/> PRESSURE <input checked="" type="checkbox"/> DIFF. PRESSURE	
	OUTPUT SIGNAL	4-20 mA	
	NO. OF WIRE	TWO	
	ACCURACY	± 0.075% OF SPAN	
	LINEARITY, HYSTERESIS AND DEAD BAND	± 0.1% OF SPAN	
	REPEATABILITY	± 0.05% OF SPAN	
	STABILITY	± 0.25 % OF SPAN OR BETTER FOR 6 MONTHS	
	SENSITIVITY	± 0.05% OF SPAN	
	<u>MATERIAL</u>		
	A) BODY	ALUMINIUM HOUSING (Epoxy Coated)	
	B) ELEMENT	316 SS	
	C) SEAL	TEFLON	
	CONTINUOUSLY ADJUSTABLE SPAN AND ZERO ADJUSTMENT PROVIDED	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
	MOUNTING	<input type="checkbox"/> WALL/PIPE STAND <input checked="" type="checkbox"/> TRANSMITTER RACK	
	ENCLOSURE	IP67	
	TURN DOWN RATIO	30:1	
	INSULATION RESISTANCE	TO BE SPECIFIED BY BIDDER	
	ZERO SUPPRESSION RANGE	TO BE SPECIFIED BY BIDDER	
ZERO ELEVATION RANGE	TO BE SPECIFIED BY BIDDER		



DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER

SPECIFICATION NO.:

VOLUME

SECTION

REV. NO.

DATE:

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)

INTEGRAL INDICATOR(LCD TYPE)

☒ YES ☐ NO

TRANSMITTER SHALL BE ABLE TO
DRIVE OUTPUT IMPEDANCE OF 700
OHMS.

YES

ZERO DRIFT

< 0.1%

SPAN DRIFT

< 0.1%

MANIFOLD

DIFFERENTIAL PRESSURE
MEASUREMENT

5 WAY

CABLE ENTRY DETAIL

SUITABLE FOR DIA OF 17.5 mm

PREPARED BY

CHECKED BY

APPROVED BY

COMPANY SEAL

NAME


NAME

SIGNATURE

SIGNATURE

DATE

DATE

	CHECK LIST FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (Mechanical Auxiliary Packages)	SPECIFICATION NO.:	
		VOLUME	
		SECTION	
		REV. NO.	DATE:
		SHEET 1 OF 1	
Data Sheet No.: PE-CL-999-145-1026-0			

SL NO	TESTS/CHECKS	QUANTM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS	AGENCY			REMARKS
				M	C	B	
1.0	CHECKS FOR VISULA, MODEL TAG NO.	SEE NOTE-1 BELOW	APPROVED TECHINCAL REQUIREMENT/ DATA SHEET	P	W	V	MFR TO CARRY OUT ROUTINE TEST ON 100%. WHEN MATERIAL CORELATION ARE NOT AVAILABLE MFR'S COMPLIANCE TO BE PROVIDED
2.0	PROCESS CONNECTION	-do-		P	W	V	
3.0	ACCURACY	-do-		P	W	V	
4.0	REPEATEABILITY	-do-		P	W	V	
5.0	HYSTERISIS	-do-		P	W	V	
6.0	EFFECT OF TEMP VARIATION ON ACCURACY	-do-		P	W	V	
7.0	SPAN /ZERO ADJUSTMENT	ONE/TYPE		P	W	V	
8.0	EFFECT OF SUPPLY VOLTAGE VARIATION	ONE/TYPE		P	W	V	
9.0	HIGH PRESSURE TEST	SEE NOTE-1 BELOW		P	W	V	
10.0	BURN IN TEST	ONE/TYPE		P	W	V	
11.0	DEGREE OF PROTECTION	ONE/TYPE		P	W	V	

LEGEND:

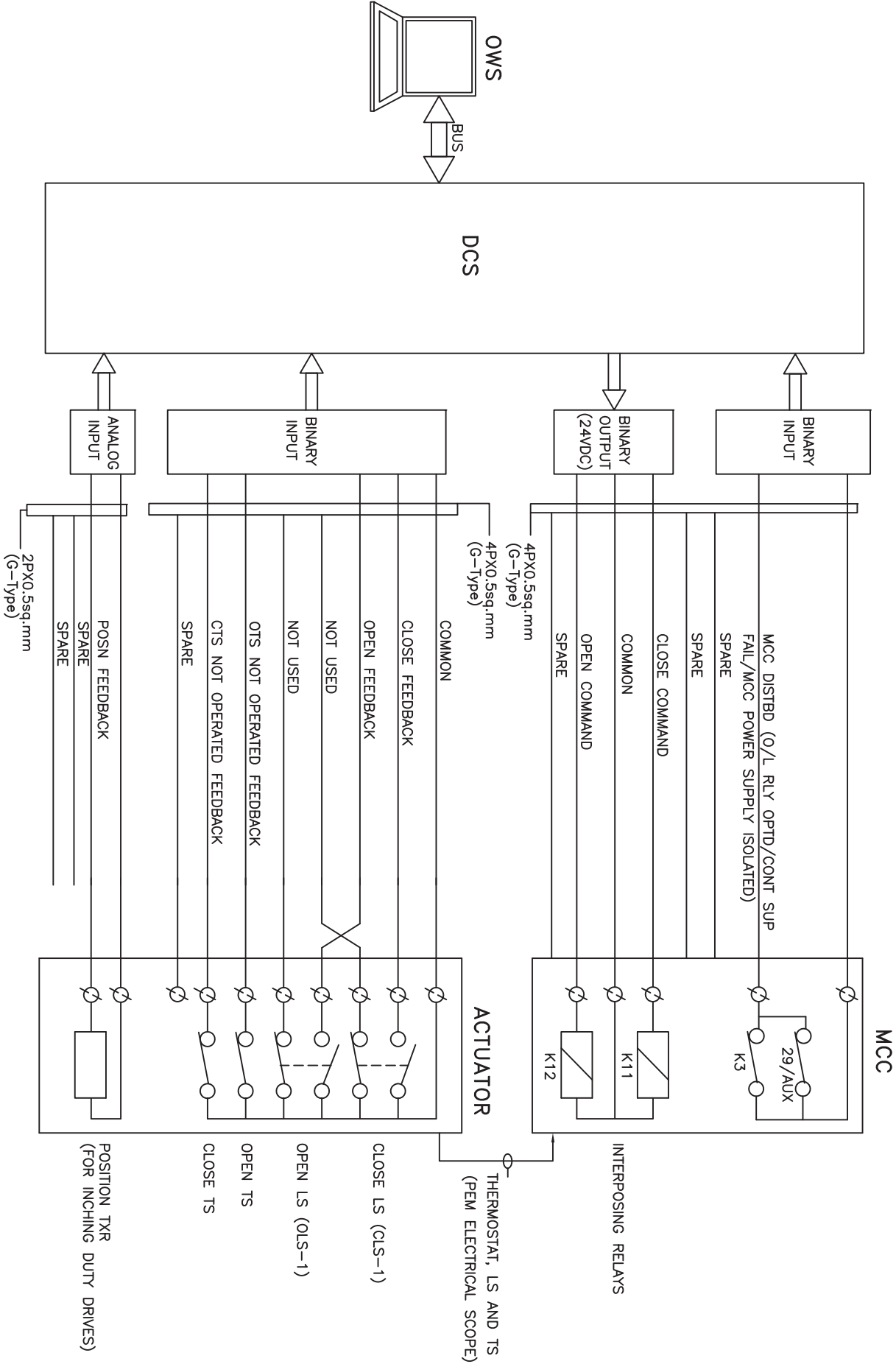
M: MANUFACTURER/ SUB CONTRACTOR, C: CONTRACTOR/ NOMINATED INSP AGENCY, B: BHEL. P: PERFORM, W: WITNESS, V: VERIFICATION.

NOTE:

1. QUANTUM OF CHECK SHALL BE AS BELOW
100 % - BY MANUFACTURER
RANDOM FOR EACH TYPE – BY BHEL & CUSTOMER
2. MANUFACTURER TO MAINTAIN CALIBRATED INSTRUMENT HAVING BETTER ACCURACY THAN THE ITEM UNDER TEST. INSPECTING ENGINEER SHALL CHECK THE SAME.
3. IN CASE OF IMPORTED ITEMS CONTRACTORS SHALL REVIEW TC's AND NOT INSPECT.

CONTRACTOR TO PROVIDE COMPLIANCE CERTIFICATE FOR TESTS/CHECKS VERIFIED BY CONTRACTOR AND SUBMIT THE SAME ALONGWITH TEST CERTIFICATES TO BE VERIFIED BY BHEL.

DCS INTERFACE FOR BIDIRECTIONAL DRIVE(WITH MCC)



PROJECT: 2 X 660 SURATGARH STPS, STAGE-V

TITLE

DDCMIS INTERFACE FOR
BIDIRECTIONAL DRIVE

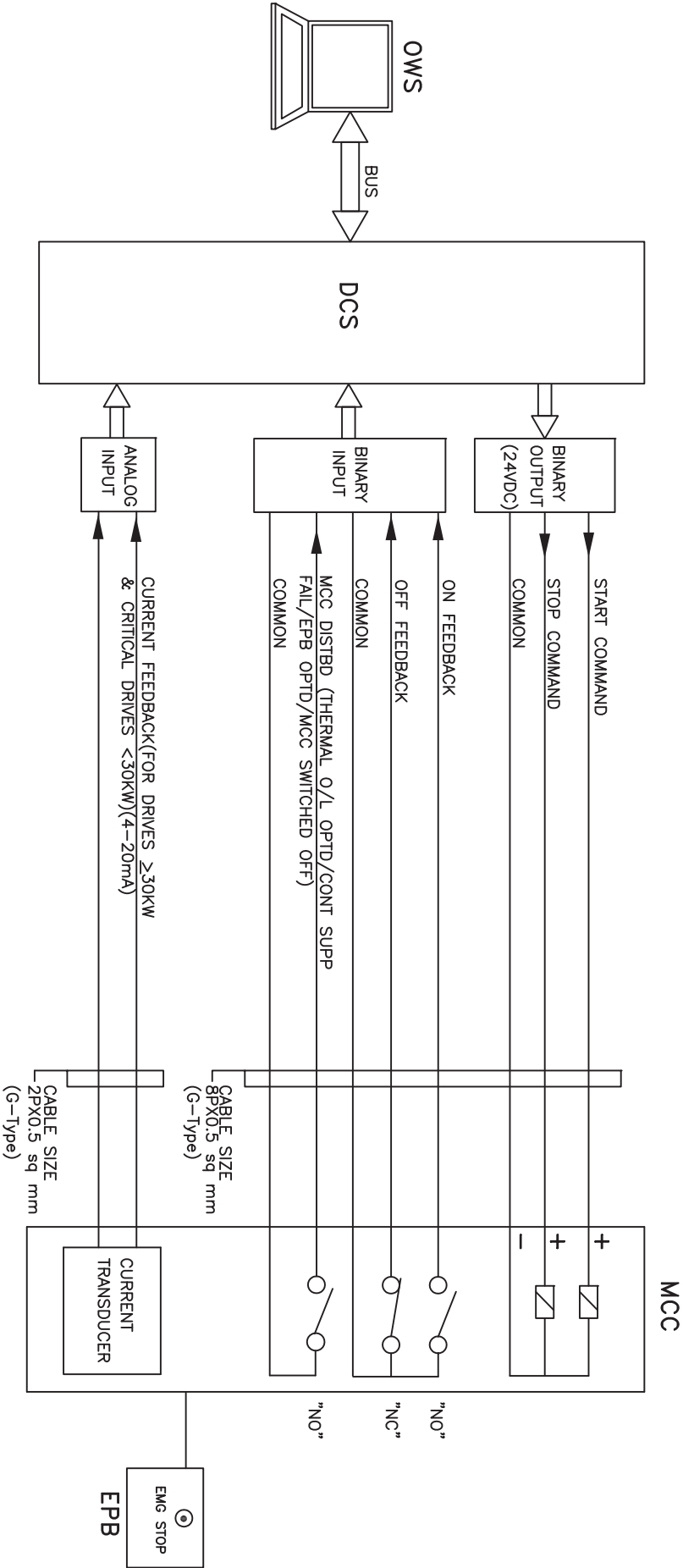
DRG.NO. PE-DM-392-145-1002

DATE 09.04.2013

REV.NO. 00

SHT 7 OF 12


DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE

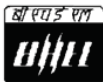



PROJECT: 2X660 MW SURATGARH STPS, STAGE-V

TITLE DDCMIS INTERFACE FOR UNIDIRECTIONAL LT DRIVE

DRG.NO.	PE-DM-392-145-1002
DATE	09.04.2013
REV.NO.	00
SHT	8 OF 12

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-SS-999-145-I007	
			VOLUME II B	
			SECTION D	
			REV. NO. 02	DATE: 17.09.07
		SHEET 1	OF 3	
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	<input type="checkbox"/> ON / OFF	<input type="checkbox"/> INCHING	
	* LINE SIZE (inlet/outlet): MATERIAL			
	* VALVE TYPE	<input type="checkbox"/> GLOBE <input type="checkbox"/> GATE <input type="checkbox"/> REG. GLOBE <input type="checkbox"/> BUTTERFLY		
	* OPENING / CLOSING TIMESECONDS		
	* WORKING PRESSUREKG/SQM		
	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:65		
	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(REGULATING) SERVICE 150 STARTS/HR MINIMUM		
HANDWHEEL	* REQUIRED	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO		
	* ORIENTATION	<input type="checkbox"/> TOP MOUNTED <input type="checkbox"/> 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.		
	ACTUATOR APPLICABLE WIRING DIAGRAM	<input checked="" type="checkbox"/> ENCLOSED (BIDDER TO CONFIRM) A: <input type="checkbox"/> DRG. NO. 3-V-MISC-24227 R00 B: <input type="checkbox"/> DRG. NO. 3-V-MISC-24283 R00 C: <input type="checkbox"/> DRG. NO. 3-V-MISC-24550 R00 D: <input type="checkbox"/> DRG. NO. 4-V-MISC-90271 R11		
	COLOUR SHADE	<input checked="" type="checkbox"/> EPOXY <input type="checkbox"/>		
	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 <input type="checkbox"/> 230 V <input type="checkbox"/> 110 V		
	@ ENCLOSURE CLASS OF MOTOR	<input type="checkbox"/> IP 65 <input checked="" type="checkbox"/> IP 67 <input type="checkbox"/> FLAME PROOF		
	@ INSULATION CLASS	<input type="checkbox"/> CLASS-B <input checked="" type="checkbox"/> CLASS-F TEMPERATURE RISE LIMITED TO CLASS B.		
	@ WINDING TEMP PROTECTION	<input checked="" type="checkbox"/> THERMOSTAT (3 Nos., 1 IN EACH PHASE) <input type="checkbox"/>		

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-SS-999-145-I007	
			VOLUME II B	
			SECTION D	
			REV. NO. 02	DATE: 17.09.07
			SHEET 2	OF 3
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
INTEGRAL STARTER	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED		
	INTEGRAL STARTER	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	TYPE OF SWITCHING DEVICE	<input checked="" type="checkbox"/> CONTACTORS <input type="checkbox"/> THYRISTORS		
	TYPE	<input checked="" type="checkbox"/> CONVENTIONAL <input type="checkbox"/> SMART (NON-INTRUSIVE)		
	IF SMART			
	a) SERIAL LINK INTERFACE	<input type="checkbox"/> INTEGRAL <input type="checkbox"/> FIELD MOUNTED		
	b) SERIAL LINK PROTOCOL	<input type="checkbox"/> FOUNDATION FIELD-BUS <input type="checkbox"/> PROFI-BUS <input type="checkbox"/> TCP/IP <input type="checkbox"/>		
	c) SERIAL LINK MEDIA	<input type="checkbox"/> TWISTED PAIR Cu-CBL <input type="checkbox"/> CO-AXIAL Cu-CBL <input type="checkbox"/> OFC		
	d) HAND HELD PROGRAMMER	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	e) MASTER STATION	<input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	f) MASTER STN INTRFACE WITH DCS	<input type="checkbox"/> MODBUS <input type="checkbox"/> TCP/IP		
	g) DETAILS OF SPECIAL CABLE	<input type="checkbox"/> ENCLOSED <input type="checkbox"/> NOT REQUIRED		
	STEP DOWN CONT. TRANSFORMER	<input checked="" type="checkbox"/> REQUIRED		
	OPEN / CLOSE PB	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	STOP PB	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	INDICATING LAMPS	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	LOCAL REMOTE S/S	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	STATUS CONTACTS FOR MONITORING	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED		
	INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY)		
INTERPOSING RELAY (Applicable for integral Starter)	INTERPOSING RELAYS	<input checked="" type="checkbox"/> REQUIRED		
	INTERPOSING RELAY (QUANTITY)	<input checked="" type="checkbox"/> 2 Nos. <input type="checkbox"/> 3 Nos.		
	DRIVING VOLTAGE	<input checked="" type="checkbox"/> 20.5 – 24V DC <input type="checkbox"/> _____ V DC		
	DRIVING CURRENT	<input checked="" type="checkbox"/> 125mA MAX <input type="checkbox"/> _____ mA MAX		
	LOAD RESISTANCE	<input checked="" type="checkbox"/> > 192 ohms - <25 k ohms <input type="checkbox"/> > _____ ohms - < _____ ohms		
TORQUE SWITCH (Not Applicable for Smart Actuator)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN / CLOSE	<input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos. / <input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos		
	CONTACT TYPE	2 NO + 2 NC		
	RATING	5A 240V AC AND 0.5A 220V DC		
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE		
	ACCURACY	+3% OF SET VALUE		
LIMIT SWITCH (Not Applicable for Smart Actuator)	MFR & MODEL NO.	BIDDER TO SPECIFY		
	OPEN : INT : CLOSE	<input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2 Nos.	2 Nos. (ADJ.)	<input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos.
	CONTACT TYPE	2 NO + 2 NC		
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC		

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO.: PE-SS-999-145-I007		
		VOLUME	II B	
		SECTION	D	
		REV. NO.	02	DATE: 17.09.07
		SHEET	3	OF 3
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)	<input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	<input checked="" type="checkbox"/> ELECTRONIC (2 WIRE) R/I CONVERTER <input type="checkbox"/> ELECTRONIC (2 WIRE) CONTACTLESS	
	SUPPLY	<input checked="" type="checkbox"/> 24V DC <input type="checkbox"/>	
	OUTPUT	<input checked="" type="checkbox"/> 4-20mA	
	ACCURACY	± 1% FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY		
	@ RATING		
TERMINAL BOX	MOTOR TERMINAL BOX	REQUIRED	
	ACTUATOR TERMINAL BOX	REQUIRED	
	ENCL CLASS MTR T.B. / ACTUATOR T.B.	<input checked="" type="checkbox"/> IP 65 <input type="checkbox"/> <input checked="" type="checkbox"/> IP65 <input type="checkbox"/>	
	@ EARTHING TERMINAL	REQUIRED	
	PLUG & SOCKET(9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	<input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED <input type="checkbox"/> 2 NOS. <input type="checkbox"/>	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:	
	@ SPACE HEATER CABLE GLAND	SIZE:	
	OTHER CONTROL CABLE GLANDS	QUANTITY & SIZE :	
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY _____ Kg.	

NOTES:

- SCOPE:** DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
- CODES & STANDARDS:** DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
- TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
- CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.
- 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.
- 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%.
- THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.

NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	VENDOR COMPANY SEAL
	M.A. Mansoori	Pankaj Jain	S.K. Datta	NAME
				SIGNATURE
	17.09.2007	27.09.2007	28.09.2007	DATE
NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @ = TO BE FILLED BY ES				



TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)

SPEC. NO. PE-TS-392-165-N003

VOLUME : IIB

SECTION : D

REV. NO. 0

DATE :22.04.14

SHEET 1 of 1

LIST OF SUB-VENDORS

LIST OF SUB-VENDORS (AS ON DATE)

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 1 OF 16
<p><u>The list of acceptable makes for I&C equipment / system are as listed below: -</u></p> <p>AIR FILTER REGULATORS</p> <p>PLACKA Shavo – Norgan (India) Pvt Ltd. ABB Ltd. BELLS CONTROLS LTD. Schrader – Schorill Duncan Ltd., Mumbai. Vel jan Hydrair Pvt Ltd., Hyderabad.</p> <p>GAS ANALYSERS</p> <p>Emerson Process Management ABB Ltd. Teledyne Novatel Codel Land Combustion Fuji. Yokogawa Bluestar Ltd. Chemtrols. Siemens.</p> <p>NITRIC OXIDE (NOX) ANALYSER</p> <p>Land Combustion Ltd. Emerson Process Management Horiba Chemtrols Siemens ABB Ltd.</p> <p>OXYGEN MEASUREMENT (ZIRCONIUM PROBE)</p> <p>ABB Ltd. H & B (HARTMANN & BRAUN) Emerson Process Management Seco Controls Land Combustion.</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 2 OF 16
<p>PARTICULATE EMISSION</p> <p>Land Combustion Ltd. Emerson Process Management Siemens Durag. Fireye. Sintrol – oy – Finland. Erwin – Sick (Germany) Oldham (France)</p> <p>SMOKE DENSITY</p> <p>Skil Teledyne / Honeywell Codel Land Combustion EMERSON PROCESS MANAGEMENT Durag</p> <p>SULPHUR-DI-OXIDE (SO2)</p> <p>ABB Land Combustion Ltd. Emerson Process Management Horiba, Fuji.</p> <p>COMPENSATING CABLE</p> <p>Industrial Instrumentation Consortium General Instruments Toshiniwal Industries Pvt. Ltd. Polycab. Udey Pyro Cables. REL</p> <p>INSTRUMENT CABLES</p> <p>Incab Delton Fort Globster Industries</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 3 OF 16
<p>Universal Cables Ltd Reliance Cables</p> <p>Gems Cab</p> <p>CONTROL CABLES Delton Incab Universal Cables ltd Reliance Cables Gems Cab.</p> <p>CONDUCTIVITY MEASUREMENT</p> <p>Emerson Process Management Honeywell ABB Ltd. Polymetron. Yokogawa Bluestar Ltd</p> <p>DISSOLVED OXYGEN MEASUREMENT</p> <p>Honeywell Polymetron Emerson Process Management ABB Yogokawa Bluestar Ltd.</p> <p>HYDRAZINE ANALYSER</p> <p>Hach ABB Polymetron Emerson Process Management</p> <p>PH</p> <p>Hach Polymetron Forbes Marshall Honeywell Emerson Process Management ABB Ltd</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 4 OF 16
<p>SILICA</p> <p>Hach Polymetron Braun & Leube ABB Emerson Process Management</p> <p>CONTROL VALVES</p> <p>Dresser Masoneilan - France, Fisher Yamatake CCI ABB Welland & Tuxhorn Gulde Regal Armtturen. Pneucon</p> <p>ELECTRICAL ACTUATORS</p> <p>Vaas Bernard Auma India Ltd. Limitorque Rotork Controls Ltd. Antrieb</p> <p>DIFFERENTIAL PRESSURE INDICATORS</p> <p>Indfoss AN Instruments Switzer Instruments Ltd. Waaree Instruments Ltd. General Instruments (GIC) H.Guru A N Instruments</p> <p>DIFFERENTIAL PRESSURE SWITCHES</p> <p>Indfoss Switzer Instruments Ltd. Varma Trafag Waaree Instruments Ltd</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 5 OF 16
<p>General Instruments (GIC)</p> <p>PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER</p> <p>Honeywell Emerson Process Management ABB Yokogawa Fuji Yamatake Endress & Hauser SIEMENS</p> <p>DIGITAL DISPLAY UNIT</p> <p>Laxsons Yogokawa Bluestar Ltd. Tata Honeywell Ltd. Gossien Metrawatt</p> <p>DISPLACEMENT TYPE LEVEL TRANSMITTERS</p> <p>Dresser Masoneilan Emerson Process Management Magnetrol Yamatake Endress & Hauser</p> <p>ELECTRIC METERS</p> <p>AE MECO Gossien ABB</p> <p>E/P CONVERTERS</p> <p>Bells Controls Ltd. ABB Emerson Process Management Sical Yamatake</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 6 OF 16
<p>FLOW ELEMENT</p> <p>Starmech Micro precision products Engineering Specialities Pvt Ltd. Mech Engg General Instruments (GIC) Teleflow Emerson Dag Process Instruments Hydropnematic</p> <p>FLOW GLASSES</p> <p>Eureka General Instruments Levcon V.Automat & Instrument (p) Ltd. Bliss Anand</p> <p>FLOW INTEGRATORS</p> <p>Lectrotek Nishko ABB Ltd. Rockwin</p> <p>ILLUMINATED PUSH BUTTONS</p> <p>EAO H & B L & T Ronan Honeywell Siemens</p> <p>STANDALONE SER</p> <p>Hathaway (Imported) Ronan (Imported)</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 7 OF 16
<p>MICROPROCESSOR BASED ANNUNCIATION SYSTEM</p> <p>Hathaway (Imported) Ronan (Imported)</p> <p>LEVEL GAUGES</p> <p>Chemtrols Engg. Levcon Sigma Instruments co. Technomatic (India) pvt. ltd. Teleflo Instruments co. ltd. Pune Techtrol B K Equipment V Automat SBEM Bliss Anand</p> <p>LEVEL SWITCHES</p> <p>Bells Control Ltd. Levcon Magnetrol Placka Pune Techtrol B K Equipment V Automat SBEM Bliss Anand</p> <p>POSITION TRANSMITTER</p> <p>Endress & Hauser Yamatake Siemens Gulde</p> <p>PRESSURE INDICATORS</p> <p>H.Guru Bells Controls ltd. General Instruments</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 8 OF 16
<p>A.N. Instruments Gauges Bourdon Industrial Eqpt. co. Waaree Instruments Ltd. Odion Druck India Wika Instruments</p> <p>PRESSURE SWITCHES</p> <p>Indfoss (India) Ltd. Switzer Instruments ltd. Varma Trafag A.N. Instruments Waaree Instruments Ltd Dag Process Instruments Chemtrols</p> <p>PUSH BUTTONS</p> <p>Honeywell Larsen & Toubro ltd. Siemens ltd. Tele Mechanic</p> <p>RECEIVER INDICATOR (BAR GRAPH)</p> <p>Laxons Masibus Industrial Instrumentation Yokogawa Teletherm Instruments co.</p> <p>RECEIVER RECORDER / MULTIPOINT RECORDER</p> <p>Laxons Engg. & Electronic Pvt. Ltd. Yokogawa. Tata Honeywell ABB Digital Electronics. Penny & Guile</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 9 OF 16
<p>RELAYS</p> <p>Jyothi ABB Paramount Omron SIEMENS</p> <p>SAMPLE COOLER</p> <p>Polymetron Emerson Process Management Sentry Lowe</p> <p>SAMPLING RACK</p> <p>Emerson Process Management Polymetron</p> <p>SOLENOID VALVES</p> <p>Asco Avcon Rotex Schrader Herion-Norgren Schovill Duncan Ltd.</p> <p>TEMPERATURE INDICATORS</p> <p>G.I.Consortium Bells Controls Waaree instruments ltd Dresser-USA</p> <p>TEMPERATURE SWITCH</p> <p>Ashcroft Switzer Instruments Ltd. Waaree Instruments Ltd Dresser-USA</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 10 OF 16
<p>TEMPERATURE TRANSMITTERS</p> <p>ABB Ltd. Emerson Process Management Camille-Baur P & F.</p> <p>THERMO COUPLE ASSEMBLY</p> <p>Industrial Instrumentation General Instruments Nagman Sensors (p) Ltd Pyro Electric instruments Toshniwal Industries Pvt. Ltd. Altop Temsens Waaree</p> <p>THERMOWELL</p> <p>General Instruments Nagman Sensors (p) Ltd. Pyro Electric Instruments Detriev Instrumentation Toshniwal Industries Ltd. Altop Temsens Waaree</p> <p>RTD</p> <p>Industrial Instrumentation Nagman Sensors (p) Ltd. Toshniwal Industries Pvt. Ltd Pyro Electric Instruments Altop Temsens Waaree</p> <p>UNIT CONTROL PANELS</p> <p>Industrial Controls & Appliances (P) Ltd. J & H</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 11 OF 16
<p>Chemin Rittal</p> <p>LOCAL CONTROL PANELS</p> <p>Industrial Controls & Appliances (P) Ltd. J & H Pyrotech Rittal Chemin</p> <p>VARIABLE AREA FLOWMETERS</p> <p>Eureka Krone – Marshall Scientific Devices Chemtrols Trac Instrument Engineers</p> <p>CONDITION MONITORING SYSTEM</p> <p>Bently Nevada Schenk Avery SPM Instruments Ltd. Rockwell Automation. Shinkawa.</p> <p>ANNUBAR</p> <p>Dietrich Emerson Process Management</p> <p>ASSIGNABLE TREND RECORDER</p> <p>Honeywell Yokogawa Penny & Guile</p> <p>DESUPERHEATER</p> <p>Fisher Dresser Masoneilan</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 12 OF 16
<p>CCI</p> <p>FLOAT & CHORD TYPE LEVEL INDICATOR</p> <p>Jayati Pune Techtrol B K Equipment V Automat SBEM Bliss Anand</p> <p>LEVEL SWITCH (PROBE TYPE)</p> <p>Level Stat Solatron Keystone Yarway.</p> <p>LAB INSTRUMENTS</p> <p>Dead Weight Tester (Pneumatic)</p> <p>Pressurements Waaree Instruments Ltd</p> <p>PRESSURE AND VACCUM GENERATORS WITH FINE REGULATOR</p> <p>Superb Instruments</p> <p>HIGH PRECISION REGULATORS FOR PRESSURE & VACUUM</p> <p>Fairchild</p> <p>HIGH TEMPERATURE FURNACE</p> <p>Nagman Waaree Instruments Ltd</p> <p>DIGITAL STORAGE OSCILLOSCOPE</p> <p>Phillips</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 13 OF 16
<p>AC CLAMP ON METER</p> <p>Extech</p> <p>DIGITAL STROBOSCOPE</p> <p>Lutron</p> <p>SLING SYNCHROMETER</p> <p>Extech</p> <p>PORTABLE FLUE GAS ANALYSER</p> <p>Emerson Process Management</p> <p>BAROMETER</p> <p>Standard make subject to purchaser's approval</p> <p>SMD REWORK STATION</p> <p>Soldron Hakko OKS</p> <p>LAB & Control room FURNITURE</p> <p>Godrej</p> <p>PNEUMATIC POSITIONER / ELECTRO PNEUMATIC POSITIONER</p> <p>Masoneilan (India) Ltd. ABB</p> <p>ULTRASONIC TYPE LEVEL SWITCHES</p> <p>Nivo Controls Pvt Ltd. SB Electro Mechanics Ltd. E & H. Emerson Process Management</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 14 OF 16
<p>RF Level Switch.</p> <p>EIP Bulk Controls Pvt Ltd. EIP Enviro Controls.</p> <p>TERMINAL BLOCKS</p> <p>Phoenix Weidmueller Wago</p> <p>MINIATURE CIRCUIT BREAKERS</p> <p>Siemens ABB L & T.</p> <p>LARGE VIDEO SCREENS / PLASMA VIDEO WALLS</p> <p>Barco Synelec SONY SAMSUNG LG</p> <p>DCS</p> <p>ABB BHEL Tatahoneywell Emerson Process Management Invensys Siemens Yokogawa Bluestar Ltd</p> <p>PLC</p> <p>AllenBradley ABB Honeywell</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 15 OF 16
<p>BUNKER LEVEL INDICATORS</p> <p>Pepper &Flucs E&H Emerson Process Management EIP Enviro Controls</p> <p>PLASMA MONITORS</p> <p>Sony Samsung LG</p> <p>WORK STATIONS / MIS STATIONS/SERVERS</p> <p>IBM HP DELL</p> <p>MASS FLOW METER</p> <p>Emerson Process Management E&H</p> <p>SCREW PUMPS & DEAD WEIGHT TESTER(Hydraulic) Manometer India Budenberg Nagman Druck</p> <p>VIBRATION ANALYSIS SYSTEM</p> <p>Bentley Nevada Bruelenzar Rockwell SKF</p> <p>FURNACE FLAME ANALYSIS SYSTEM</p> <p>Durag, Hitech(BFI) EU tech scientific engg., GMBH</p>		
		ISSUE R1

SPEC.NO. TCE.5750A-H-500-001	TATA CONSULTING ENGINEERS LIMITED	VOLUME V SECTION:TABLE17
Package: EPC	RRVUNL, 2 x 660 MW,Super-Critical TPS,Stage-V, Unit # 7 & 8 at Suratgarh, Rajasthan INSTRUMENTATION AND CONTROL EQUIPMENT LIST OF SUB VENDORS	SHEET 16 OF 16
<p>PADO</p> <p>STEAG encotec (India) Pvt. Ltd. (Evonics) Honeywell Invensys Emerson</p> <p>CMMS</p> <p>Honeywell InvensysABB TCS</p> <p>AAQMS & MMS</p> <p>Chemtrols Campbell scientific canda corp Honeywell (Teledyne) Techmark engineers and cosultants (Horiba) Nevco engg pvt. Ltd. (LSI lastern)</p> <p><u>NOTES</u></p> <ol style="list-style-type: none"> 1. The final make selected out of the recommended makes listed above shall be subject to purchaser / consultant's approval during detailed Engineering. 2. Wherever the make is not specified for any item, the Bidder shall indicate 2 or 3 reputed makes, out of which Purchaser / Consultant shall select any one which is acceptable suggest an acceptable make. This shall have no price implication. 		
		ISSUE R1