TSGENCO, 4X270 MW BHADRADRI TPS

TECHNICAL SPECIFICATION

FOR SELF CLEANING STRAINERS (SCS)

Specification No. : PE-TS- 411-165-N003 (REV. 0)

VOLUME -IIB

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

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.
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)

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.

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SECTION - A
SCOPE OF ENQUIRY

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 4X270 MW BHADRADRI TPS.

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.

2.0.2.00 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.

SECTION – B

PROJECT INFORMATION

PROJECT INFORMATION

INTRODUCTION

4x270 MW Bhadradri TPS is being set up by Telangana State Electricity Corporation Limited (TSGENCO) at Manuguru in the district of Khammam, Telangana, India.

The Bidder shall acquaint himself by a visit to the site, if felt necessary, with the conditions prevailing at site before submission of the bid. The information given here in under is for general guidance and shall not be contractually binding on BHEL/Owner. All relevant site data /information as may be necessary shall have to be obtained /collected by the Bidder.

APPROACH TO SITE

The distance from Manuguru to Major cities in state:

City	Km
Hyderabad	345
Warangal	180
Bhadrachalam	38
Kothagudem	70
Khammam	130
Vijayawada	195

District : KHAMMAM

State : TELANGANA

Nearest Airport: The nearest airport is Vijayawada Airport but the most used airport is the Hyderabad International Airport.

Nearest Railway Station: Manuguru railway station is 10KM from nearby town. However Warangal/Vijaywada railway Station is major railway station near to Manuguru.

	PROJECT INFORMATION FOR 4 X 270 MW BHADRADRI TPS	SPECIFICATION NO.	
		VOLUME II - B	
		SECTION - B	
		REV 00	DATE MAR 2015

1. Owner : TSGENCO
2. Project Title : 4X270 MW Bhadradri TPS
3. Location : 16 Km from Manuguru Railway station
4. Nearest Railway Stn. : Manuguru
5. Temperature
   a. Mean daily minimum ambient temperature during oldest month of the year: 11.5 Deg.C
   b. Mean daily minimum ambient temperature during hottest month of the year: 45.1 Deg.C
6. Rainfall: Intensity of rainfall @ 50 mm/hr considering heaviest fall in 24 hrs
7. Wind Data: Basic wind speed at 10m height : 44 m/sec
8. Wind pressure As per IS: 875 Part III- 1987
9. Seismic Zone: Zone III as defined in IS:1893 (part-1)-2002 according to Indian Standard Seismic Zoning Map

10	**Power Supply : The power supplies for distribution and auxiliaries shall be as under:**	
	a) In plant generation	16.5kV ±5% , 3ph, 50Hz ±5%, high resistance earthed.
	b) MV distribution	6.6kV ±6 %, 3ph, 3w , 50 Hz, + 5 % to – 5%, Non-effectively earthed
	c) LT distribution	415V ±10%, 3ph, 4W, 50Hz + 5% to –5%, Effectively earthed
	d) Motor rated above 160kW	6.6kV ±6 %, 3 ph 50Hz +5% to -5%.
	e) Motor rated 160kW and below all motorized actuators.	415V ±10%, 3 ph, 50Hz +5% to -5%.
	f) For motors equal and below 30kW winding heating	24V AC ±10, 50 Hz %, [to be generated in 415V switchgear by vendor]
	g) DC Motors	220V DC + 10% to - 15%, 2 wire ungrounded system
	h) Control supply for relay panel/ 6.6kV breakers/415V breakers and DC emergency lighting.	220V DC + 10% to - 15%, 2 wire ungrounded system
	i) UPS for instrumentation & Control system	240V AC ±1 %, 1 ph ,50Hz ±0.5% 2 Wire AC system
	j) Control supply for 415V Motor contactors/AC Control circuits [to be generated in MCC /panel by vendor]	110V AC ±10%, 50Hz + 5% to –5%.
	k) Diesel Generator emergency supply	415V ±10%, 3ph,3W, 50Hz +5%to –5%.
11	**Fault levels**	
	a) 400kV	40kA rms for 1 sec
	b) 6.6kV	40 kA rms for 1 sec.
	c) 415V	50 kA rms for 1 sec.
	d) DC Supply	25 kA

TELANGANA STATE POWER GENERATION CORPORATION LIMITED

APGE

TEST REPORT BY ENVIRONMENT SUB DIVISION

1. Sample Name : GODAVARI RIVER WATER
2. Location : AT MANUGURU
3. Sampling date : 09-10-2014.
4. Reporting date : 10-10-2014.

S.NO	TESTING PARAMETER	RESULT
1.	pH	7.73
2.	Conductivity(micro Siemens/cm)	328
3.	Dissolved solids(mg/litre)	218
4.	Total Hardness as $CaCo_3$, mg/litre	94
5.	Calcium as Ca, mg/litre	60
6.	Magnesium as Mg.mg/litre	34
7.	Total Alkanity as $CaCo_3$, mg/litre	140
8.	Chlorides as Cl, mg/litre	30
9.	Sulphates as SO_4,mg/litre	58
10.	Silica as SiO_2,mg/litre	5.20
11.	Iron as Fe,mg/litre	0.007
12.	Turbidity (NTU)	16

10/10/14

CHEMIST/ENV.SUB.DVN

10/10/14

CLARIFIED WATER ANALYSIS WITH COC OF 5.

SECTION – C

SPECIFIC REQUIREMENTS

SECTION C1 : SELF CLEANING STRAINERS (MECHANICAL)

SECTION C2 : ELECTRICAL SYSTEMS

SECTION C3 : C&I SYSTEMS

SECTION C1

SELF CLEANING STRAINERS

(MECHANICAL DETAILS)

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 of the 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.	4X270 MW BHADRADRI TPS	2 SETS PER UNIT VIZ. TOTAL 8 SETS FOR 4 UNIT.

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 this project.

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 debris disposal pipework and bends as per the list of BOQ mentioned in Annexure-I to this Section. In case actual, still bidder has to supply the same 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) All Valves and NRVs in Bidder's Inter Connecting Piping/Debris Disposal Piping along with their Counter Flanges. (Refer Annexure-II of this Section)

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

e) SCS shall be supplied along with flanges as well as the Counter flanges, complete with bolts, nuts and gaskets.

f) 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.

g) 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.

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

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

j) 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 supply feeder).

k) Power and Control cables between Panel and various drives in bidder's scope of supply. Location of Local Starter Panel may be considered 20m away from the drives and accordingly bidder to estimate cables in their scope.

l) Control cables between field instruments and panel.

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

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

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

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

q) Various drawings, data test reports/ certificates instruction manuals for erection operation and maintenance etc. as specified in Data Sheet-C. and cables schedule indicating BOQ for power & control cables.

r) 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 this project

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 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 :**

  i. 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.

  ii. Bidder shall demonstrate guarantees including pressure drops at site during subsequent visit for SCS of each unit.

  iii. 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.

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 2.5 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.

8.0 SPARES :

8.1 **Recommended Spares :**
Bidder to submit the list of recommended spares (along with prices) as per NIT required for three (3) years of reliable operation and maintenance of SCS for BHEL reference purpose only.
The recommended spares shall not be considered for evaluation and ordering purpose.

8.2 **Mandatory Spares : As per Datasheet-A.**

9.0 Quality Plan

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

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.

ANNEXURE-I

SELF CLEANING STRAINERS

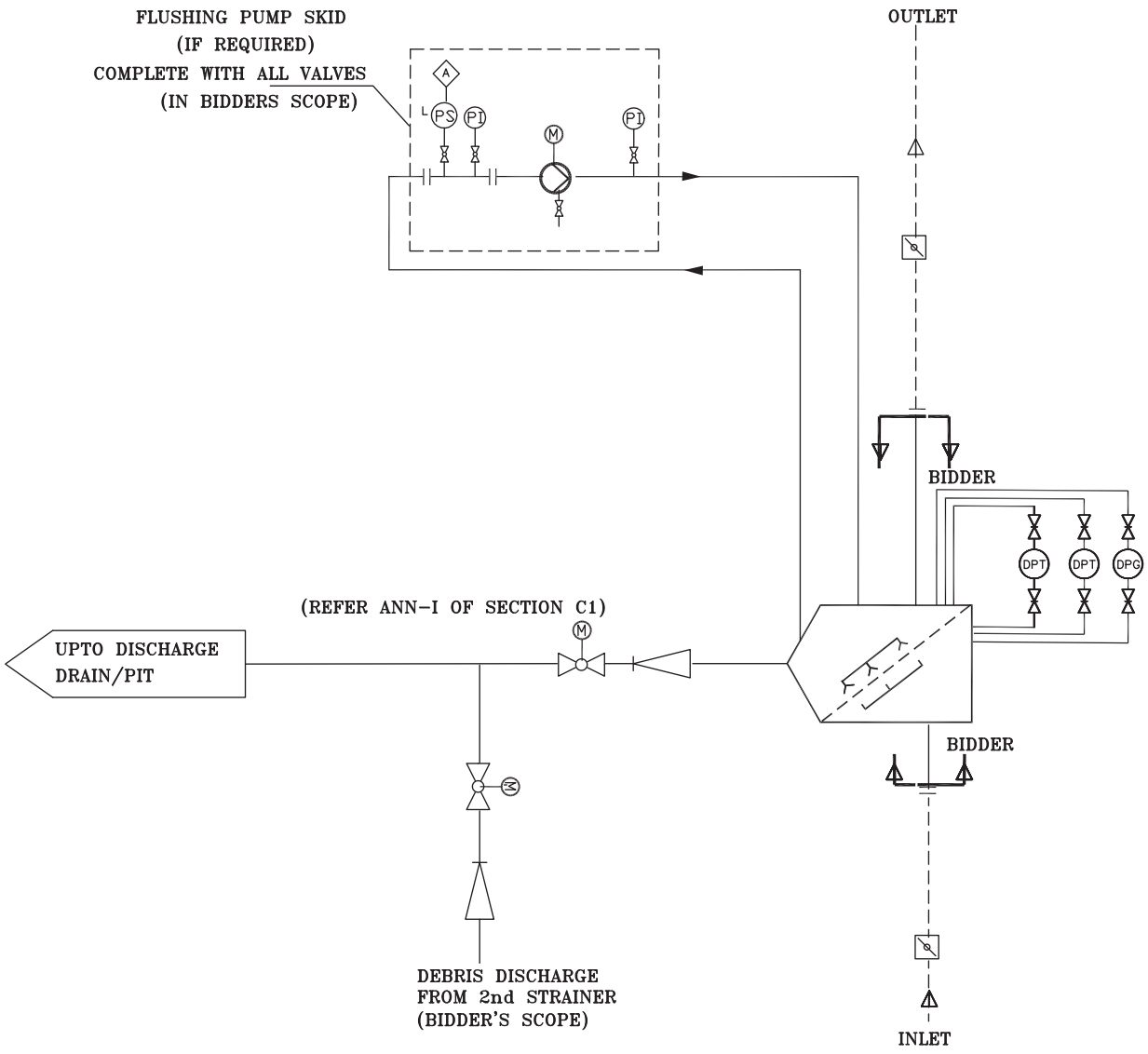
SL.NO.	Projects	Size (NB)	Length of SCS (Excluding Counter Flange)	Scope of Counter Flange	Scope of nuts and bolts.
1.	4X270 MW BHADRADRI TPS	600 NB	2400 mm	In Bidder's Scope	In Bidder's Scope

BOQ OF DEBRIS DISPOSAL PIPE WORK for each unit of 270 MW:

A) Individual line for each SCS
i) Pipe - 10M
ii) 90 elbow -4 Nos

B) Common line
i) Pipe - 60M
ii) 90 elbow -10 Nos.
iii) Unequal Tee - 2 Nos

ANNEXURE–II



NOTE :–

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

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

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

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

5. PURCHASER — BIDDER'S SCOPE OF SUPPLY

FLOW DIAGRAM FOR

SELF CLEANING STRAINER

SECTION C2

SELF CLEANING STRAINERS

(ELECTRICAL DETAILS)

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

a) Services and equipment as per "Electrical Scope between BHEL and Vendor".
b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
d) Electrical load requirement for COLTCS/SCS
e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
h) Motor shall meet minimum requirement of motor specification.
i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
j) Cable BOQ worked out based on routing of cable listing provided by the vendor for " both end equipment in vendor's scope"shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

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

Refer "Electrical Scope between BHEL and Vendor".

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

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

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

4.0 List of enclosures :

a) Electrical scope between BHEL & vendor (Annexure –I)
b) Technical specification for motors.
c) Datasheets (A & C) & quality plan for motors.
d) Electrical Load data format (Annexure –II)
e) BHEL cable Schedule format (Annexure –III)
f) Explnatory notes for cable routing

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

PACKAGES: SCS
SCOPE OF VENDOR: SUPPLY

PROJECT:

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC Starter cum control panel (if applicable)	BHEL Vendor	BHEL BHEL	415 V AC, 3 phase, 4 wire supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	 BHEL Vendor BHEL	 BHEL BHEL BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Cabling/ termination by BHEL.
4	Junction box for control & instrumentation cable	Vendor	BHEL	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	BHEL	Refer scope/ C&I portion of specification for scope of fibre Optical cables if used between PLC/ micro processor & DCS.
6	Cable trays, accessories & cable trays supporting system	BHEL	BHEL	
7	Cable glands and lugs for equipment supplied by Vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty copper lugs for power & control cables.
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	BHEL	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding & lightning protection	BHEL	BHEL	

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

PACKAGES: SCS
SCOPE OF VENDOR: SUPPLY

PROJECT:

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

NOTES:

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

SECTION C3

SELF CLEANING STRAINERS

(C&I DETAILS)

		4 X 270 MW BHADRADRI TPS
1.00	**SYSTEM**	SELF CLEANING STRAINER
2.00	**COMMON / PER UNIT**	PER UNIT
3.00	**CONTROL SYSTEM**	DCS
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	***PROTECTION CLASS FOR PLC / RIO PANEL***	NA
8.00	**CONTROL FROM PB's ON LCP/OWS ON LCP**	NA
9.00	**ANNUNCIATION ON LCP (Y/N) -- IF Y, MIN NO. OF HARDWIRED ALARMS / INDICATIONS**	NA
10.00	**CONTROL FROM DCS IN CCR (Y/N)**	Y
11.00	**TYPE OF SOFTLINK (TP/OFC)**	NA
12.00	**RIO / RPU (Y/N)**	NA
13.00	**## NO. OF OWS / LAPTOP**	NA
14.00	**NO. OF PRINTER**	NA
15.00	**$$ POWER SUPPLY AVAILABLE FOR BALL MONITOR (24V DC / 110 V AC UPS / 230 V AC UPS)**	NA
16.00	**ACTUATOR WITH INTEGRAL STARTER (Y/N)**	Y
17.00	**PG/ DPG/ PS/ DPS/ PT/ DPT per Self cleaning Strainer**	DPT = 2 nos. DPG = 1 no.
18.00	**REMARKS**	
19.00	**PROJECT SPECIFIC INFO**	

20.00 **NOTES:**

1. COMPLETE CONTROL & INSTRUMENTATION FOR SCS IS IN BIDDER SCOPE OF SUPPLY. ITEMS NOT SPECIFICALLY MENTIONED HOWEVER REQUIRED FOR THE COMPLETENESS OF THE SYSTEM SHALL BE SUPPLIED BY BIDDER.

2. FOR 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. COMPLETE CABLE SCHEDULE (IN BHEL EXCEL FORMAT PROVIDED IN ELECTRICAL PORTION OF THE SPECIFICATION) & CABLE INTERCONNECTION DETAILS FROM FIELD TO JB/LCP & JB/LCP TO DCS SHALL BE PROVIDED BY BIDDER.

3. ALL THE INSTRUMENTS ALONG WITH NECESSARY FITTINGS, ACCESSORIES AND VALVE MANIFOLD ETC., INSTRUMENT RACK AND JUNCTION BOXES,ERECTION HARDWARE SHALL BE IN BIDDER'S SCOPE OF SUPPLY.

4. BIDDER TO FURNISH ELECTRICAL LOAD DATA DURING DETAILED ENGINEERING.

5. ALARM FACIA SHALL BE UNDER BIDDER'S SCOPE. NO. OF FACIA SHALL BE DECIDED DURING DETAILED ENGINEERING.

6.THE SCOPE OF CABLE SHALL BE REFERRED IN ELECTRICAL SCOPE SPLIT SHEET IN ELECTRICAL PORTION OF THE SPECIFICATION.

7. Two (2) sets of SCS shall have one common starter Panel (Switch Gear Panel).

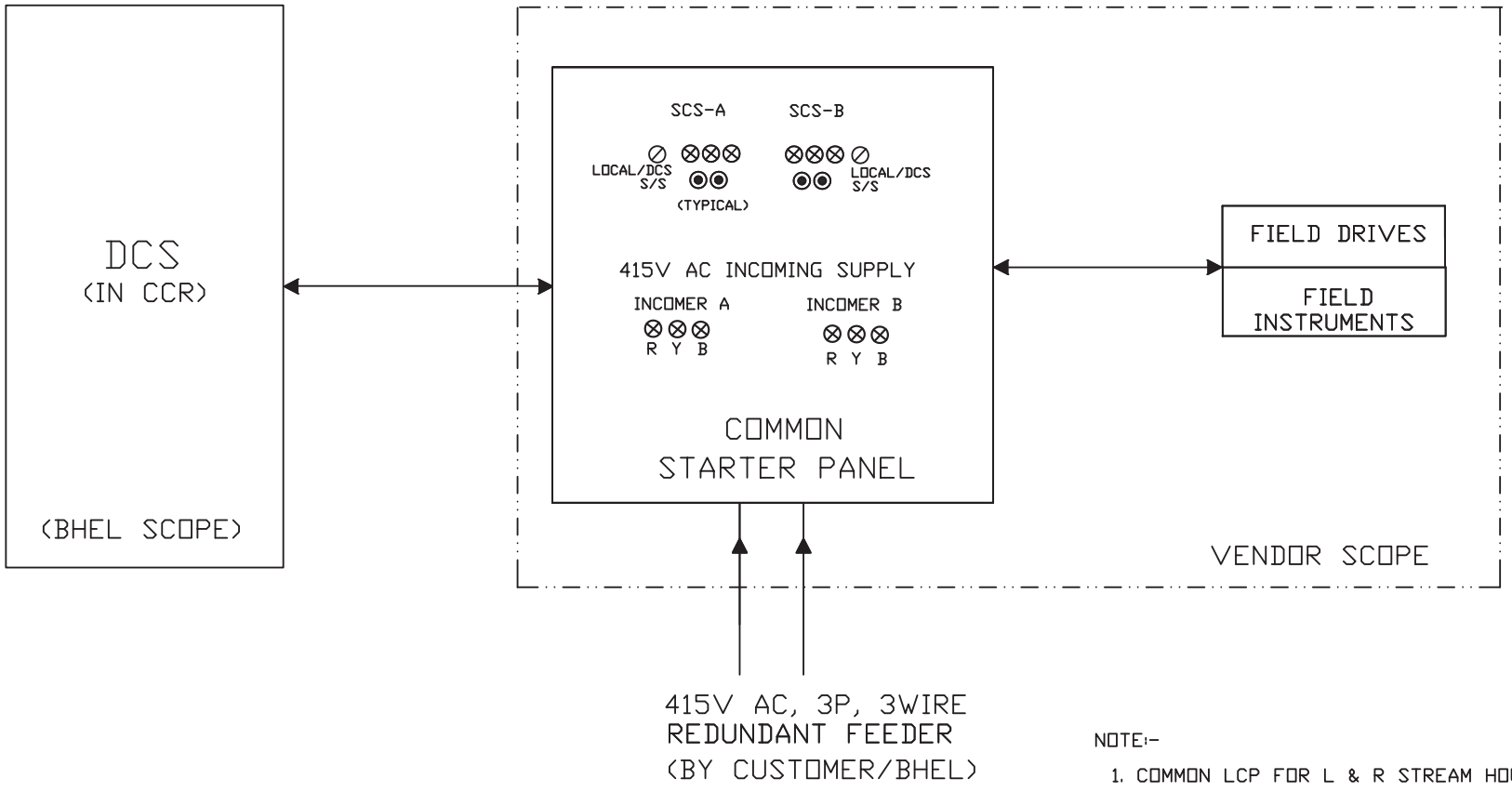
LEGEND:

DCS- DISTRIBUTED CONTROL SYSTEM

PLC- PROGRAMMABLE LOGIC CONTROLLER

RPU - REMOTE PROCESSING UNIT

STANDARD BLOCK DIAGRAM FOR SCS PACKAGE WITH DCS



NOTE:-

1. COMMON LCP FOR L & R STREAM HOUSING PB , LAMPS ETC.
2. SIGNALS FOR FIELD INSTR. & FOR 'BID' DRIVES WITH INTEGRAL STARTER SHALL BE ROUTED TO DCS THROUGH STARTER PANEL.

DRG. NO. PE-DG-999-145-I275A(a)

SECTION – D

STANDARD TECHNICAL SPECIFICATION

SECTION D1 : SELF CLEANING STRAINER (MECHANICAL)

SECTION D2 : ELECTRICAL SYSTEMS

SECTION D3 : C&I SYSTEM

SECTION D1

STANDARD TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINERS

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,

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%) chocked conditions shall not be more than those specified in Data Sheet -A.

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

3.02.04 The coarse particles and floating matter accumulating at the filter section/screen are flushed out of the system by the 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 tappings 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.

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 tappings 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 equiped with built in flushing arrangement consisting of flushing pump, valves and associated piping, to prevnet 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 bran pump glands.

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

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/back wash 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.

3.11.00 **Material of Construction**

Material of self-cleaning filter and other accessories shall be corrossion resistant and consistant 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

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. Penentrant 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 ASTEM-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 fushion 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

matching parts.

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

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

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:-

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 assembles, 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.

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.

S. No.	DESCRIPTION	UNITS	4X270 MW BTPS
1.0	GENERAL		
1.1	Type of Strainers/ Filters	-	Self Cleaning Strainers
1.2	No. of Strainers/ Filters required	Nos.	Total 8 Sets for Total Station viz. i.e.(1 Working + 1 Standby) per unit of 270 MW.
1.3	Inlet connection	mm Nb	600
1.3	Outlet connection	mm Nb	600
1.4	Filter type/ duty	-	On line / continuous
1.5	Location	-	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)	2.0 to 3.0
2.2	Design pressure	Kg/cm^2)	7.5
2.3	Design temperature	Deg. C	60
2.4	Flow rate through filter a) Normal b) Maximum		 2560 3330

S. No.	DESCRIPTION	UNITS	4X270 MW BTPS
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 • For initiating flushing/ backwashing • For 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	-	Max. 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	-	

S. No.	DESCRIPTION	UNITS	4X270 MW BTPS
	a) Clean condition	mbar	Refer Section – C of specification
	b) Partially (50%) chocked condition	mbar	Not to exceed 110
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	-	Carbon Steel as per IS:210 Gr. FG 260 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.

S. No.	DESCRIPTION	UNITS	4X270 MW BTPS
4.9	Valves	-	
4.9.1	Check Valves (65 NB & Above)		For sizes 65 NB and above-Swing check type or dual plate type.
	a) Body & Bonnet		SA216-WCB for Cast steel (for sizes above 50 NB) / SA105 for Forged steel.(For sizes below 50 NB), Flanged Ends
	b) Disc for Check Valve		Same as that of Body
	c) Stem		13 % Chromium Steel
4.9.2	Check Valves (50 NB & Below)		For size 50 NB and below-Piston type
	a) Body & Bonnet		SA216-WCB for Cast steel (for sizes above 50 NB) / SA105 for Forged steel.(For sizes below 50 NB), Flanged Ends
	b) Disc for Check Valve		Same as that of Body
	c) Stem		13 % Chromium Steel
4.9.3	Globe Valves 50 Nb & Below		
	Body, Bonnet & trim		IS 318 Gr. 2 / SA216-WCB for Cast steel/ SA105 for Forged steel.
4.9.3	➢ BF Valves (65 Nb & above)		
	➢ Body & Disc		SA216-WCB for Cast steel (for sizes above 50 NB) / SA105 for Forged steel.(For sizes below 50 NB)
	➢ Sealing, Retaining segment & internals		18 – 8 SS
	➢ Bearings		Self lubricating
	➢ Companion Flange		IS 2062, Gr. B

S. No.	DESCRIPTION	UNITS	4X270 MW BTPS
	C) Ball valves		
	i) Body		SA 351 CF8M
	ii) Ballv		SA 351 CF8M
	iii) Stem		SS 316
4.10	Piping	-	By Bidder
	Material a) upto 150 Nb		• Carbon steel ERW, IS:1239 (Heavy Grade)
	a) 200 Nb and above		• Greater than 150NB – CS to IS 2062 Gr. B, rolled & butt welded, conforming 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	610 X 6
7.0	**PAINTING**		
7.1	External Surface	-	
	a) Surface preparation	-	SA 2.5 of Swedish Specification SIS 05.5900.197

S. No.	DESCRIPTION	UNITS	4X270 MW BTPS
	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

S. No.	DESCRIPTION	UNITS	4X270 MW BTPS
9.0	Adequate provision for future installation of cathodic protection required		YES
10.0	Flow straightener for streamlining the ACW flow in SCS		If required as per bidder's design – the same to be incorporated by bidder in its constructional feature.
11.0	Performance Guarantee & Bid Evaluation		
11.1	Performance Parameters to be Guaranteed		
	❖ Pressure drop SCS		As per Guarantee schedule of bidder
11.2	Bid evaluation Criteria & Liquidated damages		As per clause no. 8.00.00 of section C1
11.3	Bid evaluation rate		@ Rs 1.2 Lacs per 0.1 MWC pr. Drop across each SCS
11.4	Liquidated damages		Twice the bid evaluation rate
12.0	Whether automatic flushing/ back- washing operation effected by the following : i. Differential pressure ii. Adjustable timer iii. Push button		 YES YES YES

S. No.	DESCRIPTION	UNITS	4X270 MW BTPS
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		As per Annexure-V

4 X 270 MW BHADRADRI TPS- C&I MANDATORY SPARES

ANNEXURE-V

Sl. No.	Equipment/Package Name	Quantity	Remarks
	MANDATORY SPARES FOR CONTROL AND INSTRUMENTATION		
1.00	**Mandatory Spares for Measuring Instruments**		
1.01	**Mandatory Spares for Electronic Transmitters (for pressure, DP, Flow, level, Temperature) and Electrical Transducers.**		
1	Transmitters and Electrical Transducers (10% of total number of offered for each model and type for the project or a minimum of one number, whichever is more)	2	Lot
1.02	**Mandatory spares for local gauges/switch (for Pressure, DP, Temperature, Flow, level , etc.)**		
1	Local gauges/ Switch (for Pressure, DP, Temperature, Flow, level , etc.) (10% of total number of instruments offered for each model and type for the project or a minimum of one number, whichever is more.)	2	Lot
1.03	**Mandatory Spares for Control Panels / Desks**		
1	Crimping Pins	2	Roll
2	Bulbs for indicating lights (Three times the one hundred percent spare replacement)	2	Lot
3	control circuit fuses of each current rating (Three times, the one hundred percent spare replacement)	2	Lot
4	Push buttons, electrical control switches and Illuminated push buttons etc	2	Lot (20%)

NOTE:			
1	**Unless stated otherwise, a "set" or "Lot" means items required for complete replacement in one equipment of each type / size/ range.**		

Pipe Size Table

(Refer Cl. No. 6.2, Section C1, Vol-IIB)

Pipe		
CS		
NB	OD	Thick
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	6.00
250	273.00	6.00
300	323.80	6.00
350	355.60	6.0
600	610.00	6.0
700	711.00	7.0
800	813.00	8.0
900	914.00	8.0

Manufacturer's Name & Address	STANDARD QUALITY PLAN		BHEL Doc No.: PE-V4-XXX-165-N08
	Item :	Vendor Q.P. NO.	PROJECT:
	Self Cleaning Strainer	PACKAGE : SELF CLEANING STRAINER	CUSTOMER:
P.O. No.		Date :	PURCHASER:
		Page 01 of 12	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

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

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

Manufacturer's Name & Address

P.O. No.

STANDARD QUALITY PLAN

Item : Self Cleaning Strainer

Vendor Q.P. NO.

PACKAGE : SELF CLEANING STRAINER

Date :

BHEL Doc No.: PE-V4-XXX-165-N08

PROJECT:

CUSTOMER:

PURCHASER:

CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency M	Agency C	Agency O	Remarks
1	2	3	4	5	6	7	8	9		**	10		11
1.0.0	SELF CLEANING STRAINER												
1.1.0	Raw Material												
[a]	Housing Shell, Nozzle flanges & Main flanges/Counter Flange	Chemical properties	Major	Chemical Analysis	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	All raw material identification as per manufacturer TC/Lab report by BHEL
		Physical properties	Major	Physical test	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Surface Defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate /Inspection Report	–	P	V	V	
		Sub Surface Defects	Major	Ultrasonic Test	100%	ASME A 435/A609	ASME A 435/A609	Inspection report	*	P	V	V	Plates > 20mm Thk only
[b]	Nozzle Pipes	Chemical properties	Major	Chemical Analysis	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Physical properties	Major	Physical test	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Surface defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate /Inspection Report	–	P	V	V	
		Leak tightness	Major	Hydrostatic test	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate /Inspection Report	–	P	V	V	
[c]	Screen basket, Nozzle flanges	Chemical properties	Major	Chemical Analysis	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Physical properties	Major	Physical test	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Surface Defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate /Inspection Report	–	P	V	V	
		Sub-surface defects	Major	Ultrasonic test	100%	ASME A 745	ASME A 745	Inspection report	*	P	V	V	Plates > 20mm Thk only (UT full volume)
		Corrosion Resistance	Major	IGCI	One/Heat	ASTM A 262	Practice E of ASTM A 262	Test Report	*	P	V	V	

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

	BHEL	Manufacturer's Name & Address			STANDARD QUALITY PLAN				BHEL Doc No.: PE-V4-XXX-165-N08					
					Item :		Vendor Q.P. NO.		PROJECT:					
					Self Cleaning Strainer		PACKAGE : SELF CLEANING STRAINER		CUSTOMER:					
		P.O. No.					Date :		PURCHASER:					
							Page 03 of 12		CONSULTANT:					

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency M	Agency C	Agency O	Remarks
1	2	3	4	5	6	7	8	9		**	10		11
[d]	Nozzle Pipes	Chemical properties	Major	Chemical Analysis	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Physical properties	Major	Physical test	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Surface defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate/ Inspection Report	–	P	V	V	
		Leak tightness	Major	Hydrostatic test	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate/ Inspection Report	–	P	V	V	
1.2.0	**Inprocess Quality Control**												
1.2.1	Welding procedure specification	Correctness	Critical	Scrutiny	100%	ASME Sec. IX	ASME Sec. IX	QW 482 of ASME Sec.IX	–	P	V	V	Welders already qualified by BHEL/ LRQA / NTPC in the past shall be employed for this job.
1.2.2	Welding procedure qualification	Weld soundness	Critical	Physical test	100%	ASME Sec. IX	ASME Sec. IX	QW 483 of ASME Sec.IX	–	P	V	V	Welding procedure already approved by BHEL/ LRQA / NTPC shall be followed.
1.2.3	Welder performance qualification	Weld soundness	Critical	Physical test	100%	ASME Sec. IX	ASME Sec. IX	QW 484 of ASME Sec.IX	–	P	V	V	Welders already qualified by BHEL/ LRQA / NTPC shell be employed for this job.
1.2.4	Fit-up of butt weld	Alignment.and dimensions	Major	Template, visual	100%	Manufacturing Drawng	ASME Sec.VIII Div. I	Log book	–	P	V	–	BHEL to witness >20mm thick butt joint.
1.2.5	Fit-up of shell flange and nozzle assembly to shell	Orientation,alignment and dimensions	Major	Template, visual	100%	Manufacturing Drawng	ASME Sec.VIII Div. I	Log book	–	P	–	–	
1.2.6	**Weld quality for Pressure Parts**												
	[a] Root run	Surface defects	Major	Penetrant test / Visual	100%	ASME Sec.VIII Div. I / sec V	ASME Sec.VIII Div. I Appendix 8	Operation Process Sheet		P	–	–	
1.2.7	[a] Completed butt welds	1.Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div. I / sec V	ASME Sec.VIII Div. I Appendix 8	Inspection report	*	P	V	V	
		2.Sub-surface defects	Critical	Radiography test	10% of total weld length+ 100% T Joints.	ASME Sec.VIII Div. I / sec V	ASME Sec.VIII Div. I Appendix 4 / UW 52	Radiographs and inspection report	*	P	V	V	RT films will be reviewed by BHEL
	[b] Completed fillet welds	Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div. I / sec V	ASME Sec.VIII Div. I Appendix 8	Inspection report	*	P	V	V	

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Signature		

BHEL (logo)	Manufacturer's Name & Address	**STANDARD QUALITY PLAN**	BHEL Doc No.: PE-V4-XXX-165-N08
		Item : / Vendor Q.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 M	Agency C	Agency O	Remarks
1	2	3	4	5	6	7	8	9	**	10			11
1.2.8	Pickling and Passivation	Protection Layer	Major	Visual	100%	IS : 10117	IS : 10117	Log Book	--	P	–	–	
1.2.9	Fabricated Shell (Prior to sand blasting)	1.Dimensions, Orientation	Major	Measurement by visual	100%	Manufacturing Drawing	Manufacturing Drawing	Inspection report	*	P	V	V	
		2. Hydro test	Critical	Hydrostatic Pr. @ 1.5 times of design pr.(positive) [Duration 30 minutes]	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1	Inspection report	*	P	V	V	
1.3.0	Final tests (completed equipments) - After assembly	1.Dimensions, orientation, workmanship & finish	Major	Measurement by visual	100%	G.A.drawing	G.A.drawing	Inspection report	*	P	V	V	
		2. Leak tightness for assembly	Critical	Leak test @ design pr.(positive) [Duration 30 minutes]	100%	ASME Sec.VIII Div.1	No leakage	Inspection report	*	P	W	V	
		3.Dry function test for Debris filter	Critical	Operational test	100%	Approved Procedure	Approved Procedure	Inspection report	*	P	W	V	
1.4.0	**Rubber Lining (Shell)**												
1.4.1	Rubber Formulation	Tensile, elongation & hardness	Major	Physical test	One per lot	Manufacturer's procedure	BS 6374/Equivalent	Manufacturers Test certificate	*	P	V	V	
		Polymer Identification	Major	Flame test	One per lot	For Semi Ebonite /Ebonite Polymer catches fire and on removal from fire continues to burn	For Semi Ebonite /Ebonite Polymer catches fire and on removal from fire continues to burn	Inspection report		P	V	V	
		% Change in weight after 24 hours of immersion in sea water at 70°	Major	Immersion test (bleeding test)	One per lot	ASTM D 471	+ / - 1%	Inspection report		P	V	V	
1.4.2	Surface preparation of items to be lined	Free from rust, scale,dust & grease	Major	Visual	100%	SA 2.5	SA 2.5	Manufacturers Internal Inspection report		P	–	–	
1.4.3	Vulcanising	Temperature, Pressure & Time	Major	Process monitoring	100%	Manufacturer's procedure	Manufacturer Procedure	Process Procedure		P	–	–	
1.4.4	Vulcanised Rubber Lined items	[a] Chip test	Major	Chip test	One per lot	Approved Drawing & BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V	
		[b] Adhesion, Visual defects, Thickness & Hardness	Major	Measurement, Visual Inspection	100% visual, Thickness/ hardness at random	Approved Drawing & BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V	
		[c] Spark test for Pin Holes at 5 kv/mm	Major	Spark test for Pin Holes	100%	Approved Drawing & BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V	

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Manufacturer / Sub-Contractor Contractor
Signature

Name & Sign. Of approving authority & Seal

	BHEL (logo)	**Manufacturer's Name & Address**			**STANDARD QUALITY PLAN**				BHEL Doc No.: PE-V4-XXX-165-N08				
					Item :		Vendor Q.P. NO.		PROJECT:				
					Ball Valves		PACKAGE : SELF CLEANING STRAINER		CUSTOMER:				
		P.O. No.					Date :		PURCHASER:				
							Page 05 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**
										M	**C**	**O**	
1	2	3	4	5	6	7	8	9		**	10		11
2.0.0	**Ball valves**												
2.1.0	**Materials**												
	Body and Tail end pieces	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
2.1.1	Ball	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
2.1.2	Stem	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
2.2.0	**In-process inspection**												
2.2.1	Ball	Hardness	Major	Hardness Testing	Random	Approved Drg. / Data Sheet	Approved Drg. / Data Sheet	Manufacturers TC	*	P	V	V	
2.3.0	**Assembly**	a) Dimensions	Major	Measurement	100%	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		b) Opening / Closing	Major	Operation	100%	—	As per approved data sheet	–		P	–	V	
2.4.0	**Testing**												
	[a] Body	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2	EN 12266-1&2 / Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[b] Seat test	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2	EN 12266-1&2 / Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[c] Seat	Leakage	Critical	Air test	100%	EN 12266-1&2	EN 12266-1&2 / Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	

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Manufacturer / Sub-Contractor Contractor

Signature

Name & Sign. Of approving authority & Seal

BHEL (logo)	Manufacturer's Name & Address	**STANDARD QUALITY PLAN**	BHEL Doc No.: PE-V4-XXX-165-N08
		Item : Self Cleaning Strainer	Vendor Q.P. NO.	PROJECT:
			PACKAGE : SELF CLEANING STRAINER	CUSTOMER:
	P.O. No.		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 M	Agency C	Agency O	Remarks
1	2	3	4	5	6	7	8	9			10		11
3.0.0	**Butterfly valves**												
3.1.0	**Materials**												
	Body and Disc	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
3.1.1	Shaft	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
3.1.2	Seat	–	Major	–	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
3.1.3	Stem	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
3.2.0	**Assembly**	a) Dimensions	Major	Measurement	100%	EN ISO 17292/Appd data sheet	EN ISO 17292/Appd data sheet	Manufacturer's T.C.	*	P	V	V	
		b) Opening / Closing	Major	Operation	100%	–	As per approved data sheet	–	*	P	–	–	
3.3.0	**Testing**												
	[a] Body	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2/API598	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[b] Seat test	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2/API598	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[c] Seat	Leakage	Critical	Air test	100%	EN 12266-1&2/API598	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	

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Signature		

	BHEL	Manufacturer's Name & Address			Manufacturing Quality Plan				BHEL Doc No.: PE-V4-XXX-165-N08					
					Item : Pressure Gauge, DP Gauge, DP switch&DP Transmitter		Vendor Q.P. NO.		PROJECT:					
		P.O. No.					PACKAGE : SELF CLEANING STRAINER		CUSTOMER:					
							Date :		PURCHASER:					
							Page 07 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	
										M	C	O		
1	2	3	4	5	6	7	8	9		**	10		11	
4.0.0	In process quality control	Make, Range and Model	Critical	Visual	100%	Approved Data Sheet	Approved Data Sheet	Manufacturer test certificate	*	P	V	V		
		Calibration	Critical	Calibration test	100%	Approved Data Sheet	Approved Data Sheet	Manufacturer test certificate	*	V	V	V		
		Degree of protection	Critical	_	Type test certificate	Approved Data Sheet	Approved Data Sheet	Manufacturer test certificate	*	V	V	V		

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Signature		

	BHEL	Manufacturer's Name & Address			Manufacturing Quality Plan				BHEL Doc No.: PE-V4-XXX-165-N08					
					Item : Geared Motor drive & Worm planetary Gear box		Vendor Q.P. NO.		PROJECT:					
		P.O. No.					PACKAGE : SELF CLEANING STRAINER		CUSTOMER:					
							Date :		PURCHASER:					
							Page 08 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	
										M	C	O		
1	2	3	4	5	6	7	8	9		**	10		11	
5.0.0	GEARED MOTOR DRIVE	Running Test	Critical	Functional Test	100%	Approved Data Sheet	Approved Data Sheet	Manufacturer's compliance certificate	*	P	V	V		
		No load	Critical	Functional test	100%	Approved Data Sheet	Approved Data Sheet		*	P	V	V		
		Noise test	Critical	Functional test	100%	Approved Data Sheet	Approved Data Sheet		*	P	V	V		
		Oil leakage test	Critical	Functional test	100%	Approved Data Sheet	Approved Data Sheet		*	P	V	V		
		Visual	Critical	-	100%	Approved Data Sheet	Approved Data Sheet		*	P	V	V		
		Name plate verification	Critical	-	100%	Approved Data Sheet	Approved Data Sheet		*	P	V	V		
5.1.0	Complete Unit of planetary gear	No Leak Test	Critical	Functional test	One Sample/lot	Approved Data Sheet	Supplier Catalogue	Manufacturer's compliance certificate	*	P	V	V		
		Noise Level	Minor	Functional test	One Sample/lot	Approved Data Sheet	Approved Data Sheet			P	V	V		
		Visual Name plate Verification	Minor	-	100%	Approved Data Sheet	Approved Data Sheet			P	V	V		

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

		Manufacturer's Name & Address			Manufacturing Quality Plan				BHEL Doc No.: PE-V4-XXX-165-N08					
					Item : Actuators		Vendor Q.P. NO.		PROJECT:					
							PACKAGE : SELF CLEANING STRAINER		CUSTOMER:					
		P.O. No.					Date :		PURCHASER:					
							Page 09 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	
										M	C	O		
1	2	3	4	5	6	7	8	9		**	10		11	
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		
		Make, Range, Model	Major	Visual	100%	Supplier catalogue/Appd data sheet	Supplier catalogue/Appd data sheet	Inspection Report	-	P	-	-		
		Assembly check alongwith valves	Major	Visual	100%	Supplier catalogue/Appd data sheet	Supplier catalogue/Appd data sheet	Inspection Report	-	P	-	-		
		Functional Check along with settings / Auxillary Caontacts	Major	Visual	100%	Supplier catalogue	Supplier catalogue/Appd data sheet	Inspection Report	-	P	-	-	Review of TC's	
			LEGEND											
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Manufacturer / Sub-Contractor		Contractor	C : CONTRACTOR		O: OWNER									
Signature			Indicate : "P" - Perform, "W" - Witness and "V" - Verification										Name & Sign. Of approving authority & Seal	

	Manufacturer's Name & Address			Manufacturing Quality Plan				BHEL Doc No.: PE-V4-XXX-165-N08					
				Item : Starter Panel		Vendor Q.P. NO.		PROJECT:					
						PACKAGE : SELF CLEANING STRAINER		CUSTOMER:					
	P.O. No.					Date :		PURCHASER:					
						Page 10 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
										M	C	O	
1	2	3	4	5	6	7	8	9		**	10		11
7.0.0	**Starter panel**												
7.1.0	**Incoming Material**												
7.1.1	Fabricated & Painted Panel	Dimension	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--	7 Tank treatment before painting
		Panel G.A.	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--	
		Paint colour	Major	Visual	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--	
		Paint thickness	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--	
		Paint Shade, Adhesion	Major	Visual	Sample	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--	
7.1.2	Wire	Size / Colour / Rating / Surface Defects	Major	Visual / Dimension	Sample	IS 694	Specification / drawings	Inspection report	-	P	--	--	ISI Marked wire
7.1.3	Panel Mounting	Make, Functional, Type & Rating	Major	Visual / Electrical	100%	Approved BOM	Approved BOM	---		P	V	V	For bolt list refer starter panel document Part - II
7.2.0	**In Process Inspection**												
7.2.1	Name Plate, Component Mounting, Etc.	Workmanship, Finish, Correctness	Major	Visual	100%	Approved Drgs.	Approved drawings	Inspection report	-	P	--	--	
7.2.2	Electrical Wiring of Panels	Continuity, Colour of wires, Bunching and Grouping	Major	Visual	100%	Mounting Drawing	Approved drawings	Inspection report	-	P	--	--	
7.2.3	Ferruling of Cables	Start & End	Major	Visual	100%	Manufacturer's drawing	Manufacturer's drawing	Inspection report	-	P	--	--	
7.3.0	**Final Inspection**									P	--	--	
7.3.1	Workmanship, Finish & Paint shade / Thickness	Visual	Major	Visual	100%	G.A Drawing	Approved drgs.	Inspection report	*	P	W	V	
7.3.2	Overall Dimension, G.A of starter panel	Measurement	Major	Visual	100%	G.A Drawing	Approved drgs.	Test Certificate	-	P	W	V	
7.3.3	Component Identification	Visual	Major	Visual	100%	G.A Drawing	Approved drgs.	Inspection report	-	P	W	V	
7.3.4	IR - HV - IR	Electrical	Critical	Electrical	100%	Mfg.Procedure	Mfg. Pocedure	Inspection report	-	P	W	V	
7.3.5	Functional & Continuity	Functional	Major	Functional	100%	Appd Drawing	Appd Drawing	Inspection report	*	P	W	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	Contractor
Signature	

Name & Sign. Of approving authority & Seal

	BHEL	Manufacturer's Name & Address		Manufacturing Quality Plan				BHEL Doc No.: PE-V4-XXX-165-N08					
				Item : Fasteners		Vendor Q.P. NO.		PROJECT:					
						PACKAGE : SELF CLEANING STRAINER		CUSTOMER:					
		P.O. No.				Date :		PURCHASER:					
						Page 11 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
										M	C	O	
1	2	3	4	5	6	7	8	9		**	10		11
8.1.0	**Internal Fasteners - SS**												
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			Manufacturing Quality Plan				BHEL Doc No.: PE-V4-XXX-165-N08					
					Item : All components / Equipments		Vendor Q.P. NO.		PROJECT:					
							PACKAGE : SELF CLEANING STRAINER		CUSTOMER:					
		P.O. No.					Date :		PURCHASER:					
							Page 12 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	
										M	C	O		
1	2	3	4	5	6	7	8	9		**	10			11
9.0.0	All Components / Equipments	Painting Dry film thickness and	Major	Measurement	Random	Painting schedule	Painting schedule	Inspection report		P	V	V		
		Packing	Major	Measurement	100%	Packing Procedure	Packing Procedure	Inspection report		P	–	–		

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

SECTION D2

STANDARD TECHNICAL SPECIFICATION FOR ELECTRICAL SYSTEMS

	TITLE	SPECIFICATION NO.
	LV MOTORS	VOLUME II B
	DATA SHEET-A	SECTION D
		REV NO. DATE 18.12.14
	4 X 270 MW BHADRADRI TPS	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	Details of supply system			
	a)	Rated voltage (with variation)	:	415V ± 10%
	b)	Rated frequency (with variation)	:	50 Hz + 3 % 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 boxes		
		○ 110 kW and above (Breaker Controlled)	:	50 KA for 0.20 sec..
		○ Below 110 kW (Contactor Controlled)	:	50 KA protected by HRC fuse
	f)	LV System grounding	:	Solidly
5.0	Class of insulation		:	Class 'F', with temp rise limited to class B.
6.0	Minimum voltage for starting (As percentage of rated voltage)		:	(a) 85% below 110KW (b) 80% from 110KW to 160KW (c) 85% above 160KW to 1000KW (d) 80% from 1001 KW to 4000KW (e) 75% > 4000KW
7.0	Power cables data		:	Shall be given during detailed engg.
8.0	Earth Conductor Size & Material		:	As per attached Datasheet of Earthing.
9.0	Space heater supply		:	240 V, 1¢, 50 Hz (for motors above 30 Kw)
10.0	Rating up to which Single phase motor		:	Acceptable below 0.20 kW
11.0	Locked rotor current			
	a)	Limit as percentage of FLC	:	As per IS 12615*
12.0	Flame-proof motor			
	a)	Enclosure suitable (As per IS: 2148)	:	As per requirement
	b)	Classification of Hazardous area (As per IS: 5572 part-I)	:	As per requirement
13.0	Makes		:	BHEL/ Customer approval
14.0	Paint shade		:	Shall be given during detailed engg
15.0	Degree Of protection for motor/ terminal box		:	IP 54/ IP 55

* Continuous duty LT motors up to 160 KW Output rating (at 50 deg.C ambient temperature), shall be High efficiency (IE2) as per IEC: 60034-30/ IS:12615

16.0 TESTING

16.1 Type Tests

For LT Motors above 55kW, type test reports for type tests as per IS: 325/ IS: 12615 conducted on equipment similar to those proposed to be supplied and carried out within last five years from the date of bid opening shall be submitted. However, if such reports are not available, one motor of each type shall be subjected to type tests for free of cost.

16.2 Routine Tests

All motors shall be subjected to routine tests as per IS: 325/ IS: 12615 in the presence of customer or customer representative.

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

1.0 INTENT OF SPECIFIATION

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

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

2.0 CODES AND STANDARDS

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

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

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

3.0 DESIGN REQUIREMENTS

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

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

3.3 Starting Requirements

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

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

The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.

ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)

iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for mimimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

4.0 **CONSTRUCTIONAL FEATURES**

4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.

4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.

4.5 Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.

4.6 In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.

4.7 **Terminals and Terminal Boxes**

4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.

Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".

4.7.2 unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.

4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.

4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.

4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.

4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.

4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.

4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.

4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.

4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

4.9 **General**

4.9.1 Motors provided for similar drives shall be interchangeable.

4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.

4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.

4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.

4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.

4.9.6 Name plate with all particulars as per IS: 325 shall be provided

4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

5.0 INSPECTION AND TESTING

5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.

5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.

5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.

5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

a) OGA drawing showing the position of terminal boxes, earthing connections etc.
b) Arrangement drawing of terminal boxes.
c) Characteristic curves:
(*To be given for motor above 55 kW unless otherwise specified in Data Sheet*).

i) Current vs. time at rated voltage and minimum starting voltage.
ii) Speed vs. time at rated voltage and minimum starting voltage.
iii) Torque vs. speed at rated voltage and minimum voltage.
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

CLAUSE NO.	LT SWITCHGEAR (Starter Panel).	
1.00.00	CODES AND STANDARDS	
	IEC 947, IS 13947	
2.00.00	TYPE	
	Circuit Breakers	Shall be air break, three pole, spring charged, horizontal drawout type, suitable for electrical operation.
	Switchgear	Fully drawout type single front
	MCC	Fully drawout type single front/Double front.
	ACDB/DCDB	Fixed type single front
3.00.00	SYSTEM PARAMETERS	
	415VAC +/- 10 % (SOLIDLY GROUNDED)	
	50 Hz +3%/-5%	
	45KA RMS / 1 SEC (FAULT LEVEL)	
	220V DC NOMINAL (190V DC-240V DC) ISOLATED TYPE	
4.00.00	TEMPERATURE RISE	
	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.	
5.00.00	OPERATIONAL REQUIREMENTS	
5.01.00	Breakers	
5.01.01	Breakers shall have anti-pumping feature.	
5.01.02	The incomer and bus coupler breakers for switchgear shall be electrically operated with over current releases or relays.	
5.01.03	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.	
5.01.04	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	

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	TYPE TESTS
	(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.
	(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.
	(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.
7.01.00	L. T. SWITCHGEAR
	The following type test certificates on each type & rating of L.T. Switchgear, MCC panel and distribution boards shall be submitted.
	(a) Short time withstand test with circuit breaker mounted inside the switchgear panel.
	(b) Temperature rise test.
	(c) Type II - Short circuit co-ordination test for any three ratings of MCC module as selected by the Employer.
	(d) Test sequence -1 & combined test sequence shall be carried out on each rating of circuit breaker mounted inside the panel.
	(e) Degree of protection tests

(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-scopic, 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 replacememt 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 discribing 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	

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6.00.00 DESIGN AND CONSTRUCTIONAL FEATURES

6.01.00 All 415V switch gear motor control centers (MCCs), AC & DC distribution boards (DB s), etc shall have following features :

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 whereever 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 DB s shall have following distinct vertical sections.

   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 separatelly 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
	f) hand reset lockout relay with a blue lamp for monitoring
	3) Incomers/bus coupler/outgoing breaker feeders other than motor feeders
	a) Definite time delay short circuit protection
	b) Hand reset lockout relay with a blue lamp
	4) Incomer From DG Set.
	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	Meters / instruments
	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.
5.04.06	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.
5.04.07	In case of remote controlled breaker panels,following shall be ensured.
	Each feeder shall have local/remote selector switch. Closing from local shall be possible only in test possition 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.
05.00	Control from Remote
	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.

	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.
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:
	1) Contactor controlled motor feeders (Motors up to 160 kW)
	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)
	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

AUSE NO.	LT SWITCHGEAR
01.05	Mechanical tripping shall be through red 'Trip' push button outside the panels for breakers, and through control swtiches 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.
.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.
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.
	Isolating switches and MCCBs shall have door interlocks and padlocking facility.
	Panels
	All switchgears, MCCs, DBs, panels, modules, local starters and push buttons shall have prominent engraved indentification plates.
02	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.
03	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.
4	All non-current carrying metal work of boards/panels shall be effectively bonded to earth bus of galavanised steel, extending throughout the switchboard/MCC/DB. Positive earthing shall be maintained for all positions of chassis and breaker frame.
	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.
	The incoming connection to transformer of more than 1000KVA and inter-connecting sections between switchboards shall preferably be of busducts.The busduct enclosure

	QUALITY PLAN		CUSTOMER TSGENCO			PROJECT: 4x270 MW Bhadradri TPS located at Manuguru			SPECIFICATION :			
						TITLE			NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION TITLE			
		SHEET 1 OF 2	SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		

	QUALITY PLAN		CUSTOMER TSGENCO			PROJECT: 4x270 MW Bhadradri TPS located at Manuguru TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION : TITLE :			
		SHEET 2 OF 2	SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	

NOTES:

1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON

2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		**CUSTOMER**	**TSGENCO**		PROJECT TITLE	**4X270MW BHADRADRI TPS** **COLTCS/SCS**		SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 1 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVENT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVENT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER **TSGENCO**			PROJECT **4X270MW BHADRADRI TPS**			SPECIFICATION :			
						TITLE **COLTCS/SCS**			NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 2 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER **TSGENCO**			PROJECT **4X270MW BHADRADRI TPS**			SPECIFICATION :			
						TITLE **COLTCS/SCS**			NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 3 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2	
		2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG. .	MANUFR'S DRG.	-DO-	3	-	2	FOR MV MOTOR INSULA-TION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IS	RELEVANT IS	SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	-	2*	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
		2.ELECT. PROP, & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	RELEVANT IS/ BS OR OTHER STANDARDS	RELEVANT IS/ BS OR OTHER STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3	-	2	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN	CUSTOMER **TSGENCO**			PROJECT **4X270MW BHADRADRI TPS**			SPECIFICATION :			
					TITLE **COLTCS/SCS**			NUMBER :			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 4 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
1.10	BEARINGS	1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

		QUALITY PLAN	CUSTOMER **TSGENCO**			PROJECT **4X270MW BHADRADRI TPS**			SPECIFICATION :			
						TITLE **COLTCS/SCS**			NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
		SHEET 5 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVENT SPEC./ ASTM-E165	MANUFR'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	QUALITY PLAN	CUSTOMER **TSGENCO**	PROJECT **4X270MW BHADRADRI TPS**	SPECIFICATION :	
			TITLE **COLTCS/SCS**	NUMBER :	
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE	
	SHEET 6 OF 9	SYSTEM	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION	VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	FOR MV MOTOR
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	THREE DIPS TO BE GIVEN

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER **TSGENCO**			PROJECT **4X270MW BHADRADRI TPS**			SPECIFICATION :			
						TITLE **COLTCS/SCS**			NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 7 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.7	COMPLETE STATOR ASSEMBLY	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	VERIFICATION FOR MV MOTOR ONLY
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
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	QUALITY PLAN		CUSTOMER **TSGENCO**			PROJECT **4X270MW BHADRADRI TPS**			SPECIFICATION :			
						TITLE **COLTCS/SCS**			NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 8 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1$	1	$ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1$	1	$ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1$	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY $ NOTE - 2

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN	CUSTOMER **TSGENCO**	PROJECT **4X270MW BHADRADRI TPS**	SPECIFICATION :	
			TITLE **COLTCS/SCS**	NUMBER :	
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03	SPECIFICATION : TITLE	
	SHEET 9 OF 9	SYSTEM	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)	SECTION	VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11

NOTES:

1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.

2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.

3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED.

4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

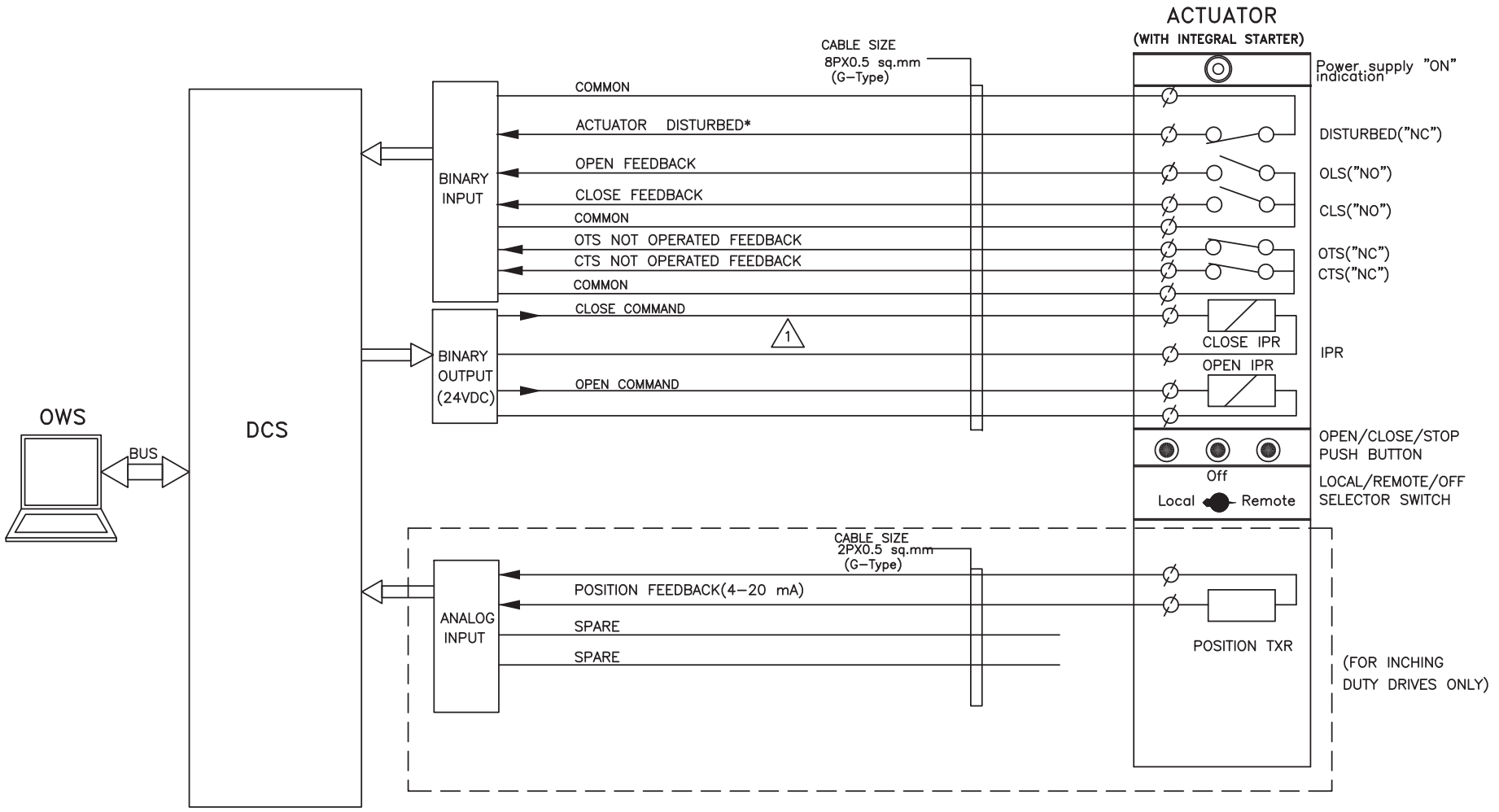
SECTION D3

STANDARD TECHNICAL SPECIFICATION FOR C&I SYSTEMS

SECTION – D

DRIVE CONTROL PHILOSOPHY

DCS INTERFACE FOR BIDIRECTIONAL DRIVE(WITH INTEGRAL STARTER)

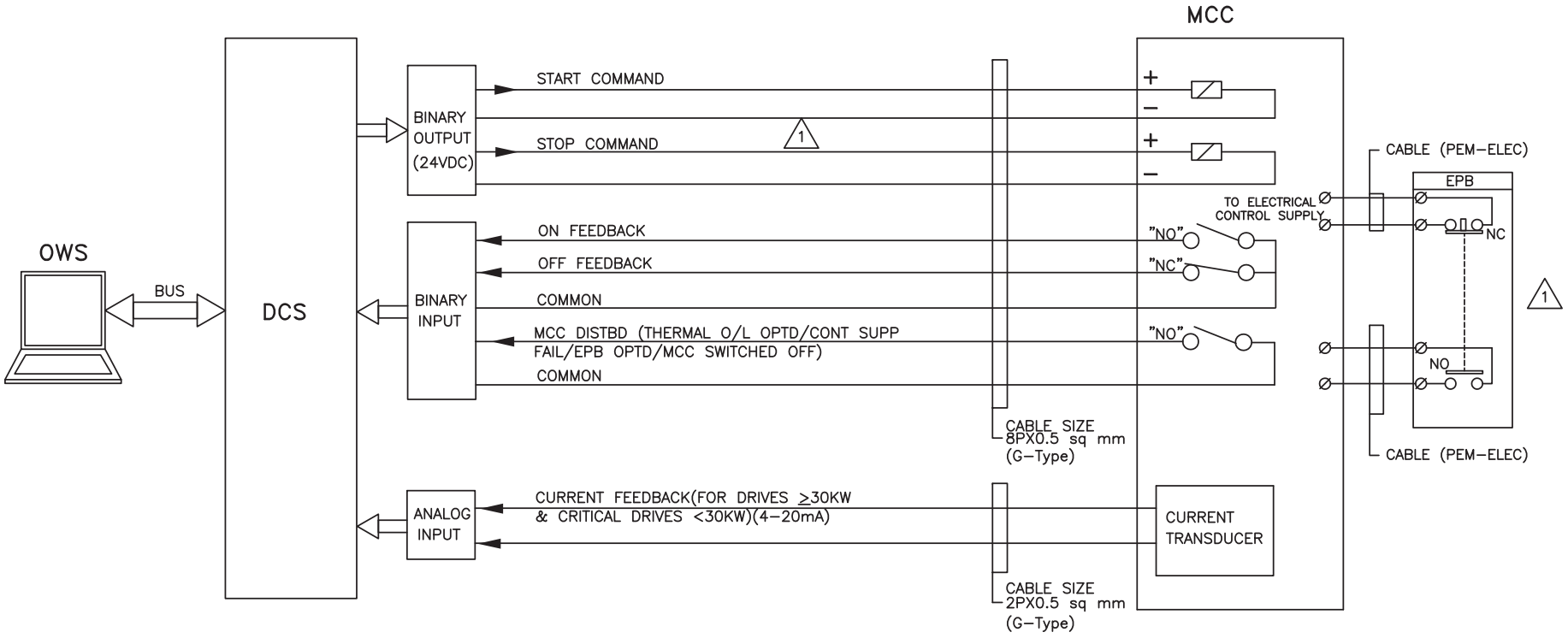


NOTE:

* DISTURBED= Loss of Power supply (1 Phase/3 Phase)/
Loss of control supply/ Motor thermostat trip/
Thermal over load/
Local/Off/Remote Sel. switch in local or off mode/
Stop PB optd.

BHEL	PROJECT: 4 X 270 MW BHADRADRI TPS	DRG.NO.	PE–DM–411–145–I002
		DATE	06.02.2015
	TITLE DDCMIS INTERFACE FOR BIDIRECTIONAL DRIVE	REV.NO.	01
		SHT	7 OF 11

DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE



BHEL	PROJECT: 4 X 270 MW BHADRADRI TPS	DRG.NO.	PE-DM-411-145-I002
		DATE	06.02.2015
	TITLE DDCMIS INTERFACE FOR UNIDIRECTIONAL LT DRIVE	REV.NO.	01
		SHT	8 OF 11

INSTRUMENTATION DATA SHEET

1.00.00 SPECIFICATION FOR ELECTRONIC TRANSMITTERS

1.01.00 PRESSURE TRANSMITTER

1.	Working Principle	:	Smart (HART Compatible)
2.	Type	:	Microprocessor based, 2 – Wire
3.	Output Signal	:	4-20 mA DC along with superimposed digital signal
4.	Measuring Element	:	Capsule / Diaphragm
5.	Element material	:	SS-316 (Stainless Steel) or better
6.	Static Pressure	:	150 % of maximum span continuously, without affecting the calibration
7.	Turn-down ratio	:	100: 1
8.	Span and Zero	:	Continuous, tamper proof, remote as well locally adjustable with zero elevation and suppression by 100% of span
9.	Enclosure Class	:	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
10.	Output Indicator	:	LCD (Integral indicator of 5 digit display)
11.	Nameplate	:	Tag number, service engraved in SS tag plate
12.	Body	:	SS
13.	Operating Voltage	:	24V DC
14.	Load	:	600 Ohms (min.) at 24 Volts D.C.
15.	Ambient Temperature	:	0 - 50 ^{O}C
16.	Performance:	:	
	i. Accuracy		$\pm$ 0.075% of Span or better

ii.	Repeatability		± 0.05% of Span or better
17.	Sealing/Isolation	:	Extended diaphragm (Silicon oil/ Flurolub filled) with 5 meters SS armoured capillary for corrosive/viscous/solid bearing or slurry type fluid applications
18.	Accessories	:	a. Universal mounting bracket suitable for 2" pipe mounting b. High tensile carbon steel U-bolts c. Siphon for steam and hot water services d. ½" NPT 2-valve stainless steel manifold, constructed from SS316 bar stock e. Companion flange with nuts, bolts and gaskets f. ½" NPT cable gland g. Handheld calibrator
19.	Adjustment/Calibration/ Maintenance	:	From handheld calibrator/ HART management system

Notes: For primary air/ secondary air/ flue gas applications, DP type transmitters shall be provided for pressure measurement.

LVDT type is not acceptable.

1.02.00 DIFFERENTIAL PRESSURE TRANSMITTER / FLOW TRANSMITTER

1.	Working Principle	:	Smart (HART Compatible)
2.	Type	:	Microprocessor based, 2 – Wire
3.	Output Signal	:	4-20 mA DC along with superimposed digital signal
4.	Measuring Element	:	Capsule / Diaphragm

5.	Element material	:	SS-316 (Stainless Steel) or better
6.	Static Pressure	:	150 % of maximum span continuously, without affecting the calibration
7.	Turn-down ratio	:	100: 1
8.	Span and Zero	:	Continuous, tamper proof, remote as well locally adjustable with zero elevation and suppression by 100% of span
9.	Enclosure Class	:	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
10.	Output Indicator	:	LCD (Integral indicator of 5 digit display)
11.	Nameplate	:	Tag number, service engraved in SS tag plate
12.	Body	:	SS
13.	Operating Voltage	:	24V DC
14.	Load	:	600 Ohms (min.) at 24 Volts D.C.
15.	Ambient Temperature	:	0 - 50 ^{O}C
16.	Performance:		
	i. Accuracy	:	$\pm$ 0.075% of Span or better
	ii. Repeatability	:	$\pm$ 0.05% of Span or better
17.	Sealing/Isolation	:	Extended diaphragm (Silicon oil/ Flurolub filled) with 5 meters SS armoured capillary for corrosive/viscous/solid bearing or slurry type fluid applications
18.	Accessories	:	a. Universal mounting bracket suitable for 2” pipe mounting b. High tensile carbon steel U-bolts

c. Siphon for steam and hot water services

d. ½" NPT 5-valve stainless steel manifold, constructed from SS316 bar stock

e. Companion flange with nuts, bolts and gaskets

f. ½" NPT cable gland

g. Handheld calibrator

19. Adjustment/Calibration/ Maintenance : From handheld calibrator/ HART management system

1.03.00 Displacer Type Level Transmitters

1. Type : Smart (HART Compatible)
2. Stages of operation : Continuous
3. Material :
4. i. Displacer SS-316
5. ii. Suspension wire SS-316
6. iii. Torque tube housing SS
7. iv. Torque tube Inconel
8. v. Displacer chamber SS
9. vi. Transmitter Housing SS
10. Operating Voltage : 24 V DC
11. Transmission : Microprocessor based, 2-wire
12. Output Signal : 4-20 mA DC along with superimposed digital signal
13. Static / overload : Maximum static pressure without

transmitters. The hand held calibrator shall be suitable for all types of transmitters supplied in the package. If one type of hand held type calibrator is not suitable for communicating with all types of transmitters then separate hand held calibrator will be provided.

3.00.00 PROCESS ACTUATED SWITCHES

3.01.00 PRESSURE SWITCH

1.	Type	:	i. Piston for high pressure application ii. Bellow / Diaphragm for low pressure application
2.	Sensing element material	:	SS-316. All other wetted part SS316
3.	Case Material	:	SSt
4.	Setter Scale	:	Black graduation on white linear scale. Graduation 0-100% with red pointer for set points
5.	Over range	:	150 % of maximum pressure
6.	Adjustments	:	a) Internal Set Point : b) Differential adjustment
7.	End Connection	:	1/2" NPT bottom connected
8.	Switch configuration	:	Two SPDT (240V, 5A AC/220V, 0.5A DC)
9.	Switch Type	:	Snap acting, shock & vibration proof
10.	Terminal Block	:	Suitable for full ring lugs
11.	Enclosure Class	:	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
12.	Performance	:	a) Repeat accuracy ± 1.0% : b) Accuracy of Setting Indication of ± 1.5%
13.	Ambient temperature	:	0 – 50 Deg.C

14.	Nameplate	:	Tag number, service engraved in SS tag plate
15.	Accessories	:	a) Silicon oil/ Flurolub filled Remote diaphragm seal with SS-316 capillary for corrosive/ viscous/ solid bearing or slurry type fluid applications b) Snubbers for pulsating fluid applications c) Siphons for steam and hot water services d) Retention ring and screws for surface mounting e) 1/2" NPT 2 Valve SS-316 barstock manifold f) ½" NPT cable gland
16.	Applications	:	During Detail Engineering on Owner's approval

3.02.00 DIFFERENTIAL PRESSURE SWITCH

1.	Type	:	i. Piston for high pressure application ii. Bellow / Diaphragm for low pressure application
2.	Sensing element material	:	SS-316. All other wetted part SS316
3.	Case Material	:	SS
4.	Setter Scale	:	Black graduation on white linear scale. Graduation 0-100% with red pointer for set points
5.	Over range	:	150 % of maximum pressure

6.	Adjustments	:	a) Internal Set Point
		:	b) Differential adjustment
7.	End Connection	:	1/2" NPT bottom/ back connected
8.	Switch configuration	:	Two SPDT (240V, 5A AC/220V, 0.5A DC)
9.	Switch Type	:	Snap acting, shock & vibration proof
10.	Terminal Block	:	Suitable for full ring lugs
11.	Enclosure Class	:	IP-65 (Explosion proof for NEC Class-1, Division 1 area)
12.	Performance	:	a) Repeat accuracy ± 1.0% b) Accuracy of Setting Indication of ± 1.5%
13.	Ambient temperature	:	0 – 50 Deg.C
14.	Nameplate	:	Tag number, service engraved in SS tag plate
15.	Accessories	:	a) Silicon oil/ Flurolub filled Remote diaphragm seal with SS-316 capillary Diaphragm seals for corrosive/ viscous/ solid bearing or slurry type fluid applications b) Snubbers for pulsating fluid applications c) Siphons for steam and hot water services d) Retention ring and screws for surface mounting e) 1/2" NPT 5 Valve SS-316 barstock manifold f) ½" NPT cable gland
16.	Applications	:	During Detail Engineering on Owner's approval.

approval

4.00.00 **LOCAL INSTRUMENTS**

4.01.00 PRESSURE GAUGE AND DIFFERENTIAL PRESSURE GAUGE

1.	Type	:	Bourdon/Bellows/Diaphragm
2.	Sensing & Socket	:	SS-316
3.	Movement Material	:	SS-316
4.	Case Material	:	Stainless steel. IP-65 (Explosion proof for NEC Class-1, Division 1 area)
5.	Dial Size	:	Generally 150 mm
6.	Scale	:	Black lettering on white in 270 O arc.
7.	Window	:	Shatterproof glass
8.	Range Selection	:	Normal process pressure: 50~70 % of range
9.	Over-range Protection	:	125% of maximum range by internal stop. External stop at zero
10.	Adjustment	:	For Zero adjustment (Micrometer screw external) For Range adjustment (Micrometer screw internal).
11.	Element Connection	:	Argon welding
12.	Process Connection	:	1/2" NPT (M) Bottom for local, back for panel mounting
13.	Performance	:	Accuracy of $\pm$ 1.0 % of span or better
14.	Operating ambient	:	0 - 50 ^{O}C
15.	Safety Feature	:	Blow out disc /diaphragm at the back
16.	Accessories	:	a) Snubbers for pulsating fluid application.discharge b) Stainless steel Diaphragm seals

			for corrosive/ viscous/ solid bearing or slurry type fluid applications
		c)	3-Way SS316 Gauge cock for pressure gauges
		d)	5-valve SS316 manifold from barstock for differential pressure gauge
		e)	Siphons for steam and hot water services
	17. Nameplate	:	Tag number, service engraved in stainless steel tag plate

4.02.00 LEVEL INDICATOR (FLOAT & BOARD TYPE)

1.	Type	:	Float and Board
2.	Float Material	:	SS-316
3.	Float Cable	:	SS-316
4.	Indicator Assembly	:	Epoxy painted Aluminium
5.	Guide wire spring assembly	:	SS-316 (2 Nos.)
6.	Guide Wire Anchor	:	SS-316
7.	Scale Board	:	Anodized Aluminium with engraved marking (Minimum graduation 10mm), mounting brackets and suitable hardware required as per tank height
8.	Elbow Assembly	:	Anodized Aluminium
9.	Flanges	:	RF , ANSI 150 , SS (3 Nos.)
10.	Accuracy	:	± 10 mm or better
11.	Accessories	:	All mounting accessories including counter flange, nuts & bolts, suitable

INSTRUMENTATION CHECK LIST

CHECK LIST FOR PRESSURE SWITCH

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	V	V	
	1.1 MODEL NO/TAG NO						
	1.2 RANGE						
	1.3 END CONN						
	1.4 NO. OF CONTACT						
2	CALIBRATION			P	V	V	
	2.1 REPEATABILITY						
	2.2 SET POINT ADJUSTMENT						
	2.3 DIFFERENTIAL						
3	OVER PR & LEAK TEST			P	V	V	
4	ELECT. INSULATION/HV TEST	ONE		P	V	V	
5	REVIEW OF TC FOR MATERIALS OF	FOR LOT		V	V	V	
	5.1 SENSOR						
	5.2 MOVEMENT						
	5.3 PROCESS CONNECTION						
	5.4 HOUSING						
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST		V	V	V	
7	REVIEW OF TC OF MICROSWITCH	FOR LOT		V	V	V	

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

Note :

1. Quantum of check shall be as below :
   100 % - By Manufacturer
2. Manufacturer to carry out ROUTINE TEST on 100 %.
3. Contractor to provide compliance certificate for tests/checks verifid by contractor and the same alongwith test certificates to be verified by BHEL

CHECK LIST FOR TRANSMITTER

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

Legend :

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

Note :

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

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

CHECK LIST FOR PRESSURE & DP GAUGE

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

Legend :

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

Note :

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

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

CHECK LIST FOR ANNUNCIATORS

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

Legend :

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

Note :

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

ACTUATOR SPECIFICATION

VOLUME: V-A

SECTION-III

TECHNICAL SPECIFICATION FOR ELECTRIC MOTOR ACTUATORS

1.00.00 SCOPE

1.01.00 This Section covers the general requirements of Electric Motor Actuators for valves/dampers.

1.02.00 All electric motor actuators shall be furnished in accordance with this general specification and the accompanying driven equipment specification. All the electrical actuators shall be INTEGRAL type only.

2.00.00 STANDARDS

2.01.00 All electrical equipment shall conform to the latest applicable IS, ANSI and NEMA Standards, except when stated otherwise herein or in driven equipment specification.

2.02.00 Major standards, which shall be followed, are listed below. Other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed

i) IS -9334

ii) IS-325

3.00.00 SERVICE CONDITIONS

3.01.00 The actuator shall be suitable for operation in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash.

3.02.00 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the general specification.

3.03.00 For actuator motor installed outdoor and exposed to direct sun rays, the effect of solar heat shall be considered in the determination of the design ambient temperature.

4.00.00 RATING

4.01.00 For isolating service, the actuator shall be rated for three successive open-close operation of the valve/damper or 15 minutes, whichever is longer.

4.02.00 For regulating service, the actuator shall be suitably time-rated for the duty cycle involved with necessary number of starts per hour, but in no case less than 150 starts per hour.

5.00.00 **PERFORMANCE**

The actuator shall meet the following performance requirements:

5.01.00 Open and close the valve completely and make leak-tight valve closu re without jamming.

5.02.00 Attain full speed operation before valve load is encountered and imparts an unseating blow to start the valve in motion (hammer blow effect).

5.03.00 Operate the valve st em at st andard stem speed and shall function against design differential pressure across the valve seat.

5.04.00 The motor reduction g earing shall be sufficient to lock the shaft when the motor is de-energised and prevent drift from torque switch spring pressure.

5.05.00 The entire mechanism shall withstand shock resulting from closing with improper setting of limit sw itches or from lodging of foreign matter und er the valve seat.

6.00.00 **SPECIFIC REQUIREMENT**

6.01.00 **Construction**

6.01.01 The actuator shall essentially comprise the drive motor, torque/ limit switches, gear train, clutch, hand wheel, position indicator/ transmitter, in-built thermostat for over load protection, space heater and internal wiring.

6.01.02 The actuator enclosure shall be totally enclosed, dust tight, weather-proof suitable for outdoor use without necessity of any canopy. Degree of protection of enclosure for motor actuator shall be IP-65.

6.01.03 All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.

6.01.04 The actuator shall be designed for mounting in any position without any lubricant leakage or operating difficulty.

6.02.00 **Motor**

6.02.01 The drive motor shall be three phase, squirrel cage, induction machine with minimum class B insulation and IPW-55 enclosure, designed for high torque and reversing service. Canopy shall be provided for outdoor service.

6.02.02 The motor shall be designed for full voltage direct on-line start, with starting current limited to 6 times full-load current.

6.02.03 The motor shall be capable of starting at 85 percent of rated voltage and running at 80 percent of rated v oltage at rated torque and 85 percent rated voltage at 33 percent excess rated torque for a period of 5 minutes each.

6.02.04 Motor leads shall be terminated in the limit switch compartment.

6.02.05 Motor actua tors for valves/dampers shall be with inte gral starter with 3phase/3wire, 415V AC and operable from remote.

6.02.06 Earthing terminals shall be provided on either side of the motor.

6.03.00 **Limit Switches**

Each actuator shall be provided with following limit switches: -

6.03.01 2 torque limit switches, one for eac h direction of travel, self-locking, adjustable torque type.

6.03.02 4 end-of-travel limit switches, two for each direction of travel.

6.03.03 2 position limit switches, one for each direction of travel, each adjustable at any position from fully open to fully closed positions of the valve/damper.

6.03.04 Each limit swit ch shall have 2 NO + 2 NC potential free contacts. Contact rating shall be 5A at 240V A.C. or 0.5A at 220V D.C.

6.04.00 **Hand Wheel**

Each actuator shall be provided with a hand wheel for emergency manual operation. The hand wheel shall declutc h automatically when the moto r is energized.

6.05.00 **Position Indicator/Transmitter**

The actuator shall have:

6.05.01 One (1) built-in local position indicator for 0-100% travel.

6.05.02 One (1) position transmitter, 4-20 mA current signal as position feedback, for remote indicator.

6.06.00 **Space Heater**

A space heater shall be included in the limit switch compartment suitable for 240V, 1 phase, 50 Hz supply.

6.07.00 **Wiring**

All electrical devices shall be wired up to and terminated in a terminal box. All wiring shall be done with 1100 V grade fire resistance PVC insulated stranded copper conductor of not less than 2.5 Sq.mm cross section. All wiring shall be identified at both ends with ferrules. A ll the electrical actuators shall have uniform wiring.

6.08.00 **Terminal Box**

The terminal box shall be weather proof, with removable front cover and cable glands for cable connection. The terminal shall be suitable for connection of 2.5 Sq.mm copper conductor.

7.00.00 **ACCESSORIES**

As required for the driven equipment, the actuator shall be furnished with starting equipment mounted on the actuator. This shall include:

7.01.00 One (1) triple pole MCCB

7.02.00 One (1) reversing starter with mechanically interlocked contactors, 3 thermal overload relays, 2 NO + 2 NC auxiliary contacts for each contactor.

7.03.00 One (1) remote-local selector switch.

7.04.00 CLOSE-STOP-OPEN oil tight push buttons with indication lights.

7.05.00 415/240 V control transformer with primary & secondary fuses.

8.00.00 **TEST**

The actuator and all components thereof shall be subject to tests as per relevant Standards. In addition, if any special test is called for in equipment specification, the same shall be performed.

9.00.00 **DRAWINGS, DATA & MANUALS**

9.01.00 Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

9.02.00 **To be submitted with Bid**

Data sheet for each type of actuator shall be furnished along with internal wiring diagram, suggested control schematic and torque limit switch contact development and manufacturer's catalogues. Drawings, Data & Manuals shall be submitted in triplicate with the bid and in quantities and procedures as specified in General Conditions of Contract and/or elsewhere in the specification for approval and subsequent distribution after the issue of 'Letter of Intent'.

9.03.00 **To be submitted for Owner / Purchaser's Approval and Distribution**

All relevant drawings and data pertaining to the equipment like GTP, GA drawing, foundation plan, BOM, control & schematics, QAP, etc. shall be submitted by the Bidder for approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A : Technical Specifications for Electrical Equipment & Accessories.

ANNEXURE-A

DESIGN DATA

1.0 AUXILIARY POWER SUPPLY

Supply		Description	Consumer
L.V. Supply	(i)	415V, 3Ø, 3W, 50 Hz Effectively earthed Fault level 50 kA symm. for 1 sec.	Motors above 0.2kW upto less than 175kW.
	(ii)	240V AC/415V AC 240V, 1Ø, 2W, 50 Hz effectively earthed	Motors upto 0.2kW. Lighting, Space heating , A.C supply for Control & protective devices.
D.C. Supply		220V, 2W, unearthed Fault level 25* kA. for 1 sec.	D.C. alarm, control & protective devices

* Indicative only, the actual value will be decided by the Bidder, after substantiating the same by calculation.

2.0 RANGE OF VARIATION

A.C. Supply :

Voltage	:	± 10%
Frequency	:	+3% to -5%.
Combined Volt + frequency	:	10% (absolute sum)

During starting of large motor, the voltage may drop to 80% of the rated voltage for a period of 60 seconds. All electrical equipment while running shall successfully ride over such period without affecting system performance.

D.C. Supply :

Voltage : 187 to 242

Actuator Data Sheet

BHEL	**SPECIFICATION FOR MOTORISED VALVE ACTUATOR**	SPECIFICATION NO.: PE-SS-411-145-I007 VOLUME SECTION REV. NO. 00 DATE: 14.11.14 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)
350			
GENERAL*	* PROJECT	4X270 MW BHADRADRI TPS	
	OFFER REFERENCE		
	* TAG NO. SERVICE		
	* DUTY	■ ON / OFF ■ INCHING (AS REQUIRED)	
	* LINE SIZE (inlet/outlet): MATERIAL		
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY	
	* OPENING / CLOSING TIME		
	* WORKING PRESSURE		
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%	
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY	
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY	
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY	
CONSTRUCTION AND SIZING			
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL	
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.	
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.	
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING(REGULATING) SERVICE 150 STARTS/HR MINIMUM	
HANDWHEEL	* REQUIRED	■ YES ☐ NO	
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED	
	TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.		
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY	
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY	
	MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT.	
	ACTUATOR APPLICABLE WIRING DIAGRAM	■ ENCLOSED (BIDDER TO CONFIRM) A: ■ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ☐ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11	
	COLOUR SHADE	■ BLUE (RAL 5012) ENAMEL ☐	
	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 INTERNALLY	
	@ ENCLOSURE CLASS OF MOTOR	☐ IP 65 ■ IP 67 ☐ FLAME PROOF ☐ IP 55, TOTALLY ENCL, SELF VENTILATED.	
	@ INSULATION CLASS	☐CLASS-B ■ CLASS-F (**TEMP. RISE LIMITED TO CLASS B**)	
	@ WINDING TEMP PROTECTION	■ THERMOSTAT (3 Nos.,1 IN EACH PHASE) ☐ ----------	

BHEL	**SPECIFICATION FOR MOTORISED VALVE ACTUATOR**	SPECIFICATION NO.: PE-SS-411-145-I007 VOLUME SECTION REV. NO. 00 DATE: 14.11.14 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)
350			
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED	
INTEGRAL STARTER	INTEGRAL STARTER	■ REQUIRED ☐ NOT REQUIRED	
	TYPE OF SWITCHING DEVICE	■ CONTACTORS ☐ THYRISTORS	
	TYPE	■ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)	
	STEP DOWN CONT. TRANSFORMER	■ REQUIRED	
	OPEN / CLOSE PB	■ REQUIRED ☐ NOT REQUIRED	
	STOP PB	■ REQUIRED ☐ NOT REQUIRED	
	INDICATING LAMPS	■ REQUIRED ☐ NOT REQUIRED	
	LOCAL REMOTE S/S	■ REQUIRED ☐ NOT REQUIRED	
	STATUS CONTACTS FOR MONITORING	■ REQUIRED ☐ NOT REQUIRED	
	INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (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	REQUIRED	
	INTERPOSING RELAY (QUANTITY)	☐ 2 NOs. ■ 3 NOs.	
	DRIVING VOLTAGE	■ 20.5 – 24V DC ☐ _____V DC	
	DRIVING CURRENT	■ 125mA MAX ☐ _____mA MAX	
	LOAD RESISTANCE	■ > 192 ohms - <25 k ohms ☐ > _____ohms - < _____ohms	
TORQUE SWITCH	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN / CLOSE	■1 No. ☐2Nos. / ■1 No. ☐2Nos	
	CONTACT TYPE	2 NO + 2 NC	
	RATING	5A 240V AC AND 0.5A 220V DC	
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE	
	ACCURACY	+3% OF SET VALUE	
LIMIT SWITCH	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN : INT : CLOSE	■1 No ☐2 Nos. / 2 Nos. (ADJ.) / ■1 No. ☐2Nos.	
	CONTACT TYPE	2 NO + 2 NC	
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC	

BHEL	**SPECIFICATION FOR MOTORISED VALVE ACTUATOR**	SPECIFICATION NO.: PE-SS-411-145-I007 VOLUME SECTION REV. NO. 00 DATE: 14.11.14 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)

350

POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty)	■ REQUIRED ☐ NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	■ ELECTRONIC (2 WIRE) R/I CONVERTER ☐ ELECTRONIC (2 WIRE) CONTACTLESS	
	SUPPLY	■ 24V DC ☐	
	OUTPUT	■ 4-20mA	
	ACCURACY	± 1% FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY		
	@ RATING	415v, 3PH, AC FOR RATING > 0.2KW; SINGLE PHASE FOR RATING < 0.2KW	
TERMINAL BOX	MOTOR TERMINAL BOX	REQUIRED	
	ACTUATOR TERMINAL BOX	REQUIRED	
	ENCL CLASS MTR T.B. / ACTUATOR T.B.	@■ IP 67 @☐..... ■ IP67 ☐.....	
	@ EARTHING TERMINAL	REQUIRED	
	PLUG & SOCKET(9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	☐ REQUIRED ■ NOT REQUIRED☐ ☐ 2 NOS. ☐ ----------	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:--DURING DETAIL ENGINERING	
	@ SPACE HEATER CABLE GLAND	SIZE: 2C x 2.5 sq. mm	
	OTHER CONTROL CABLE GLANDS-1	INSTRUMENT CABLE SIZE FOR ON/OFF DUTY VALVES SHALL BE 8PXO.5 SQMM - ONE CABLE GLAND OF OD SIZE 20 MM. INSTRUMENT CABLE SIZE FOR INCHING DUTY TYPE VALVES SHALL HAVE TWO NO. CABLES (ONE NO. 8PXO.5 SQMM AND 2ND 2PXO.5 SQMM) - TWO NO. GLANDS OF OD SIZES 20 MM & 15 MM.	
	OTHER CONTROL CABLE GLANDS-2		
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	_____ Kg.

NOTES:

1. **SCOPE**: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
2. **CODES & STANDARDS**: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATION STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
   IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.
5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION.THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
6. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
7. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.

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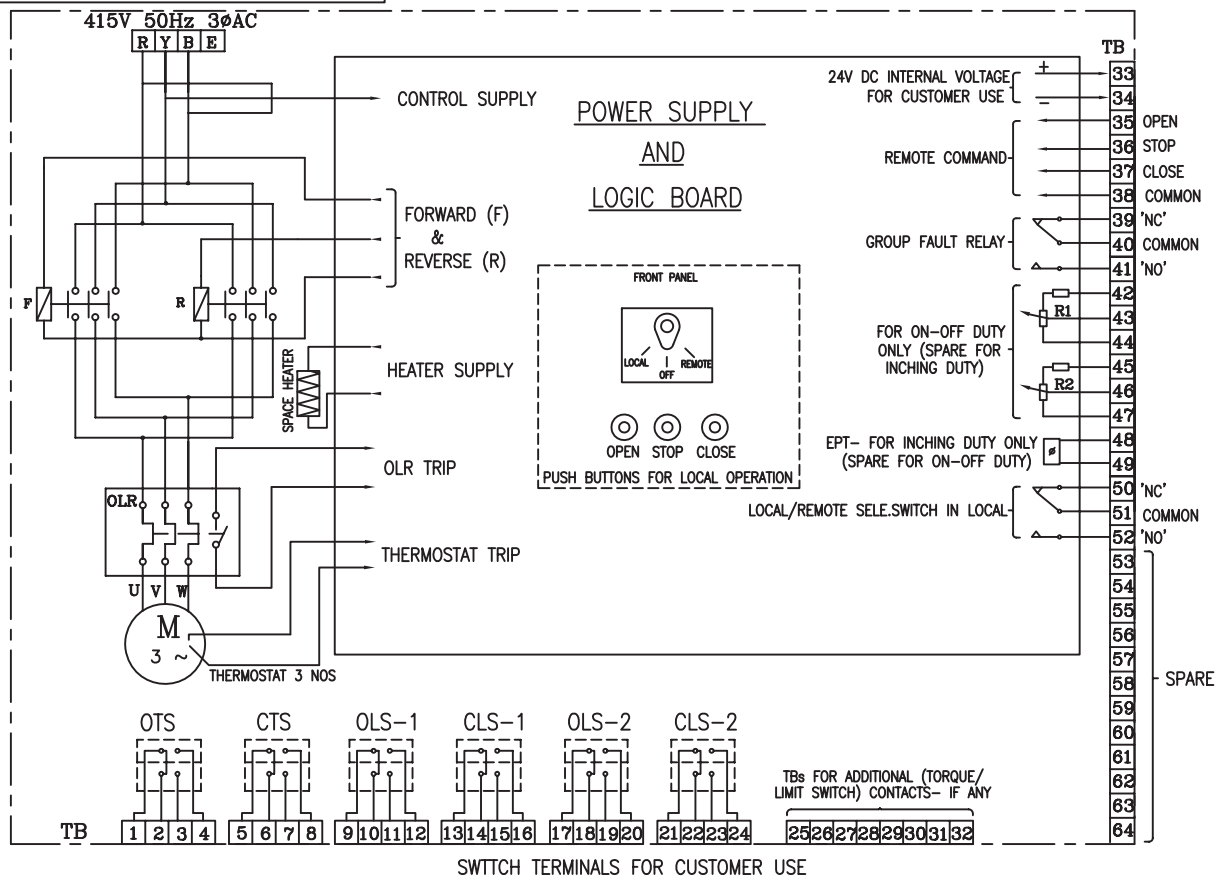
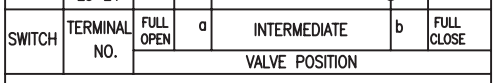
NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @= TO BE FILLED BY ES

DRAWING NO. 3-V-MISC-24227



CONTACT DEVELOPMENT DIAGRAM

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



INDICATES CONTACT CLOSED

INDICATES CONTACT OPEN

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

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH

VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF 100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	CLS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CTS	#

\# - CLS NOT TO BE CONNECTED IN TRIP CIRCUIT

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

NOTE:-

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

REV	DATE	ALTERED
		CHD & APPD

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

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

	NAME	SIGN	DATE	NO.OF VAR.
DRN	N.P.ESWAR	N.P	07.10.04	
CHD	D.DINAKARAN	D.D	07.10.04	
APPD	K.ARUNACHALAM	K.A	07.10.04	

DEPT: VL | CODE | SCALE | WEIGHT (KG). | REFERENCE INFORMATIONS | NO. OF ITEMS

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

CARD CODE: U 01

DRAWING NO. 3-V-MISC-24227

REV 0

Size A3

LCP & JUNCTION BOXES SPECIFICATION

1.00.00 **GENERAL REQUIREMENT**

1.01.00 ENCLOSURES FOR INSTRUMENTS AND OTHER EQUIPMENT

1.01.01 All panels, cabinets, distribution boxes, junction boxes, terminal boxes and all other field mounted equipment / enclosures shall have suitable environmental protection as detailed in Section-I of this volume of the specification.

1.02.00 SURFACE PREPARATION & PAINTING

1.02.01 All sheet metal panel/ desk exterior steel surfaces shall be sand blasted, ground smooth and painted as specified below.

1.02.02 Suitable filler shall be applied to all pits, blemishes and voids in the surface. The filler shall be sanded so that surfaces are level and flat; corners are smooth and even. Exposed raw metal edges shall be ground burr-free. The entire surface shall be blast clean to remove rust and scale and all other residue due to the fabrication operation. Oil, grease and salts etc. shall be removed from the panels by one or more solvent cleaning methods prior to blasting.

1.02.03 Two spray coats of inhibitive epoxy primer surfacer shall be applied to all exterior and interior surfaces, each coat of primer surfacer shall be of dry film thickness of 1.5 mil. A minimum of two spray coats of final finish color (Catalyzed epoxy or polyurethane) shall be applied to all surface of dry film thickness 2.0 Mil. The finish colors for exterior and interior surfaces shall conform to the following shades:

- Exterior – Opaline green shade 275 of IS: 5 or equivalent international code..
- Interior - Brilliant White.

1.02.04 Paint films, which show sags, cheeks, blisters, teardrops, fat edges or other painting imperfections, shall not be acceptable.

1.03.00 WIRING

1.03.01 All spare contacts of relays, switches and push buttons shall be wired up to the terminal blocks. All intercommunications between sections of panels/desks shall be furnished.

1.03.02 Each wire shall be identified at both ends with wire designation as per approved wiring diagram. Heat shrinkable type ferrules with indelible computerized ink print shall be used with cross- identification.

1.03.03 All wire termination shall be made with insulated sleeve and crimping type lugs. Wire shall not be spliced or tapped between terminals. Open-ended terminal lugs will not be accepted. Wires shall not be looped around the terminal screws or studs.

1.03.04 Internal wiring should be terminated uniformly on one side of the terminal block leaving the other side available for termination of outgoing cables. Internal wiring shall be grouped so that all outgoing wiring to each particular remote location is terminated on adjacent terminal blocks. Interior wiring and jumperings shall be arranged so that external connections can be made from internal side of terminal blocks. Common connections shall be limited to two (2) wires per terminal.

1.03.05 Wiring shall be arranged to ensure free access to all instrument or devices for maintenance. No wire shall be routed across the face or rear of any device in a manner, which will impede the opening of covers or obstruct access to leads, terminals or devices

1.03.06 Wires shall be dressed and run in trays or troughs with clamp-on type covers. Wirings may be neatly bunched in groups by non-metallic cleats or bands. Each group shall be adequately supported along its run to prevent sagging or strain on termination.

1.03.07 Shield wires shall be terminated on separate terminal blocks. Common connections shall be limited to two wires per terminal. Signal circuit shields shall be grounded at the power supply end only or as recommended by manufacturer.

1.03.08 All low level signal cables shall be separately bundled to from control cable and maintained at 300 mm minimum spacing from control bundles.

1.03.09 Panel internal wiring shall follow distinct color-coding to segregate different voltage levels viz. 24V DC, 48V, 110V AC, 240V AC, 220V DC etc.

1.03.10 Thermocouple lead wires, analyzer measuring lead wires, or any other lead wires carrying measuring signal of the order of low milli volt or micro volt shall be electrically and physically isolated from other AC and DC wiring. Shielded wires used in such cases for panel internal wiring shall be continuous and ungrounded with the shield terminated individually and separately in panel terminal block.

1.03.11 Wiring to door mounted devices shall be provided with multi-strand wires of (49 strands minimum) adequate loop lengths of hinge-wire so that multiple door openings will not cause fatigue failure of the conductor.

1.03.12 Internal wiring in factory pre-wired electronic systems cabinets may be installed according to the Contractor's standard wire size, insulation, and method of termination on internal equipment. Insulation for all wiring, including circuit board wiring, back panel wiring, power supply wiring and interconnecting cables between devices shall pass the vertical flame test per IPCEAS-1981. Identification of conductors may be done by insulation color-coding identified on drawings or by printed wiring lists.

1.04.00 TERMINAL BLOCKS

1.04.01 All terminal blocks shall be rail mounted/ post mounted type, cage clamp type with high quality non-flammable insulating material of melamine suitable for working temperature of 105 Deg C. The terminal blocks in field mounted junction boxes, instrument enclosures racks etc. shall be suitable for cage clamp connections. The terminal blocks in Control Equipment Room termination/ marshalling cubicles shall be suitable for post mounted cage clamp connection at the field input end. The exact type of terminal blocks to be provided by Bidder shall be subject to Owner.

1.04.02 All terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, small partitions, transparent covers, support brackets, distance sleeves, warning level, marking etc. For RTDs ring - tong type lugs shall be used at Junction Boxes.

1.04.03 The characteristics of the terminal blocks shall be as follows.

i) High contact force, independent of conductor cross-section and large contact surface area.

ii) Integrated self-loosening protection to avoid shifting of contact surface that may allow contamination of connection point.

iii) Inspection and maintenance free (resistant to thermal aging and vibration)

iv) Low and constant voltage drop

1.04.04 The insulation of the terminal blocks shall be of suitable thermoplastic material.

1.04.05 The spacing between Terminal blocks channels in panels and cubicles shall be adequate for routing the cable troughs and to allow adequate free workspace for termination and removal of wires. The terminal blocks shall be arranged with atleast 100 mm clearance between two sets of terminal blocks and junction box walls.

1.04.06 Signals of different voltage levels shall be clearly segregated by providing separate rows to each type of signal and by using terminal blocks of different color for each type of signal and by providing barrier strips between them.

1.04.07 Terminal blocks shall be provided with white marking strips / self-adhesive marker cards and where permitted by the safety codes and standards, shall be without covers. Power terminals and high voltage (above 48 volts) terminals shall have protection covers. All terminals shall be provided with permanent terminal identification numbers on both sides.

1.04.08 At least 20% spare unused terminals shall be provided on each terminal block for circuit modifications and for termination of all conductors in a multi-conductor control cable.

1.04.09 The bottom of the terminal block shall be at least 200 mm above the cable gland for bottom entry type panels.

1.04.10 For extending 24 V DC supply to panels, the size of the terminals shall be decided based on voltage drop and not based on current.

1.04.11 Other requirements of the terminal blocks are as follows:

i) The last terminal in a rail-mounted assembly shall be closed with an end plate and end bracket.

ii) For visual and electrical separation of terminal groups, partition plates shall be provided, which can be push fitted after forming an assembly.

iii) Design shall permit testing of incoming and outgoing signals by using suitable test plug and socket without disconnecting the cable connections.

iv) It shall be possible to use jumper plugs through the above test plug socket to connect adjacent terminals. Adequate number of short circuit jumper plugs shall be provided for the purpose.

v) Where more than one connection to a terminal block is required, two tier terminals shall be used.

1.05.00 GROUNDING

1.05.01 Separate Protective and Electronic system ground as required shall be provided.

1.05.02 All panels, desks, cabinets shall be provided with a continuous bare copper ground bus (Frame ground), bolted to the panel structure at bottom on both sides and effectively ground the entire structure. The bolts shall face inside of panels.

1.05.03 For electronic system cabinets the electronic system ground bus (Electronic ground) shall be similar but insulated from the cabinet and shall be separately connected to the system ground .The same ground may be used to earth the shield of shielded signal cables, otherwise a separate ground bus shall be provided for connecting the signal cable shields. Cable shields shall be grounded at the panel end only and shall never be left open .The electronic ground between panels of a shipping section shall be firmly looped.

2.00.00 CONTROL DESKS & PANELS

2.01.00 GENERAL

2.01.01 All control desk, panels etc. shall be furnished fully wired with necessary provision for convenience outlets, internal lighting, utility receptacles, grounding, ventilation, space heating, anti-vibration pads, internal piping &

accessories as required for completeness of the system.

2.01.02 The design shall conform to the EN ISO 11064 (Ergonomical design of Control Room), Part 1, 2 and 3.

2.01.03 The exact dimensions, material, construction details, grounding, general arrangement etc. shall be as per actual requirement and shall be finalized during detail engineering and subjected to Owner's approval.

2.01.04 Incoming power supply feeders shall be duplicated. Alarm shall be provided for failure of a power supply feed.

2.01.05 For Control desk/ panel mounted instruments/ devices etc. which are to be powered from UPS, all required conversion of interface equipments/ accessories to make such devices compatible with UPS supply shall be provided. All necessary hardware like input switches/ fuse unit for each feeder as well as switch fuse unit for each instrument/ device on the power supply line shall be provided. From UPS redundant feeders shall be provided wih suitably rated MCB and provision of fast auto changeover of UPS feeders.

2.01.06 Crating of the panels and desks shall be suitable for protection against shock, vibration, inappropriate handling and inclement weather conditions during transportation and warehousing. Mounted equipment shall have adequate protection against damage during handling, transit and storage. Suitable desiccant shall be used inside the packing case.

2.01.07 Nameplate

a) Nameplate shall be provided for instrument or device mounted on the panel.

b) Nameplates for panels shall be provided both in front and rear.

2.02.00 CONTROL DESK

2.02.01 Control desk shall be free standing, floor mounting, table top type with doors at back and shall be constructed of 3 mm thick (minimum) CRCA steel or Aluminium extrusion. Aluminium structure shall be anodized or powder coated paint finish. The top surface of control desk shall be 30 mm (minimum) thick with the top 12 mm (minimum) of acrylic solid surface and the remaining 18 mm of laminated medium density fibre (MDF) board.

2.02.02 Monitors with retractable keyboard shall be provided on the desk. Desk shall be arranged in arc-like shape without any sharp edges. Edges shall be extruded PVC or rounded post-formed laminate.

2.02.03 Desks shall be of modular, scalable and industrially ruggedized design and shall have connections for PA system handsets & telephone sets.

2.02.04 Desks shall have concealed cable trays for wire dressing. Both Horizontal & Side Managers (2 separate horizontal cable routing wire baskets for power & data cables) shall be provided.

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

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

2.02.05 Design shall include Earthing bolts.

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

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

2.02.08 HARDWIRED DEVICES ON CONTROL DESK (DRAW OUT SECTION)

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

2.03.00 BACK UP PANEL

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

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

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

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

be mounted on the back up panels.

2.04.00 PANELS/CABINETS

2.04.01 All DDCMIS system modules, power supply components and other Local Control panels (PLC/Relay based) shall be housed in cabinets as specified below.

2.04.02 The cabinet mounted equipments shall be fully assembled, installed in mounting racks, wired and fully tested as per specification requirements and Owner approved drawings prior to shipment to the project site.

2.04.03 The Bidder shall ensure that the cabinets are complete & ready for installation before dispatch from manufacturing works. The installation work at project site for these cabinets shall only involve connections through multi-pair cables from marshalling cabinets (wherever provided) to system cabinets and inter-cabinet/cabinet to Control Desk/ Back up Panel.

2.04.04 All electronic cards, network components, power supply modules etc. located shall be suitably housed in cabinets and shall be neatly arranged in sub-racks. Network components shall be visible in door closed condition (e.g. Glass doors etc.) as approved by Owner.

2.04.05 Bidder shall design the cabinet internal arrangement, floor cutout and cable gland plate such that all the cables entering or leaving the cabinet can be properly glanded in the gland plate.

2.04.06 The packaging density of panels shall be such that the temperature rise within the panels shall never exceed 10°C above ambient even under worst operating conditions. Cooling Fans shall be provided wherever required and this shall be of industrial grade.

2.04.07 TECHNICAL PARTICULARS

1.	Material of Construction	:	Cold Rolled Coal Annealed (CRCA) steel sheet	
2.	Thickness of Sheet	:	a)	2.0 mm for faces supporting instruments / terminals
		:	b)	1.6 mm for other sides and top
3.	Construction	:	Welded throughout as per approved National Standards	
4.	Post welding operation	:	a)	Grounding of all welds to smoothness
		:	b)	Rounding of corners

		:	c)	Cleaning of weld spatters
5.	Panel height	:	2300 mm (approx)	
6.	Corners	:	7 mm inner radius	
7.	Dimensional Tolerances	:	a)	In height & length - 3 mm
			b)	In height between adjacent sections - 2 mm
			c)	Total for a group - 6 mm
8.	Doors	:	Double, recessed, turned back edges, full height front & rear	
	i) Thickness of Sheet	:	2 mm	
	ii) Hinges	:	Stainless steel	
	iii) Door latches	:	Three point type	
	iv) Door gaskets	:	Neoprene rubber on fixed frame to result dust proof/weatherproof enclosure	
	v) Opening of the doors	:	Outward	
	vi) Louvers	:	With removable wire mesh to ensure dust and vermin proof	
9.	Gland plates	:	Removable in sections 4 mm thick (bottom)	
10.	Cable entry	:	Bottom	
11.	Hardware	:	a)	Anti vibration pad- 15 mm
			b)	Predrilled base channel ISMC – 100 or equivalent for all sides
			c)	Stainless steel buff- finished 2 mm thick kick plate for all sides
			d)	Stainless steel scratch strips along desk edges fixed with pan-head recessed screws
			e)	Rubber strips to ensure air

tightness between kick plate and finished floor

f) Lifting hook / Eye bolt

g) Drawing pocket

h) Door switch, lamps, thermostat, heaters and industrial grade cooling fans,, illumination fixures

12.	Name Plate	:	Both at front and back surface of the panel
13.	Fixing of name plate	:	Stainless steel pan head screws
14.	Name plate material	:	Laminated phenolic (3 layers)
15.	Lettering	:	Black with white engraved
16.	Mounting of terminal blocks	:	Vertical angle support bracket tack welded on sheet steel plate, screwed on internal wall of enclosure

2.05.00 FURNITURE

All the furnitures in the Central / Local control Room (s), Engineers' rooms, Instrument laboratory , SWAS Room & any other rooms with C&I equipments located in different plant buildings under Bidder's scope shall be included in Bidder's scope of supply. Bidder shall provide following industrial grade furniture items as a minimum from reputed manufacturers/suppliers meeting International Standards. The furniture shall be modular and latest with ease of operational features. The furniture shall be modern, aesthetically designed, modular, flexible, space saving and future safe.

2.05.01 WORK STATION FURNITURE

Modular work station furniture, suitable for mounting servers & historians, programmer stations, PC based systems, printers (A4/A3 color laserjet) etc. shall be provided.

2.05.02 PC RACK

PC Racks shall be provided to mount CPUs of workstations/PCs of OWS/LVS etc. in control room. For each PC / workstation / monitor at least one chair shall be included.

2.05.03 CHAIRS

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

2.05.04 TABLES

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

2.05.05 ALMIRAHS

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

2.05.06 KEYPAD

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

2.05.07 LOCKERS

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

3.00.00 LVS PANEL

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

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

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

clearly brought out by the Contractor in his offer, alongwith all relevant details/basis.

3.03.00 Any other requirement for proper LVS mounting & functioning & viewing shall also be specifically brought out by the Contractor in his offer, along with all relevant details.

4.00.00 **LOCAL INSTRUMENT RACK (LIR) & LOCAL INSTRUMENT ENCLOSURE (LIE)**

4.01.00 GENERAL

4.01.01 Devices (Transmitters/ Switches) located in the field shall be suitably grouped together to the extent possible and installed in the LIE (Closed Rack) and LIR (Open Rack) in Boiler/TG Building and Off-site plant areas.

4.01.02 Racks and enclosure shall be factory prefabricated & painted and shall complete with internal piping, tubing, manifold, isolation valves, blowdown valves, integral junction box, illumination etc.

4.01.03 No more than six instruments shall be grouped in a single rack / enclosure.

4.01.04 Racks shall be installed above the tapping points for air, flue gas and coal air mixture application whereas for applications such as for water and steam, racks to be installed below the source point.

4.01.05 Attention shall be paid in the layout to avoid air traps in liquid piping and water accumulation in air /gas piping.

4.01.06 Racks used for furnace, flue gas and air application shall be provided with intermittent & continuous air purging

4.01.07 Welding of impulse lines shall comply with the provisions of the latest applicable ANSI Code for Pressure Piping.

4.01.08 Earth stud shall be furnished at rack for safety grounding.

4.02.00 LOCAL INSTRUMENT ENCLOSURE (LIE)

4.02.01 Enclosure shall be free standing type. Racks shall be adequately reinforced to ensure true surfaces and to provide support. Major load - bearing posts shall be suitably supported by gusset plates or moment members.

4.02.02 Enclosure outer shall be constructed from at least 3 mm thick steel plate and epoxy painted to shade gray. Base frame shall be made of ISMC 100 and black colour finish.

4.02.03 2” NB galvanized pipes shall be laid horizontally and supported at two end channels to mount transmitters at accessible height. Center posts or any

member, which would reduce access, shall be avoided.

4.02.04 Double leaf interlocking front opening doors with three point locking shall be provided and shall be arranged for maximum possible access to the interior. Key shall be of identical for all enclosures.

4.02.05 Doors shall have concealed quick removal type pinned stainless steel hinges and locking handles. Gaskets shall be used between all mating sections to achieve dust and weather proof enclosure rated for IP-65 including the internal junction box. All enclosures shall have access doors on front side.

4.02.06 Removable type bulkhead plates of thickness not less than 6 mm shall be mounted at the racks with suitable high temperature gasket. Impulse lines within the enclosures shall be properly clamped.

4.02.07 All internal wirings between the instruments and junction box shall run through flexible conduits. No exposed wirings within transmitter racks both open and closed type, is admissible.

4.02.08 Racks shall have a common blowdown drain header, which will connect individual instrument blowdown line after suitable pressure breaking through regulating globe type blowdown valves. Covered funnels shall be used for saturated liquid and steam service, whereas, open funnels may be used for cold liquid services. Header (2" NB ASTM A 106, Sch-80 Gr. C) shall be suitably sloped and shall have one end flanged and extending beyond the rack for connection to plant drain header..

4.02.09 Each rack shall be provided with one receptacle, light fixtures with wire guard and one lighting switch each at instrument & Junction box compartments with wire guard. Lighting switches may be door actuated & mounted inside the panel. Outlet box, switch box and device covers shall be of galvanized stamped steel. Light switches and receptacles shall be installed inside the enclosure on the wall near the latch side of the enclosure door. Light fixtures shall be installed on the ceilings of the enclosures.

4.02.10 Power supplies for miscellaneous devices shall be provided with MCB located within the enclosures. MCB shall be mounted in fuse blocks. Nameplates shall be furnished above the MCB blocks, identifying the devices being served.

4.02.11 Vibration dampeners shall be installed for supporting each enclosure. The loading at each corner of the enclosure shall be determined by actual test weighting when construction is complete to determine the correct length of each dampener for proper loading of the dampener in accordance with manufacturer's recommendations

4.03.00 LOCAL INSTRUMENT RACK (LIR)

4.03.01 Rack shall be free standing type constructed from 6 mm thick steel channel frame provided with a canopy to protect the instrument from dripping water or

falling objects and shall be epoxy painted. Canopy shall be of CRCA steel sheet of at least 3 mm thickness.

4.03.02 Rack Major load-bearing posts shall be suitably supported by gusset plates or moment members. Suitable fenders grill shall be welded to the end-posts of the rack to outline a boundary beyond which no mounted equipment shall project to protect instrument from accidental contact during personnel movement. Center posts or any member, which would reduce access, shall be avoided.

4.03.03 2" NB galvanized pipes laid horizontally and supported at two end channels shall be employed at working accessible height for mounting of instruments.

4.03.04 All internal wirings between the instruments and junction box shall run through flexible conduits. No exposed wirings are admissible.

4.03.05 Racks shall have a common blowdown drain header, which will connect individual instrument blowdown line after suitable pressure breaking through regulating globe type blowdown valves. Covered funnels shall be used for saturated liquid and steam service, whereas, open funnels may be used for cold liquid services. Header (2" NB ASTM A 106, Sch-80 Gr. C) shall be suitably sloped and shall have one end flanged and extending beyond the rack for connection to plant drain header..

Each rack shall be provided with one receptacle, one light fixture with wire guard and one lighting switch. Outlet box, switch box and device covers shall be galvanized stamped steel. Light fixtures shall be installed on the canopy of the rack

4.03.06 Power supplies for miscellaneous devices shall be provided with MCB located within the enclosures. MCB shall be mounted in fuse blocks. Nameplates shall be furnished above the MCB blocks, identifying the devices being served.

4.04.00 JUNCTION BOX

1.	Type of Enclosure	:	Dust tight & weatherproof conforming to IP 65
2.	Material	:	3 mm sheet steel / fiberglass reinforced polyester(UV stabilized)
3.	Type of Cover	:	Solid unhinged with retention chain / Screwed at all four corners
4.	Paint	:	i) Exterior : Opaline green shade 275 of IS: 5 ii) Interior - Brilliant Glossy White.

			Surface / Two (2) inch Pipe stanchion
5.	Mounting	:	(At a dry compartment at one side of the enclosure / rack with front opening type door)
6.	Cable Entry	:	3 mm (min) Bottom / side Gland plate
7.	Gasket	:	Neoprene
8.	Grounding	:	Brass earth lug with green screw head External-2 nos , Internal-1no. (M6)
9.	Number of Drain Holes	:	Two at bottom capped
10.	Identification	:	Label for JB and Tags for cable
11.	Accessories	:	a) Rail mounted cage clamp type screwless terminals (suitable for conductor size up to 2.5sq.mm of suitable voltage grade) with markers and 20% spare terminals b) Cable gland (Brass) & raceways c) Ferrules & lugs (Brass) d) Aluminum back panel e) Canopy at top f) Mounting brackets g) bolts and nuts made of brass etc.

LCP Quality Plan

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

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

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

1 - BHEL 2 - Vendor 3 - Sub-vendor

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

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

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

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

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

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

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

1 - BHEL; 2 - Vendor; 3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 22-02-2008
SHEET	7 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IEC-60947, IEC-60079	BHEL approved spec., drg relevant IEC-60947, IEC-60079	Type Test Certificate	3	---	1	
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant standard	BHEL approved spec., drg., BOM & relevant standard	Test Report	2	1	1	
15	FUCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		2. Instrument Calibratio	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant standard	BHEL approved spec/drg & relevant standard	Inspection Report	2	1	1	

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

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

1 - BHEL; 2 - Vendor; 3 - Sub-vendor

ERECTION HARDWARE

1.00.00 GENERAL TECHNICAL REQUIREMENTS

This section provides the general technical guidelines for the erection materials for instruments. All erection materials shall be of good quality and conform to the operating environment of the corresponding instrument.

However, any item required for erection of Bidder supplied system but not categorically indicated in this section, shall be supplied by the Bidder and all these items shall conform to International / National standards / codes.

1.01.00 Electrical Accessories

Electrical conduit and associated materials shall conform to the requirements of the articles which follow :

a) Rigid Steel Conduit

i) Conduits up to and including 25 mm shall be of 16 SWG and conduits above 25 mm shall be of 14 SWG. Minimum size of conduits shall be 19 mm.

ii) Each piece of conduit shall be straight, free from blister and other defects and covered with capped bushing at both ends.

iii) All rigid conduit couplings and elbows shall be hot dip galvanized rigid mild steel in accordance with IS:9537 Part-I (1980) and Part-II(1981).. The conduit interior and exterior surfaces shall have a continuous zinc coating with an over coat of transparent enamel lacker or zinc chromate. Conduits shall be furnished in standard length of 3 meters, threaded at both ends.

iv) All rigid conduit fittings shall conform to requirements of IS:2667,1976. Galvanised steel fittins shall be used wth steel conduit. All flexible conduit fittings shall be liquid tight, galvanized steel. The end fitting shall be compatiable with the flexible conduit supplied.

b) Flexible Conduit

i) Flexible conduit shall be of three layer construction of very high quality of lead coated steel. Outside and inside layer shall be reinforced with heat resistant material.

ii) Lead coating outside and inside of the conduit steel surface shall provide a non-corrosive characteristic particularly in acidic atmosphere. Besides flexibility, this shall be strong enough to stay at the desired profile without support and shall be durable and strong so as to offer sufficient mechanical protection. It shall also be fully liquid dust and air tight and shall withstand a continuous hydraulic pressure up to 2 Kg/Sq. cm and temperature up to 200 °C.

c) Special Fittings

i) Conduit sealing and fittings shall be provided as required and shall be consistent with the area and equipment with which they are installed.

ii) Double locknuts shall be provided on all conduit terminations not provided with threaded lugs and couplings. Locknuts shall be designed to securely bond the conduit to the enclosure when tightened. Locknuts shall not loosen due to vibration.

1.02.00 Electrical Junction Box:

Please refer to Section VII , Subsection – D of this volume of the Specification.

1.03.00 Cable Gland

1.	Type	: Double compression
2.	Entry Thread	: NPT / ET
3.	Material	: Brass
4.	Finish	: Cadmium Plated.
5.	Protection	: IP 54 or better
6.	Accessories	: Neoprene gasket, locknuts, reducers etc

1.04.00 Cable Tray

1.	Material	: Mild steel, slotted
2.	Thickness	: not less than 2.0 mm
3.	Finish	: Hot dip galvanized
4.	Perforation	: As per MFR standard
5.	Cover	: Suitable for tray

1.05.00 Process Hook Up Accessories & specification

Material and rating of the hook up items shall suit the piping and fluid condition. Hook up materials shall be IBR certified for applicable cases. Bidder shall furnish hook up drawings and the drawings for open racks & closed racks for owner's approval.

1.05.01 Seamless Stainless Steel Pipe

1.	Reference	: ASTM A-312 TP 316
2.	Material Grade	: TP 316
3.	Type	: Seamless /Plain end
4.	Size	: As applicable (e.g.½" NB etc)
5.	Schedule	: 40
6.	Standard Length	: 5 meter

1.05.02 Stainless Steel Pipe Fittings

	1.	Reference	: ASTM A-182 F 316 / ANSI B16.11
	2.	Type	: Forged
	3.	Rating	: 3000 lbs / 6000 lbs / 9000 lbs
	4.	Size	: To suit related SS pipe.
	5.	End connection	: Generally socket weld
	6.	Type of Fittings	: Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc.

1.05.03 Seamless Stainless Steel Tube

	1.	Reference	: ASTM A-213 , ASTM A-249 or ASTM A-269
	2.	Material Grade	: TP 316
	3.	Size	: As applicable (e.g.½" OD X 0.083" wall thickness / ¼" OD X 0.049" wall thickness etc.)
	4.	Type	: Cold drawn annealed, pickled, passivated, de-scaled, hydraulically cleaned seamless tube.
	5.	Properties	: The tube shall be free from scratches and suitable for bending and capable of being flared by hardened and tapered steel pin. The expanded tube shall show no crack or rupture. Hardness shall be RB 80.
	6.	Test Pressure	: 400 Kg/Sq. cm (minimum)
	7.	Tolerance	: ± 0.13 mm for outside diameter
			: ± 15 % for wall thickness
	8.	Standard Length	: 5 meter
	9.	Test	: Flare, Hardness, Ball and Bubble Test

1.05.04 Stainless Steel Tube Fittings

	1.	Reference	: ASTM-A-182
	2.	Type	: Double ferrule double compression
	3.	Material	: 316 Stainless steel forged
	4.	Ferrule	: 316 Stainless Steel

	5.	Type of Fittings	: Male / female connector, elbow, cross /equal tee, straight connector, bulkhead union, ferrule etc. as required to suit installation.
	6.	Size	: To suit SS tubing and NPT end connection

1.05.05 C.S. Pipe

	1.	Reference	: ASTM-A 106 Gr. C
	2.	Material	: Cold drawn seamless black C.S.
	3.	Type	: Seamless / Plain ends
	4.	Size	: As applicable (e.g. ½" NB etc)
	5.	Schedule	: 80, 160, XXS as required
	6.	Standard Length	: 5 meter

1.05.06 C.S. Pipe Fittings

	1.	Reference	: ASTM-A 105 / ANSI B16.11
	2.	Type	: Forged
	3.	Rating	: 3000 lbs / 6000 lbs / 9000 lbs
	4.	Size	: Suitable to related C.S.Pipe
	5.	End connection	: Generally socket weld
	6.	Type of Fittings	: Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc.

1.05.07 A.S. Pipe

	1.	Reference	: ASTM-A 335 P22 AS PER ANSI B 36.10
	2.	Material	: Cold drawn seamless A.S.
	3.	Type	: Seamless / Plain ends
	4.	Size	: As applicable (e.g. ½" NB etc)
	5.	Schedule	: XXS
	6.	Standard Length	: 5 meter

1.05.08 A.S. Pipe Fittings

1.	Reference	: ASTM-A 182 F22 AS PER ANSI B 16.11	
2.	Type	: Forged	
3.	Rating	: 9000 lbs	
4.	Size	: Suitable to related A.S.Pipe	
5.	End connection	: Generally socket weld	
6.	Type of Fittings	: Reducing coupling, male-female reducer, straight coupling, equal tee, three piece union, elbow, cap etc.	

1.05.09 G.I.Pipe

1.	Reference	:	IS-1239, Part-I
2.	Type	:	Medium grade, threaded at both ends protected with end caps
3.	Material	:	Continuous ERW galvanized MS pipe
4.	General	:	Pipe shall be galvanized both inside and outside
5.	Size	:	As applicable (e.g 1/2”/3/4”/1” etc.)

1.05.10 G.I.Pipe Fittings

1.	Reference	:	IS-1239, Part-II for material, dimension, thread etc.
2.	Style	:	Threaded
3.	Type of Fittings	:	Equal tee, three piece union, unequal tee, straight socket, 90 Deg. elbow, reducing socket cap. etc. to suit installation.
4.	Size	:	Suitable to related G.I.Pipe

1.05.11 Carbon Steel Globe Valve

1.	Reference	: ASTM A-105
2.	Type	: Globe
3.	Construction	: Forged Body Cadmium Plated
4.	End Connection	: As applicable (eg. ½” Socket Weld etc.)
5.	Rating	: Cl. 800 / CL. 2500

	6.	Material	: Body - Carbon steel
			: Stem - Hardened Steel
			: Plug - AISI 316 SS
			: Seat- Stainless steel stellited
	7.	Packing	: Teflon / Grafoil as required
	8.	Yoke	: ASTM A105
	9.	Hand wheel	: Carbon steel
	10.	Design standard	: As per ANSI B 16.34

1.05.12 Stainless Steel Globe Valve

1.	Reference	: ASTM A-182 F316
2.	Type	: Globe
3.	Construction	: Forged Body
4.	End Connection	: As applicable (eg. ½" Socket Weld etc.)
5.	Proof Pressure	: 400 Kg/Cm2
6.	Material	: Body - Stainless steel
		: Stem - Hardened Steel
		: Plug - AISI 316 SS
		: Seat- Stainless steel stellited
7.	Packing	: Teflon as required
8.	Yoke	: ASTM A182 F316
9.	Handwheel	: Carbon steel
10.	Design standard	: As per ANSI B 16.34

1.05.13 Alloy Steel Globe Valve

1.	Reference	: ASTM A-182 F22
2.	Type	: Globe
3.	Construction	: Forged Body

4.	End Connection	: As applicable (eg. ½" Socket Weld etc.)
5.	Rating	: CL. 2500
6.	Material	: Body - Alloy steel
		: Stem - Hardened Steel
		: Plug - AISI 316 SS
		: Seat- Stainless steel stellited
7.	Packing	: Grafoil as required
8.	Yoke	: ASTM A182 F22
9.	Handwheel	: Carbon steel
10.	Design standard	: As per ANSI B 16.34

1.05.14 Structural Steel

Steel supports for JB's, trays; tubes and related equipments shall not be limited to the following:

a) MS Angle
b) MS Channel
c) I-Beam
d) Hexagonal head Bolt & Nut with washer
e) Foundation Bolt & Nut
f) Expansion Bolt
g) Steel Plates / Flats
h) CRCA sheet
i) 50 NB Pipe
j) Pipe clamps, U Bolts & Nuts
k) Checker plate

1.05.15 Condensate Pot

1.	Reference	: ASTM A182 F22 /ASTM A105
2.	Material	: Alloy steel / carbon steel as per application
3.	Construction	: Drilled from barstock
4.	End connection	: As applicable (e.g 3 nos. ½" socket weld end etc.)

	5.	Accessories	: Vent valves
1.05.16	Instrument Valve Manifold		
	1.	Type	: Two valve manifold
			: Five valve manifold
	2.	Mounting	: Remote 2” Pipe Mounting / Transmitter Rack mounting
	3.	Construction	: Single block (bar stock)
	4.	Material	: Forged body and bonnet AISI 316 stainless steel
	5.	Ports	: Mfg std. (e.g 1/2 " NPT (F) etc.)
	6.	Rating	: 420 Kg/Sq. cm at ambient
	7.	Operating Temperature	: (-)30 to (+)170 Deg C
	8.	Packing	: PTFE Wafer
	9.	Seat & Stem	: AISI 316 SS
	10.	Plug	: AISI 316 SS free to turn on stem / 17-4 PH
	11.	Handle Bar	: AISI 316 SS
	12.	Connection	: Straight
	13.	Accessories	: Plugs for all ports, Mounting Bracket , bolts , nuts

1.06.00 Pneumatic Hook Up Accessories

1.07.00 Air Header

Technical Particulars	**For Panel**	**For Field**
Material of Construction	: Stainless steel	: Stainless steel
Inlet Connection	: 2" NPT (M)	: 1" NPT (M)
Header Take-off Material	: Stainless steel	: Stainless steel
Take off connection	: 1 / 2” NPT (M)	: 1/ 2” NPT (M)
Take-off Valves Material	: stainless steel	: stainless steel

Tube Take-off	: Tube adapter on valve	: Tube adapter on valve
Drain	: SS drain valve at lowest point	: SS drain valves at lowest point

APPLICABLE CABLE TYPES

CABLE SIZES FOR 4 X 270 MW BHADRADRI TPS PROJECT JOB NO. 411 (PER UNIT)	
Sl no.	**Cable Type**
	G-TYPE
1	2P X 0.5 sqmm
2	4P X 0.5 sqmm
3	8P X 0.5 sqmm
4	12P X 0.5 sqmm
	F-TYPE
1	4P X 0.5 sqmm
2	8P X 0.5 sqmm
3	12P X 0.5 sqmm
4	24P X 0.5 sqmm
	CONTROL CABLE
1	3C X 2.5 sqmm
2	5C X 2.5 sqmm
3	12C X 1.5 sqmm

APPLICABLE CODES & STANDARDS

4.45.00 Local Instruments , Flow Elements and Control Valves

Required local instruments including gauge boards, etc. and Flow Elements , Control valves shall be provided for safe and efficient operation of the plant. .

4.46.00 Erection Hardware

Standard and good engineering practice of international standard shall be adopted throughout. All materials supplied shall be suitable for tropical, dust laden, humid power plant environment and shall be from reputed manufacture.

4.47.00 C&I Cabling

Instrumentation cables shall be copper, overall screened for binary signals and individual pair and overall screened for analog signals. All cables shall be FRLS type (inner and outer sheath) ,armored, other than short run cables which may be unarmored. Unarmored cables shall run through conduits.

C&I cable type shall also include FO , Prefab , Coaxial , compensating cable , special cable etc

The screen shall be grounded at the remote panel end at control / equipment room only.

5.00.00 CODES AND STANDARDS

The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards eg. ANSI, ASME, IEEE, ISO, IEC, IGCI, AWS, NFPA, AISC, IGS, SAMA, UBC, UL, NESC, NEMA, ISA, DIN, VDE , IS etc. Generally, the following latest edition of codes and standards prevailing at the time of award of contract shall be applicable.

1) Temperature Measurement

   a) Instrument and apparatus for temperature measurement - ASME PTC 19.3 (1974).

   b) Temperature Measurement - Thermocouples - ANSI - MC 96.1 - 1982.

   c) Temperature Measurement by electrical resistance thermometers - IS: 2806

   d) Thermometer-element-Platinum resistance - IS: 2848 / DIN 43760.

2) Pressure Measurement

   a) Instrument and apparatus for pressure measurement - ASME PTC 19.2 (1964).

   b) Bourdon tube pressure and vacuum gauges - IS: 3624/1996.

3) Flow Measurement

a) Instruments and apparatus for flow measurement - ASME PTC 19.5 (1972) Interim supplement, Part-II

b) Measurements of fluid flow in closed conduit - BS 1042.

4) Electronic Measuring Instruments and Control Hardware

a) Automatic null balancing electrical measuring instruments -ANSI C 39.4 (Rev. 1973), IS 9319

b) Safety requirements for electrical and electronic measuring and controlling instrumentation - ANSI C 39.5 / 1974.

c) Compatibility of analog signals for electronic industrial process instruments - ISA-S 50.1: ANSI MC 12.1 / 1975.

d) Dynamic response testing of process control instrumentation - ANSI MC 4.1 (1975) - ISA -S26 (1968).

e) Surge withstand capability (SWC) tests - ANSI C 37.90A (1989), IEC-255.4.

f) Printed circuit boards - IPC TM-650, IEC 326C.

g) General requirements and tests for printed wiring boards - IS-7405 (Part-I)/1973.

h) Edge socket connectors - IEC 130-11.

i) Requirements and methods of testing of wire wrap terminations--DIN 41611 Part-2.

j) Dimensions of attachment plugs and receptacles- ANSI C73-1973.(Supplement ANSI C73a – 1980)

k) Direct Acting Electrical Indicating Instruments - IS - 1248 - 1968

5) Instrument Switches and Contacts

a) Contact Rating - AC services NEMA ICS Part-2 125, A-600

b) Contact Rating - DC services NEMA ICS Part-2 125, N-600

6) Enclosures

a) Enclosures for Industrial Controls and Systems–NEMA ICS-6-110.15 through 110.22

b) Racks, panels and associated equipment -EIA: RS-310-B-1983 (ANSI C83.9 - 1972) / IEC 60947 / IEC 60529

c) Protection Class for Enclosures , Cabinets Control Panels and Desks - IS 2147 1962

7) Apparatus, Enclosures and Installation Practices in Hazardous Area

a) Classification of hazardous area - NEMA Article 500, Volume-6, 1978./ NFPA Article 500 , Vol.70-1984

b) Electrical Instruments in hazardous dust locations - ISA-RP 12.11.

c) Intrinsically safe apparatus - NFPA Article 493 Volume-4 1978.

d) Purged and pressurized enclosure for electrical equipment in hazardous location - NFPA Article 496 Volume-4, 1982.

8) Sampling System

a) Stainless Steel material of tubing and valves, for sampling system - ASTM A 269-79 GRTO-316.

b) Submerged helical coil heat exchangers for sample coolers -- ASTM D11-98.

c) Steam and water sampling ,conditioning and analysis in the power cycle - ASME PTC - 19.11

d) Standard methods of sampling system - ASTM D 1066-69

9) Annunciators

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

b) Surge withstand capability tests -ANSI C37.90 a -1971 and IEEE Standard 472-1974.

10) Interlocks, Protections

a) Relays and relay system associated with electric power apparatus - IEEE Standards 3.13.

b) Surge withstand capability tests - ANSI C37.90 a - 1971 and IEEE Standard 472-1974.

c) General requirements and tests for switching devices for control and auxiliary circuits including contactor relays - IS-6875 (Part-I)/1973.

d) Turbine water damage prevention - ASME-TDP-1-1980.

e) Boiler safety interlocks - NFPA Section 85B, 85D, 85E, 85F, 85G.

f) Installation and operation of Pulverized fuel system - ANSI / NFPA 8503

g) Functional diagramming of Instrument and control systems - SAMA PMS 22.1

h) Digital interface for programmable instrumentation - ANSI / IEEE 488

11) Control Valves

a) Control valve sizing (Incompressible fluids) - ISA-S39.2 / 1972.

b) Control valve sizing (Compressible fluids) - ISA-S39.4 / 1972.

c) Control Valve seat leakage – ANSI / FCI 70.2

d) Face to face dimensions of Control Valves - ANSI B16.10

e) Control Valve Capacity Test Procedure – ISA – S75.02

12) Process connection Piping and Tubing

a) Seamless Carbon Steel Pipe - ASTM-A-106.

b) Forged carbon steel fittings - ASTM-A-105.

c) Dimensions of fittings - ANSI-B16.11.

d) Code for pressure piping, welding, hydrostatic testing - ANSI-B 31.1.

e) Nomenclature for instrument tube fittings - ISA-RP 42.1 / 1982.

f) Seamless Stainless Steel Tube ASTM A-213 TP 316 / ASTM A-269 TP 316

g) Seamless Alloy Steel Pipe ASTM A 335 P22

h) Seamless Stainless Steel Pipe ASTM A-312 TP 316

i) Forged and Rolled alloy steel pipe flanges , forged fittings , valves and parts ASTM A - 182

j) Pipe fittings of wrought carbon steel and ally steel - ASTM A - 234

k) Composition bronze metal castings ASTM B - 62

l) Seamless copper tube , bright annealed ASTM B- 168

m) Valves flanged and butt welding ends ANSI B 16.34

13) Cables

a) Thermocouple extension wires / cables - ANSI MC96.1.

b) Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy-IPCEA S-61-402

c) Guide for design and installation of cable system in power generating station (insulation, jacket materials) -IEEE Standard 422.

d) Requirements of vertical tray flame test - IEEE 383

e) Standard specification for tinned soft or annealed copper wire for electrical purpose - ASTM B33.

KKS PHILOSOPHY

KKS NUMBERING PHILOSOPHY

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

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

X	X	X	A	A	Y	Y	B	B	B

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

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

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

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

ANNEXURE-1

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

1) Self cleaning strainer: PCA

ANNEXURE-2

Standard Equipment Codes:

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

Standard Apparatus Codes:

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

Standard Measuring Circuits Codes:

CD	Density
CE	Electrical Quantities
CF	Flow, throughput
CG	Distance, Length, Position
CK	Time
CL	Level
CM	Humidity
CQ	Analysis (SWAS)

CS	Speed, Velocity, Frequency
CT	Temperature
CY	Vibration, Expansion

ANNEXURE-3

Numerical Keys

A) Numerical Keys at System Code Level

i) Use 10, 20, 30... To distinguish between main systems having same Alpha Codes. Examples:

a) Main Steam (Left) and Main Steam (Right)

b) BFP – A/B/C

c) ID Fan – A/B, FD Fan A/B, AH – A/B

ii) For branch off from main system path having code say 10, keep the same alpha code and use 11, 12, 13 etc. Similarly for other branch off from main system path having code say 20, keep the same alpha code and use 21, 22, 23 etc and shall carry on further in the same way.

iii) If the branch off from main system / sub system path is used for some other system, where different alpha codes can be applied, then in that case the said branch line will be designated by the alpha codes of the system to which it is providing the input.

B) Numerical keys at Equipment Code level:

There are three numerical keys available for each type of equipment code. Following has been agreed upon considering present practice, better flexibility and ease in sorting.

i) Valves and Dampers --- *Equipment Code – AA*

		N1	N2 N3
Motorised *(on/off duty)*	-	*0*	*01 to 50*
Motorised (inching duty)	-	*0*	*51 to 99*
Pneumatic (Control)	-	*1*	*01 to 50*
Motorised (thyrestor Control)	-	*1*	*51 to 99*
Sol. Operated	-	2	01 to 99
(Open / Close duty (Valves, NRVs, Gate)			
Hydraulic	-	3	01 to 99
NRV (Without actuation)	-	4	01 to 99

Manual	-	5	01 to 99
Manual	-	6	01 to 99
Relief & Safety Valves	-	7	01 to 99
Reserve	-	8	01 to 99
Reserve	-	9	01 to 99

ii) Field Instruments

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

(Reserved for protection Signals used by Hardwar)

Example of Numerical Key Usage:

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