

2X800 MW YERMARUS STPP

VOLUME: II B & III


**TECHNICAL SPECIFICATION
FOR
CW TREATMENT SYSTEM
REV 01**

SPECIFICATION NO.: PE-TS-362-156-A001



BHARAT HEAVY ELECTRICALS LIMITED

**POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA**

	PREAMBLE		SPECN. NO.: PE-TS-362-156-A001	
			REV. NO. 01	DATE: 10-03-2013

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 General Technical Requirement.

1.2.2 Volume - III TECHNICAL SCHEDULES

This volume contains technical schedules which is to be duly filled by the bidder and the same shall be furnished with the technical bid.

2.0 The requirements mentioned in Section C/Data Sheets-A of Section-C 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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**TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT SYSTEM.
2X800 MW YERMARUS STPP**

BHEL DOCUMENTS NO.: PE-TS-362-156-A001.

VOLUME **II-B**

SECTION -A

REV. NO. 01

DATE: 10/03/13

SECTION - A

(SCOPE OF ENQUIRY)



TITLE:
**TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT SYSTEM.
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VOLUME **II-B**

SECTION -A

REV. NO. 01

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1.0 SCOPE:

- 1.1 This specification is intended to cover design, engineering, manufacturing, painting, inspection & testing at manufacturer's works, erection / installation, loading, unloading, storage and handling at site complete with all accessories including start up and commissioning spares, chemicals & consumables, packing, shipment and delivery to Power Station Site, in site transportation, site testing, pre commissioning, commissioning, trial run, performance and guarantee tests and handing over to customer the **CW CHEMICAL TREATMENT SYSTEM** for **2X800 MW YERMARUS STPP**. The scope of supply shall fully cover the requirement of the Design Criteria and Technical Specification of this specification.
- 1.2 Complete Supply and dosing of following chemicals for a period of 3 months (chemicals required for normal run ,commissioning/initial startup & PG test).
- Scale Inhibitor
 - Corrosion Inhibitor
 - Biocide
 - Bio dispersant
- 1.3 Deputation of his experts (as required by employer) for continuously supervising the CW System for 3 months.
- 1.4 Determination of corrosion rates, scale deposition and micro bio fouling conditions at regular intervals and review on regular basis and submit fortnightly reports to the BHEL.
- 1.5 Supervision of the treatment program for a period of 3 months.
- 1.6 It is not the intent to specify all the details of the design & manufacturer. However, the equipment shall conform in all respect to high standard of design, engineering, & workmanship and shall be capable of performing the required duties in a manner acceptable to Engineer / Owner, who will interpret the meaning of drawing & the specification & shall be entitled to reject any work or material, which is not in full accordance herewith.
- 1.7 Items though not specifically mentioned but needed to make the system complete as stipulated under these specifications are also to be furnished unless otherwise specifically excluded.
- 1.8 The omission of specific reference to any component/accessory necessary for the proper performance of Cooling water treatment plant shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of equipment at quoted prices.
- 1.9 BHEL's / Customer's representative 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.
- 1.10 In case of any deviation, the Bidder shall indicate the same clause by clause in the deviation schedule attached with the specification. In the absence of the same it will be construed that the bid conform strictly to the specification.
- 1.11 In case of any contradiction between two clauses / requirements of the specification, bidder to point out those contradictions during pre-award stage else BHEL / Customer interpretation shall be followed without any commercial & delivery implication to BHEL/customer after award of contract.
- 1.12 General terms & conditions instructions to the bidder and other attachments referred to elsewhere, make part of tender specification. The bidder shall be responsible for all governed by requirements stipulated hereinafter.
- 1.13 In case of any data/requirement stipulated in the drawings but not in the specification and vise-versa, such data/requirement shall be deemed to be contained in the both. Contradictions between drawings and specification, if any, shall be brought to the attention of the BHEL by the bidder and the correct requirement shall be obtained else BHEL interpretation shall prevail.
- 1.14 The equipments covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and shipping release issued by BHEL/Customer.
- 1.15 Un priced copy of the price bid shall be furnished along with the technical bid.



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SECTION -B

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**SECTION - B
(PROJECT INFORMATION)**



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VOLUME **II-B**

SECTION -B

REV. NO. 01

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- 1.0 Owner : Raichur Power Corporation Ltd
 22/23, Sudarshan Complex,
 IIInd floor, Sheshadri Road,
 Bangalore-560 009
 Karnataka, India
- 2.0 Consultant : M/s STEAG Energy Services (I) Pvt. Ltd.,A-29, Sector 16
 Noida-201301(UP), India
- 3.0 Project Title : 2x800 MW Yermarus Thermal Power Station
- 4.0 Location : Yermarus
 Raichur Dist
 Karnataka State, INDIA
 It is situated at about 8 Kms from Raichur on the
 Raichur-Hyderabad State Highway-13 and 12 kms away
 from Bank of river Krishna and about 5 kms from
 Raichur Thermal Power Station
- 5.0 Nearest Railway : Chicksugur Railway Station which is about 2 kms from
 site.
- 6.0 Nearest Airport : Hyderabad around 200 kms
- 7.0 Nearest Port : Chennai around at about 470 kms from site.
- 8.0 Latitude and Longitude : Latitude – 16° 16' 55.9"N
 Longitude – 77° 20' 38.6"E
- 9.0 Elevation above mean sea level : 350-375 meters
- 10.0 Climatic Conditions
- (a) Ambient Temperature
- i. maximum temperature : 45° C
- ii. minimum temperature : 6° C
- iii. Design Temperature : 50° C Ambient
 for all
 Electrical/
 Mechanical
 Equipment
- (b) Relative Humidity
- i. Maximum during monsoon : 85%
- ii. Minimum : 20%
- iii. Average : 65%
- (c) Rainfall



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Annual average : 720 mm
rain : 115 mm
Max. for one day : 38 mm/hr
Max. intensity : June to September
Period

(d) Wind Speed

- i. Prevailing wind direction : West, South-East, North-West, South-West
- ii. Maximum mean wind speed : 15.9 Kms / hr (4.42 m/s)
- iii. Average : 9.61 Km/hr (2.67 m/s)

11.0 Wind Load

Calculations for wind effect shall be in accordance with IS:875- (Part-3) latest revision taking into account the following :

- (a) Basic wind speed of 39 m/sec as given in Fig.1 of the code.
- (b) Factor K1 shall be taken as 1.06
- (c) Terrain category shall be 2 and corresponding values shall be taken for K2
- (d) Factor K3 shall be taken as 1.0

12.0 Wind Loading for Stack

- (a) For wind pressure as per clause 11.0 above
- (b) For RC stacks as per IS: 4998

13.0 Seismic data (as per IS:1893 latest issue)

- (a) Zone : Zone III (as per IS:1893- latest)
- (b) Importance factor (I) : 1.75

14.0 Auxiliary power supply : Auxiliary electrical equipment to be supplied against this specification shall be suitable for operation on the following supply system.

- (a) For motors rated above 1500 kW : 11000V, 3 phase, 3 wire, 50Hz medium earthed AC
- (b) For motors rated 175KW and above and below 1499KW. : 3300V, 3 phase, 3 wire, 50Hz medium earthed AC
- (c) For motor rated 174 kW and below : 415, 3 phase, 3 wire solidly earthed AC
- (d) For motor control centre : 415V, 3 phase, 3 wire solidly earthed AC



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- (e) DC. motor starters, DC solenoids, DC alarm, control and protections : 220 V DC, 2 wire, unearthed DC
- (f) AC control & protective devices : 110 V 1 phase, 50Hz, 2 wire AC supply. The single-phase 110V AC supply shall be derived by Contractor by providing 415V/110V control transformers of adequate rating with MCCB /MCB on both the primary and secondary sides.
- (g) Uninterrupted power supply : 240 V, 1 phase, 50Hz, 2 wire AC supply from UPS system for I&C (including indicator recorders) and UCMS only
- (h) AC solenoids, indicators/recorders, space heaters (for motors rated 30KW and above) : 240V 1 phase, 2 wire, 50Hz AC system with effectively earthed neutral. The power supply shall be derived by CONTRACTOR by providing 415V/ 240V transformer of adequate rating with MCCB/MCB on primary/secondary sides.
- (i) Winding heating of motors below 30kW : 24 V 1 phase, 50Hz, AC with one point earthed. This shall be derived by CONTRACTOR by providing 415V 3 phase, 3 wire, AC supply through an adequately rated step-down transformer of adequate rating with MCCB / MCB on primary/secondary sides.
- (j) Solid state controls (including solenoid valves) : 24 V DC, 2 wire, supply from Battery chargers for instrumentation system only.
- (k) Lighting fixtures : 240 V, 1 phase, 2 wire, 50Hz system.
- (l) Lighting fixtures and space heaters in panels : 240 V, 1 phase, 2 wire, 50Hz system.
- (m) Construction supply : 415 V, 3 phase, 4 wire, 50 Hz AC supply with neutral lead solidly earthed.

- (n) The above voltages may vary as follows :

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

- i. AC supply : Voltage variation $\pm 10\%$ Frequency variation $\pm 5\%$
Combined voltage & frequency variation $\pm 10\%$
- ii. DC supply : Voltage variation $+10\%$
 -20%



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SECTION -C

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SECTION – C

SPECIFIC TECHNICAL REQUIREMENTS

C1: SPECIFIC TECHNICAL REQUIREMENTS FOR MECHANICAL

C2: SPECIFIC TECHNICAL REQUIREMENTS FOR ELECTRICAL

C3: SPECIFIC TECHNICAL REQUIREMENTS FOR C&I



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SPECIFIC TECHNICAL REQUIREMENTS-MECHANICAL



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1.0 GENERAL

The CW Chemical Treatment Plant and associated accessories shall conform to the technical specification.

2.0 SCOPE OF SUPPLY

Broad scope of work of this package includes all equipment and accessories. Please also refer Electrical and C&I sections for respective scopes.

The CW Chemical Treatment Plant, as specified in Technical data sheets, and shall consist of at least the followings:

- 2.1 Entire CW Chemical Treatment Plant as per P&ID (PE-DG-362-156-A001), Data Sheet-A and technical specification requirements.
- 2.2 Complete Supply of following chemicals for a period of 3 months (this 3 months period includes one initial start up/commissioning and PG test also) for normal run.
 - 2.2.1 Scale Inhibitor.
 - 2.2.2 Corrosion Inhibitor.
 - 2.2.3 Biocide
 - 2.2.4 Bio dispersant
- 2.3 All tanks complete with inlet and outlet connections, all fittings, flanges and appurtenances etc. as specified and as required.
- 2.4 Relay Based Local Control Panel
- 2.5 Following minimum number of instruments:
 - 2.5.1 pH transmitter Two numbers (as per P & ID).
 - 2.5.2 Online digital corrosion monitors Two numbers (as per P & ID).
 - 2.5.3 Online digital scale monitors Two numbers (as per P & ID).
 - 2.5.4 Online digital bio fouling monitors Two numbers (as per P & ID).
 - 2.5.5 Other instruments as indicated in the P&ID and tender technical specification.
- 2.6 Electrical scope shall be as per "Electrical scope between BHEL and Vendor" enclosed with the technical specification.
- 2.7 All necessary drains, vents, and sampling points, with valves, as specified and as required.
- 2.8 Hangers and supports as per the requirement.
- 2.9 Instrumentation (minimum) as per the enclosed P&ID (PE-DG-362-156-A001).
- 2.10 Safety requirement as per Data Sheet-A.
- 2.11 Start-up and commissioning spares as required.
- 2.12 All special tools necessary for proper maintenance or adjustment of the equipment packed in permanent box.
- 2.13 Finish paints for touch up painting of equipments after erection at site in sealed container.
- 2.14 Initial charge of all lubricants and grease.
- 2.15 Monitoring gadgets, instruments, and equipments required for maintenance (till PG test and plant handover).
- 2.16 Test racks (corrosion, scaling, and bio-fouling) with coupons.
- 2.17 All blank flanges/counter flanges, isolations valves, tees etc. to interconnect the pipes and all terminal points.
- 2.18 All necessary structural steel for pipe supporting structure, platforms, walkways / pathways and access stairs, mechanical plant and equipment, mechanical services and pipe work associated with Cooling water treatment Plant.
- 2.19 Permanent ladder (not rungs) for approaching the top of tanks, valves for All steel inserts with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc as required to grout in civil works and to support/hold the equipments being supplied under this specification for opening/maintenance purpose.
- 2.20 All auxiliary steel structures (U-clamps, nuts, bolts, channels etc.) for fixing the pipe on the pedestal or trestles.
- 2.21 Wrapping, coating and protection of all the buried pipe shall be as per IS 10221 or AWWA C 203.



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Note: Bidder shall study the scheme; water analysis etc contained in the specification and offer/supply the most suitable chemical(s). The chemicals proposed shall be non-toxic type. Heavy metal based chemicals such as chromate, zinc etc are not applicable. Further the chemicals shall not have any deleterious affect on any component of the CW System. Organic polymer / organic phosphorous / organic phosphates based chemicals shall be used. Required documentation in support of the above shall be made available to BHEL/customer if required.

3.0 SCOPE OF SERVICE

The bidder's scope also includes following services for scope under this specification:

- 1) Erection and commissioning, unloading, storage and handling at site.
- 2) In site transportation.
- 3) Supervision of the treatment program for a period of 3 months at site.
- 4) Arrangement of all instruments and lab facilities, chemicals, reagents to carry out trial run/commissioning and PG test.
- 5) Complete grouting for equipment, fixing and any concreting inside the vessels and lining.
- 6) All personnel required during commissioning and PG Test.
- 7) Performance testing.
- 8) Determination of corrosion rates, scale deposition and micro bio fouling conditions at regular intervals and review on regular basis and submit fortnightly reports to the BHEL.
- 9) Painting as per enclosed painting schedule (Annexure-III). However, any variation in the painting schedule as finally approved by customer shall be taken care by the bidder without any commercial and delivery implication. Color-coding scheme shall be intimated to vendor during detailed engineering.
- 10) Final touch up paint at site.

4.0 CIVIL SCOPE

Nil.

5.0 GUARANTEE:

The following guarantees have to be ensured by the bidder. Any short fall to these guarantees will not be accepted by BHEL.

a) Corrosion Rate

- i. On MS < 5.0 mpy.
- ii. On Cu < 0.5 mpy.
- iii. On SS (304) < 0.5 mpy.

b) Scaling < 15 mg/dm²/day.

c) Micro/Bio fouling conditions

- i. Total Viable Count (TVC) < 1x10⁵ Counts/ml
- ii. Sulphate reducing bacteria (SRB) < 105 Counts/100ml

Note: 98% H₂SO₄ required to maintain the M-Alkalinity 242 ppm in the Circulating water shall be supplied by BHEL. However the loading, unloading, injection/dosing, other services as indicated elsewhere shall be in bidder's scope.

6.0 TERMINAL POINT

- 6.1 Inlet service water line: At 20 meters from CW Chemical Treatment Plant area.
- 6.2 Outlet chemical line from each dosing pump in CW Chemical Treatment Plant upto the dosing point at CW Forebay and CW pump suction pit (150 meter piping distance for each dosing line).
- 6.3 All drains: Drains from all the systems shall be connected to a lime pit.
- 6.4 Acid unloading: Necessary manifold including the flexible unloading hose pipe (20 meter minimum).

7.0 EXCLUSIONS

- 7.1 98% H₂SO₄ required to maintain the M-Alkalinity 242 ppm in the Circulating water shall be supplied by BHEL. However the loading, unloading, injection/dosing, other services as indicated elsewhere shall be in bidder's scope.
- 7.2 Air-conditioning, ventilation and fire fighting facilities.
- 7.3 Drinking water and service water.
- 7.4 All Civil works at site.
- 7.5 M.C.C. / Switch fuse feeder panels for the power plant and control cabling up to & beyond the battery limit (Refer electrical section for scope).



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8.0 QP AND SUB VENDOR APPROVAL

- 8.1 Minimum QP requirements part of section-C shall be as per the enclosed QP (Annexure – VII) subject to BHEL/CUSTOMER approval. However, any additional comments as given by BHEL/CUSTOMER shall be adhered by the bidder without any commercial and delivery implication to BHEL.
- 8.2 Approved sub vendor list (Annexure – II) is enclosed elsewhere in this specification. However, any additional sub-vendor shall be subject to BHEL and CUSTOMER approval & the same shall be adhered by the bidder without any commercial and delivery implication to BHEL.

9.0 DESIGN/CONSTRUCTION

In addition to the requirements of Section-C & D the following shall also be complied under scope of this specification:

The P&ID is enclosed herein in this section for bidders compliance.

The material of construction specified in Data Sheet-A are minimum requirements and material of construction for other components not specified shall be similarly selected by the bidder for intended duty which shall be subjects to customer approval during detailed engineering.

10.0 DRAWING/DOCUMENTS REQUIREMENT

After award of LOI, following minimum drawing/documents shall be submitted by the bidder for BHEL/Customer approval. However any additional drawing/document if found necessary for completion of the engineering, the same shall be submitted by bidder without any commercial & delivery implication to BHEL.

The number of drawing/documents to be submitted by the bidder shall be as per enclosed Annexure-IV. The submission of soft copy or hard copy of the document whichever is later will be considered as final date of submission of the document. The bidder has to submit the revised document along with the compliance sheet indicating enumerate reply to all BHEL comments. Without compliance sheet the submission of the documents will not be considered and the delay on this account will be solely on bidder's side only.

- a) Detailed piping and instrument or engineering flow diagram for process and utility, showing all equipments, machinery, piping and instruments. All pipes should be indicated with diameter, pipe class, pipe number, fluid flowing through it as per the Employer's legend to be furnished later.
- b) Detailed configuration drawings, BOMs, Data Sheets, General arrangements and cross-sectional/assembly drgs, along with the manufacturer's catalogue for all the items/equipment including control & instrumentation supplied by the bidder.
- c) Detailed installation drawings for all instruments and instrumentation schedule.
- d) Preparation and finalization of functional write-up and detailed logic diagram, for all control system, electrical wiring and schematic drgs for the development of logic diagrams, GA and layout drgs of control panels, junction boxes, bill of material for panel drgs and terminal, chart for all the panel drgs, inter connection diagram for cabling, cable schedule.
- e) Design calculation of process and mechanical design, equipments and systems. The bidder shall show, explain and prove the validity of the basis/procedures and methods used in these calculations.
- f) Details civil scope drawing for all civil works.
- g) Detailed piping layout drawings, pipe support drawings, complete bill of materials of the piping, valve schedule etc.
- h) Submission of detailed procedure for various performance tests and getting the Employer's approval for the same.
- i) Conducting PG test.
- j) Submission of O&M manual.
- k) Sub vendor list.
- l) Spec. for acid/alkali resistant lining and areas requiring such lining.



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11.0 DRAWING/DOCUMENTS REQUIRED ALONG WITH THE BID (Please refer Electrical and C&I portion also).

- Deviation schedule duly fill for deviation, if any.
- Equipment lay out.
- Un Price Schedule duly filled.
- List of Spares (start up and commissioning spares).

12.0 REFERENCE DOCUMENTS

- Clarified Water Analysis - Annexure-I.
- Data sheet- A.
- P&ID for CW Chemical Treatment- PE-DG-362-156-A001.
- Plot Plan –PE-DG-362-100-M001.
- P&ID OF CW & ACW SYSTEM-PE-DG-362-165-N001.

NOTE-1: - Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the works for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.

NOTE-2: All drawings/documents shall be approved by BHEL/Customer during detailed engineering stage. Successful vendor shall comply with the comment of the customer/BHEL without price & delivery implication.

NOTE-3: The Bidder shall arrange all the monitoring gadgets / instruments / equipment required for performing guarantee parameters (returnable after PG test). Site facility as available or as extended by Owner shall only be provided.

NOTE-4: Bidder shall perform the guarantee parameters as per the specification requirement to the satisfaction of Owner. The exact modalities of verifying guarantee for the parameters indicated in the specification shall be finally as agreed with the Owner during detailed engineering & mutually agreed.

NOTE-5: There shall be following skid mounted system

- i) Skid mounted Scale / Corrosion inhibitor dosing system consist of scale/corrosion inhibitor dosing tanks, scale / corrosion inhibitor dosing pumps, agitators, instruments, ladders, platforms etc.
- ii) Skid mounted Biodispersant dosing system consist of bio dispersant dosing tank, bio dispersant dosing pumps, instruments, ladders, platforms etc.
- iii) Skid mounted Biocide dosing system consist of biocide dosing tank, instruments, ladders, platforms etc.
- iv) Skid mounted Acid dosing system consist of Acid dosing tanks, Acid dosing pumps, instruments, ladders, platforms etc.

NOTE-6: Bidder to note that BHEL reserve the right for drg/doc submission through web based Document Management System. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

- a. Internet explorer version – Minimum Internet Explorer 7
- b. Internet speed – 2 mbps (Minimum preferred)
- c. Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- d. Vendor's Internal proxy setting should not block DMS application's link
(<http://124.124.36.198/wrenchwebaccess/login.aspx>)



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CLARIFIED WATER ANALYSIS

ANNEXURE - I

Conductivity	μS/cm	300-1300
Colour	Pt -Co unit	-
Odour		-
pH		8.1 to 8.7
Temperature	Deg.C	35
Turbidity	NTU	2 (Maximum)
Total Suspended solids @ 105 deg C	ppm	9
Colloidal Index (SDI – 15)		
Total dissolved solids @180 C	Mg/l	200-870
OIL & Grease		
Surfactants	Mg/l	.08
Alkalinity-m (as CaCO3)	ppm	100-242
Alkalinity-p (as CaCO3)	ppm	2-14
Ammonia (NH3)	ppm	-
Arsenic (As)	ppm	<.05
Barium (Ba)	ppm	<.05
Bromide (Br)	ppm	<.01
Boron (B)	ppm	-
Calcium (Ca)	ppm	32.1
Carbon-di-oxide (CO2)	ppm	-
Chloride (Cl)	ppm	49-254 as Caco3
Dissolved Oxygen (DO)	ppm	4.7
Flouride (F)	ppm	0.78
Hardness Total (as CaCO3)	ppm	100-262
Hardness Calcium(as CaCO3)	ppm	80-144
Hydrogen Sulphide (H2S)	ppm	-
Iron -Total (Fe)	ppm	.05
Iron – Dissolved	ppm	-
Magnesium (Mg)	ppm	28-148 as Caco3
Manganese (Mn)	ppm	.05
Nitrate (NO3)	ppm	2.6
Phosphate (PO4)	ppm	.014
Sodium (Na)	ppm	62.2
Silica Reactive (SiO2)	ppm	5.52
Silica Total	ppm	6.41
Strontium (Sr)	ppm	<.005
Sulphate (SO4)	ppm	15-181 as Caco3
BOD	ppm	12
COD	ppm	17-43
TOC as C	ppm	BDL
Heavy Metals (Specify if any)		

BACTERIOLOGICAL ANALYSIS

Coliforms (e-coli)	cfu/ml	13
Feacal Coliforms	cfu/ml	01
Total Viable Count at 48hrs	cfu/ml	29X12



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NOTE:

A. THE CYCLE OF CONCENTRATION (COC) SHALL BE CONSIDERED AS 5.

B. DATA FOR COOLING TOWER:

- i. Total CW Flow of Condenser = 188200 Cum/hr (Unit #1 + Unit #2).
- ii. Storage/Holdup volume of cooling tower basin=32000 m³ (Unit #1 + Unit #2).
- iii. Temperature difference across cooling tower is 9.0 Deg C.
- iv. MOC of Condenser tube is SS 316.
- v. Cooling Water System metallurgy shall be as per P&ID CW/ACW System (enclosed in Technical Specification).
- vi. Cooling Tower blow down= 397 M3/Hr per Unit. Total = 794 M3/Hr (Unit #1 + Unit #2).



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**LIST OF APPROVED SUB VENDORS
ANNEXURE - II**

SL NO.	ITEM	APPROVED SUPPLIERS	PLACE
1.	METERING PUMPS	METACHEM	MUMBAI
		V K PUMPS	NASIK
		MILTON ROY	CHENNAI
2.	AGITATOR/STIRRER	FIBRE & FIBRE	MUMBAI
3.	HORIZONTAL CENTRIFUGAL PUMPS	KIRLOSKAR BROS. LTD	PUNE
		MATHER & PLATT PUMPS	PUNE
		KSB PUMPS LTD	PUNE
		SAM TURBO INDUSTRIES LTD.	COINBATORE
		BEST & CROMPTON ENGG LTD.	CHENNAI
		SULZER PUMPS LTD	MUMBAI
4.	STEEL GATE /GLOBE/NRV VALVES	A V VALVES LIMITED	CHENNAI
		NITON VALVES IND. PVT. LTD.	
		WEIR VALVES AND CONTROLS	NEW DELHI
		B.D.K ENGINEERING IND. LTD.	NEW DELHI
		KIRLOSOKAR BROTHERS LTD.	PUNE
		LEADER VALVES LTD.	JALANDHAR
		KSB PUMPS LTD.	MUMBAI
		MICON VALVES (INDIA) PVT. LTD.	MUMBAI
		FOURESS ENGG. INDIA LTD.	
		FLUIDLINE VALVES COMPANY PRIVATE LTD.	AHMEDABAD
5.	CAST IRON GATE /GLOBE/NRV VALVES/SAFETY RELIEF VALVES	STEEL STRONG VALVES (I) PVT. LTD.	MUMBAI
		CRESCENT VALVES MFG. CO. PVT. LTD.	MUMBAI
		A V VALVES LIMITED	CHENNAI
		H SARKAR AND COMPANY	
		KIRLOSKAR BROTHERS LTD	PUNE
		LEADER VALVES LTD.	JALANDHAR
		MICON VALVES LTD	MUMBAI
		FLUIDLINE VAVLES COMPANY PVT LTD	AHMEDABAD
		FEDERAL HARDWARE ENGINEERING CO PVT LTD	SINGAPORE
6.	BUTTERFLY VALVES	CRESCENT VALE S MEG CO PVT LTD	MUMBAI
		SURYA VALVES AND INSTRUMENTS MFG COMPANY CHENNAI	CHENNAI
		B D K ENGINEERING INDUSTRIES	NEW DELHI
		FOURESS ENGG INDIA LTD.	
		KIRLOSKAR BROTHERS LTD	PUNE
7.	BALL VALVES	R&D MULTIPLIES (METAL CAST) PVT LTD	
		TYCO VALVES AND CONTROLS INDIA PVT LTD	HALOL
		AKAY INDUSTRIES PVT.LTD.	MUMBAI
		VIRGO ENGINEERS LTD.	PUNE
		CRESCENT VALVES MFG. CO. PVT. LTD	MUMBAI
		PEC VALVES PVT. LTD.	MUMBAI
		FLOW CHEM INDUSTRIES	AHMEDABAD
		MICON VALVES (INDIA) PVT. LTD.	MUMBAI
		STEEL STRONG VALVES (I) PVT.LTD.,	MUMBAI
		KSB PUMPS LTD.	MUMBAI
		MICROFINISH VALVES PVT LTD.	HUBLI
		B.D.K ENGINEERING INDUSTRIES LIMITED.	NEW DELHI
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI



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		KIRLOSKAR BROTHERS LTD.	PUNE
		VALTECH INDUSTRIES	MUMBAI
		LEADER VALVES LTD.	JALANDHAR
		A.V. VALVES LTD	CHENNAI
8.	PRESSURE SWITCH/DIFF. PRESSURE GAUGE	H. GURU INSTRUMENTS	BANGALORE
		A N INSTRUMENTS	KOLKATA
		GENERAL INSTRUMENT CONSORTIUM	MUMBAI
		FORBES MARSHALL (HYD) LTD.	HYDERABAD
9.	PRESSURE SWITCH/DIFF. PRESSURE SWITCH	GENERAL INSTRUMENT CONSORTIUM	MUMBAI
		SWITZER INSTRUMENT LTD.	CHENNAI
		INDFOS (INDIA) LIMITED	CHENNAI
10.	LEVEL SWITCHES	LEVCON	KOLKATA
		PUNE TECHTROL PVT. LTD.	PUNE
		SIGMA INSTRUMENTS CO.	MUMBAI
		V. AUTOMAT & INSTRUMENTS (P) LTD.	NEW DELHI
		D.K. INSTRUMENTS PVT.LTD.	KOLKATTA
11.	LEVEL GAUGES	SIGMA INSTRUMENTS	MUMBAI
		LEVCON	KOLKATA
12.	LEVEL TRANSMITTER	FISHER-ROSEMOUNT	
		EMERSON PROCESS MANAGEMENT (I) LTD	MUMBAI
		SIEMENS	MUMBAI/ BANGALORE
13.	LT MOTORS	SIEMENS	MUMBAI
		ABB	FARIDABAD
		CROMPTON GREAVES LTD	MUMBAI
		BHARAT BIJLEE	MUMBAI
14.	PIPING	CHOKSHI TUBES	AHMEDABAD
		REMI	MUMBAI
		RATNAMANI	AHMEDABAD
15.	FITTINGS	BHARAT FORGE	PUNE
		RELIANCE FORGE	PUNE
16.	FLANGES	BHARAT FORGE	PUNE
		RELIANCE FORGE	PUNE
17.	LOCAL CONTROL PANEL	INDUSTRIAL SWITCHGEAR & APPS	MUMBAI
		PROCON	CHENNAI
		SIEMENS	KOLKATA
		DELTA CONTROL	MUMBAI
18.	STROKE CONTROLLER	V K PUMPS	NASIK
		METACHEM	MUMBAI
19.	INST CABLES (SCREENED CABLES)	RELIANCE	BANGLORE
		DELTON	FARIDABAD/NEW DELHI
20.	PH	HACH	USA

NOTE: - Any other sub-vendor not specified in above sub-vendor list shall be subject to approval of BHEL/CUSTOMER during detailed engineering without any price and delivery implication to BHEL.



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**PAINTING SCHEME DETAILS
ANNEXURE – III**

1.0 SCOPE

- 1.1 This section covers the painting requirements for the power plant equipment, structures, piping etc. and any other surface required to be painted.

2.0 CODES AND STANDARDS

Painting of equipment shall be carried out as per the specifications indicated below and shall conform to the relevant IS specification for the material and workmanship.

The following Indian Standards may be referred to for carrying out the painting job :

IS:5	:	Colours for ready mixed paints and enamels
IS:1303	:	Glossary of terms relating to paints
IS:2379	:	Colour code for identification of pipelines
IS:1477	:	Code of practice for painting of ferrous metals in buildings (Parts I & II)
IS:2524	:	Code of practice for painting of non-ferrous metals in buildings (Parts I & II)
IS:2395	:	Code of practice for painting of concrete, masonry and plaster surfaces (Parts I & II)
IS:2338	:	Code of practice for finishing of wood and wood based materials (Parts I & II)
IS:6278	:	Code of practice for white washing and colour Washing
IS:3140	:	Code of practice for painting asbestos cement building products
IS:158	:	Ready mixed paint, brushing, bituminous, black, lead-free, acid, alkali, water and heat resisting
IS:2074	:	Ready mixed paint, air drying, red Oxide Zinc Chrome, priming
IS:104	:	Ready mixed paint, brushing, Zinc Chrome, priming
IS: 2932	:	Enamel , synthetic, exterior (a) undercoating (b) finishing

3.0 PREPARATION OF SURFACES

All surfaces to be painted shall be thoroughly cleaned of all grease , oil, loose mill scale , dust , rust and any other foreign matter. Mechanical cleaning by power tool and scrapping with steel wire brushes shall be adopted to clear the surfaces. However, in certain locations where power tool cleaning cannot be carried out sand scrapping may be permitted with steel wire brushes and /or abrasive paper. Cleaning with solvents shall be resorted to only in such areas where other methods specified above have not achieved the desired results. Cleaning with solvents shall be adopted only after written approval of the OWNER/OWNER REPRESENTATIVE. The sheet steel of electrical and instrumentation panels shall be pre-treated through chemical cleaning (7 tank) process of rinsing, degreasing, rinsing, derusting, rinsing, phosphating and rinsing. However, in case mechanical cleaning is also required the Contractor shall carry out the same to get a smooth finish.

4.0 PRIMER PAINT

After the surface is prepared one coat of Zinc Phosphate primer conforming to IS 2074 shall be applied. After this first coat is dried up completely, second coat of primer shall be applied. Primer shall be applied by brushing, spray, roller as per manufacture recommendation to ensure a continuous film. The dry film thickness of each coat shall be as indicated in Ann-A enclosed. Insulated surfaces will have only primer coating and no finish painting.



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5.0 FINISH PAINT

Synthetic enamel paint conforming to IS 2932 shall be used for finish coats. The colour /shade shall be as approved by the OWNER. After cleaning the dust on the dried up primer, first coat of synthetic enamel shall be applied. After this first coat dries up hard, the surface is wet scrubbed cutting down to a smooth finish and ensuring that at no place the first coat is completely removed. After allowing the water to get evaporated completely, the second finish coat of synthetic enamel paint shall be applied.

6.0 PAINTING AND CORROSION PROTECTION FOR PIPES & FITTINGS

6.1 All uninsulated piping systems, hangers and supports shall have two coats of Zinc Phosphate Primer (conforming to IS 2074) and finish paint using synthetic enamel paint to give a finish coat. Shades shall be as per IS 5 or as indicated by PURCHASER/OWNER. Service of the pipeline designations shall be painted on all pipes at visible locations.

6.2 Before application of paint, Contractor shall clean the pipes of all mill scale, dirt dust, soot grease, rust etc.,

6.3 All pipe lines, piping components shall be adequately protected against corrosion during manufacture, fabrication, shipment and storage by appropriate protective paint.

6.4 Shop fabricated equipment/items shall be dispatched with final paint. Necessary touch up shall be done at site. Site fabricated equipment/items shall be dispatched with primer painting only and final painting shall be applied at site.

7.0 PAINTING AND CORROSION PROTECTION FOR VALVES & SPECIALTIES

Two coats of primer of thickness as indicated in Ann-B shall be applied to all steel and cast iron exposed surfaces as required to prevent corrosion before dispatch. The use of grease or oil, other than light grade mineral oil, for corrosion protection is prohibited. Bores of all valves shall be covered immediately after testing, draining and drying with suitable plastic end covers to avoid ingress of foreign materials.

8.0 Suggested Colour Codes for Painting

Suggested colour codes shall be furnished by the successful bidder after award of contract. Colour codes for piping shall be as per IS 2379 with necessary modifications. Where band colour is specified for piping, same shall be provided at 30 metre intervals on long uninterrupted lines and also adjacent to valves and junctions.

9.0 Approved Paint Makes

- i) Asian Paints (I) Ltd.
- ii) Berger Paints India Ltd
- iii) Goodlass Nerolac
- iv) Jenson & Nicholson (I) Ltd
- v) CDC carboline (I) Ltd.

- vi) Shalimar Paints Ltd.
- vii) Addison Paints Ltd.
- viii) Grand Polycoat
- ix) Bombay Paints

10 PAINTING SCHEDULES

10.1 Painting schedules for various systems/ items are furnished as per enclosed Annexures-A . Vendors of different packages/ items will furnish detailed painting schedule for customer approval during detail engineering as per this guide specification.



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ANNEXURE - A

Paint Reference Scheme	Surface Preparation Grade / Surface Profile	Primer Coat			Intermediate Coat			Finish Coat			Total DFT in microns
		Premier Paint	No. of Coats	DFT in Microns	Intermediate Paint	No. of Coats	DFT in Microns	Finish Paint (See Note)	No. of Coats	DFT in Microns	
Various type of equipment /valve, etc. (Temp. upto 90°C)	Degreasing and Mech. Cleaning with wire brushing/hand tool (Sa1/St2/St3 as applicable)	HB Zinc Phosphate (alkyd Medium) as per IS:2074	2	35-45 per coat	- NA	-	-	Synthetic enamel (alkyd med.) as per IS:2932	2	20 – 25 per coat	110 - 140
LP Piping/structural/Vessels, etc. (Temp. upto 90°)	- do -	HB Zinc Phosphate as per IS:2074 (alkyd medium)	2	35 – 45 per coat	- NA	-	-	Synthetic enamel (alkyd med.) as per IS:2932	2	20 – 25 per coat	110-140
Equipment with (Temp. upto 250°)	- do -	Heat resistant Al – paint	2	20 per coat	- NA	-	-	NA	Insulated	NA	40
Equipment in corrosive areas like CPU , Cooling water treatment plant etc.	Blast clean to Sa 2 1/2	HB Epoxy resin based zinc phosphate primer	1	50 per coat	Epoxy based MIO pigmented paint	1	50 per coat	Polyamide cured Epoxy finish coat	2	25 – 35 per coat	150 - 170
Elect. / Control Panels, etc.	Seven tank process	HB Zinc phosphate (alkyd Medium) as per IS:2074	2	35 – 45 per coat	-NA	-	-	Synthetic enamel (alkyd med.) as per IS:2932	2	20 – 25 per coat	110 - 140

Notes:

1. Surface preparation shown is as per Swedish Standards SIS 05-5900 or equivalent Indian std. Degreasing will be as per Standard SSPC-SP1.
2. Incase of insulated surfaces, only primer coats shall be applied.
3. GM/SS items with piping and G.I. pipes will not be painted. However these items carrying under Fire Fighting System shall be painted Fire Red as per TAC guidelines. Further SS/GI piping shall be given necessary colour banding for identification as per colour scheme.
4. All instruments shall be painted as per manufacturer standard practice.
5. All structural steel items shall be painted at site. Piping shall go with primer coating & finish paint shall be applied at site. Equipment shall be finish painted at shop.
6. Method of painting application shall be as per paint manufacturer's recommendation.
7. **Based on above painting schedule, detailed painting schedule will be prepared by Cooling water treatment plant supplier and will be submitted to BHEL for their approval.**
8. **The above mentioned painting requirements are bare minimum. Any variation as required by BHEL/customer during detailed engineering stage shall be adhered by the bidder without any delivery/commercial implication to BHEL.**



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11.0 SUGGESTED COLOUR CODES FOR PAINTING

SL. NO.	ITEM/SERVICE	COLOUR	IS-5 Grade	COLOUR (BAND)	IS-5
1.0	Structures, platforms, galleries, ladders and handrails	Dark Admiralty Grey	632	-	-
2.0	Boiler casing, ESP and ducting	Nut Brown	413	-	-
3.0	Crane				
3.1	Crane structure	Golden Yellow	356	-	-
3.2	Trolley and hook	Crimson	540	-	-
4.0	Fans, pumps, motors, compressors	Light Grey	631	-	-
5.0	Tanks (without insulation and cladding)				
5.1	Outdoor	Aluminium	-	-	-
5.2	Indoor	Light grey	631	-	-
6.0	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
7.0	Switchgear	Light grey	631	-	-
8.0	Control & relay panels	Light grey	631/7078 of IS 1650	-	-
9.0	Turbine	Golden Yellow	356	-	-

SL.NO.	ITEM/SERVICE	COLOUR	IS-5 Grade	COLOUR (BAND)	IS-5
10.0	Generator & exciter	Light grey	631	--	-
11.0	Transformers	Aluminium	-	-	-
12.0	Machinery guards	Signal red	537	-	-
13.0	Piping (without insulation and cladding_)				
13.1	Water System				
	Boiler feed	Sea green	217	-	-
	Condensate	Sea green	217	Light brown	410
	D M Water	Sea green	217	Light orange	557
	Soft water	Sea green	217	French blue	166
	Bearing cooling water	Sea green	217	French blue	166
	Potable & filtered water	Sea green	217	French blue	166
	Service & clarified water	Sea green	217	French blue	166
	Raw water	Sea green	217	White	-
	Cooling water	Sea green	217	French blue	166
13.2	Air System				
	Station air	Sky blue	101	-	-
	Control air	Sky blue	101	White	-
13.3	Oil system				
	Fuel oil	Light brown	410	French	166
	Light oil	Light Brown	410	Brilliant green	221



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	Lubricating oil	Light brown	410	Light grey	631
	Transformer oil	Light brown	410	Light orange	557
13.4	Gas system				
	Carbon dioxide	Canary yellow	309	Light grey	631
	Hydrogen	Canary yellow	309	Signal red	537
13.5	Fire services	Fire red	536	-	-
13.6	Ash slurry pipes	Black	-	-	-
13.7	Vacuum pipes	Sky blue	101	Black	-
13.8	Fuel pipes (pulverised coal)	Light brown	410	-	-
13.9	Drainage	Black	-	-	-

Notes :

1. This colour code basically refers to IS:2379 for piping with necessary modifications
2. Where band colour is specified, same shall be provided at 30 meter intervals on long uninterrupted lines and also adjacent to valves and junctions.
3. The above mentioned painting requirements are bare minimum. Any variation as required by BHEL/customer during detailed engineering stage shall be adhered to the bidder without any delivery/commercial implication to BHEL.



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DRAWING / DOCUMENT DISTRIBUTION SCHEDULE
ANNEXURE - IV

S. NO.	DESCRIPTION	CONSULTANT	RPCL HEAD OFFICE	RPCL SITE	BHEL UNIT	BHEL SITE
A	POST CONTRACT CORRESPONDENCE	1	S	1	1	0
		0	1	S	1	1
		0	1	1	S	1
		0	1	1	1	S
B	DRAWINGS/DOCUMENT SUBMISSION					
	A) SUBMISSION	0	7	0	S	0
	B) RETURN OF SUBMISSION WITH COMMENTS/APPROVA L BY RPCL	1	S	1	2	0
	C) RFC ISSUE	0	2	2	S	4
	D) AS BUILT	0	2	2	S	1
	E) ERECTION DRAWINGS	0	0	3	S	5
C	PROGRESS REPORT (MONTHLY)					
	EPC CONTRACTOR'S REPORT	0	5	1	S	1
D	INSTRUCTION MANUALS					
	ERECTION & COMMISSIONING	0	1	3	S	3
	O & M MANUAL	0	1 + 1CD	5 + 1CD	S	2 + 1CD

**NOTE: INITIAL SUBMISSION OF DRAWINGS / DOCUMENTS WILL BE IN SOFT FORMAT (PDF ONLY)
THROUGH EMAIL FOLLOWED BY ELEVEN (11) HARD COPIES.**

RPCL- RAICHUR POWER CORPORATION LIMITED
CONSULTANT -STEAG
S SOURCE
CD SOFT COPY

Note:

- Quantity of prints may change during detailed engineering stage based on BHEL / Customer requirement. However the same will be adhered by the bidder without any delivery/commercial implication to BHEL.
- Initial submission of drawings / documents will be in soft format (pdf only) through email followed by Eleven (11) hard copies.
- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.
- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copies whichever is later.
- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required. Vendor to come for meeting with the concerned dealing persons as per BHEL or customer (RPCL) requirement in a short notice.
- Bidder to also furnish the auto cad copy of the following documents after award of contract. However any other auto cad copy of any other document as per the insistence of BHEL / customer will also be submitted by the bidder without any delivery/commercial implication to BHEL.
 - Equipment lay out.
 - Cable tray lay out.
 - Civil scope drawings.
 - Piping lay out drawing.



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**P & ID
ANNEXURE - V**

LEGEND

1	PIPE	100mm DIA
2	PIPE	150mm DIA
3	PIPE	200mm DIA
4	PIPE	250mm DIA
5	PIPE	300mm DIA
6	PIPE	350mm DIA
7	PIPE	400mm DIA
8	PIPE	450mm DIA
9	PIPE	500mm DIA
10	PIPE	550mm DIA
11	PIPE	600mm DIA
12	PIPE	650mm DIA
13	PIPE	700mm DIA
14	PIPE	750mm DIA
15	PIPE	800mm DIA
16	PIPE	850mm DIA
17	PIPE	900mm DIA
18	PIPE	950mm DIA
19	PIPE	1000mm DIA
20	PIPE	1050mm DIA
21	PIPE	1100mm DIA
22	PIPE	1150mm DIA
23	PIPE	1200mm DIA
24	PIPE	1250mm DIA
25	PIPE	1300mm DIA
26	PIPE	1350mm DIA
27	PIPE	1400mm DIA
28	PIPE	1450mm DIA
29	PIPE	1500mm DIA
30	PIPE	1550mm DIA
31	PIPE	1600mm DIA
32	PIPE	1650mm DIA
33	PIPE	1700mm DIA
34	PIPE	1750mm DIA
35	PIPE	1800mm DIA
36	PIPE	1850mm DIA
37	PIPE	1900mm DIA
38	PIPE	1950mm DIA
39	PIPE	2000mm DIA
40	PIPE	2050mm DIA
41	PIPE	2100mm DIA
42	PIPE	2150mm DIA
43	PIPE	2200mm DIA
44	PIPE	2250mm DIA
45	PIPE	2300mm DIA
46	PIPE	2350mm DIA
47	PIPE	2400mm DIA
48	PIPE	2450mm DIA
49	PIPE	2500mm DIA
50	PIPE	2550mm DIA
51	PIPE	2600mm DIA
52	PIPE	2650mm DIA
53	PIPE	2700mm DIA
54	PIPE	2750mm DIA
55	PIPE	2800mm DIA
56	PIPE	2850mm DIA
57	PIPE	2900mm DIA
58	PIPE	2950mm DIA
59	PIPE	3000mm DIA
60	PIPE	3050mm DIA
61	PIPE	3100mm DIA
62	PIPE	3150mm DIA
63	PIPE	3200mm DIA
64	PIPE	3250mm DIA
65	PIPE	3300mm DIA
66	PIPE	3350mm DIA
67	PIPE	3400mm DIA
68	PIPE	3450mm DIA
69	PIPE	3500mm DIA
70	PIPE	3550mm DIA
71	PIPE	3600mm DIA
72	PIPE	3650mm DIA
73	PIPE	3700mm DIA
74	PIPE	3750mm DIA
75	PIPE	3800mm DIA
76	PIPE	3850mm DIA
77	PIPE	3900mm DIA
78	PIPE	3950mm DIA
79	PIPE	4000mm DIA
80	PIPE	4050mm DIA
81	PIPE	4100mm DIA
82	PIPE	4150mm DIA
83	PIPE	4200mm DIA
84	PIPE	4250mm DIA
85	PIPE	4300mm DIA
86	PIPE	4350mm DIA
87	PIPE	4400mm DIA
88	PIPE	4450mm DIA
89	PIPE	4500mm DIA
90	PIPE	4550mm DIA
91	PIPE	4600mm DIA
92	PIPE	4650mm DIA
93	PIPE	4700mm DIA
94	PIPE	4750mm DIA
95	PIPE	4800mm DIA
96	PIPE	4850mm DIA
97	PIPE	4900mm DIA
98	PIPE	4950mm DIA
99	PIPE	5000mm DIA
100	PIPE	5050mm DIA
101	PIPE	5100mm DIA
102	PIPE	5150mm DIA
103	PIPE	5200mm DIA
104	PIPE	5250mm DIA
105	PIPE	5300mm DIA
106	PIPE	5350mm DIA
107	PIPE	5400mm DIA
108	PIPE	5450mm DIA
109	PIPE	5500mm DIA
110	PIPE	5550mm DIA
111	PIPE	5600mm DIA
112	PIPE	5650mm DIA
113	PIPE	5700mm DIA
114	PIPE	5750mm DIA
115	PIPE	5800mm DIA
116	PIPE	5850mm DIA
117	PIPE	5900mm DIA
118	PIPE	5950mm DIA
119	PIPE	6000mm DIA
120	PIPE	6050mm DIA
121	PIPE	6100mm DIA
122	PIPE	6150mm DIA
123	PIPE	6200mm DIA
124	PIPE	6250mm DIA
125	PIPE	6300mm DIA
126	PIPE	6350mm DIA
127	PIPE	6400mm DIA
128	PIPE	6450mm DIA
129	PIPE	6500mm DIA
130	PIPE	6550mm DIA
131	PIPE	6600mm DIA
132	PIPE	6650mm DIA
133	PIPE	6700mm DIA
134	PIPE	6750mm DIA
135	PIPE	6800mm DIA
136	PIPE	6850mm DIA
137	PIPE	6900mm DIA
138	PIPE	6950mm DIA
139	PIPE	7000mm DIA
140	PIPE	7050mm DIA
141	PIPE	7100mm DIA
142	PIPE	7150mm DIA
143	PIPE	7200mm DIA
144	PIPE	7250mm DIA
145	PIPE	7300mm DIA
146	PIPE	7350mm DIA
147	PIPE	7400mm DIA
148	PIPE	7450mm DIA
149	PIPE	7500mm DIA
150	PIPE	7550mm DIA
151	PIPE	7600mm DIA
152	PIPE	7650mm DIA
153	PIPE	7700mm DIA
154	PIPE	7750mm DIA
155	PIPE	7800mm DIA
156	PIPE	7850mm DIA
157	PIPE	7900mm DIA
158	PIPE	7950mm DIA
159	PIPE	8000mm DIA
160	PIPE	8050mm DIA
161	PIPE	8100mm DIA
162	PIPE	8150mm DIA
163	PIPE	8200mm DIA
164	PIPE	8250mm DIA
165	PIPE	8300mm DIA
166	PIPE	8350mm DIA
167	PIPE	8400mm DIA
168	PIPE	8450mm DIA
169	PIPE	8500mm DIA
170	PIPE	8550mm DIA
171	PIPE	8600mm DIA
172	PIPE	8650mm DIA
173	PIPE	8700mm DIA
174	PIPE	8750mm DIA
175	PIPE	8800mm DIA
176	PIPE	8850mm DIA
177	PIPE	8900mm DIA
178	PIPE	8950mm DIA
179	PIPE	9000mm DIA
180	PIPE	9050mm DIA
181	PIPE	9100mm DIA
182	PIPE	9150mm DIA
183	PIPE	9200mm DIA
184	PIPE	9250mm DIA
185	PIPE	9300mm DIA
186	PIPE	9350mm DIA
187	PIPE	9400mm DIA
188	PIPE	9450mm DIA
189	PIPE	9500mm DIA
190	PIPE	9550mm DIA
191	PIPE	9600mm DIA
192	PIPE	9650mm DIA
193	PIPE	9700mm DIA
194	PIPE	9750mm DIA
195	PIPE	9800mm DIA
196	PIPE	9850mm DIA
197	PIPE	9900mm DIA
198	PIPE	9950mm DIA
199	PIPE	10000mm DIA
200	PIPE	10050mm DIA
201	PIPE	10100mm DIA
202	PIPE	10150mm DIA
203	PIPE	10200mm DIA
204	PIPE	10250mm DIA
205	PIPE	10300mm DIA
206	PIPE	10350mm DIA
207	PIPE	10400mm DIA
208	PIPE	10450mm DIA
209	PIPE	10500mm DIA
210	PIPE	10550mm DIA
211	PIPE	10600mm DIA
212	PIPE	10650mm DIA
213	PIPE	10700mm DIA
214	PIPE	10750mm DIA
215	PIPE	10800mm DIA
216	PIPE	10850mm DIA
217	PIPE	10900mm DIA
218	PIPE	10950mm DIA
219	PIPE	11000mm DIA
220	PIPE	11050mm DIA
221	PIPE	11100mm DIA
222	PIPE	11150mm DIA
223	PIPE	11200mm DIA
224	PIPE	11250mm DIA
225	PIPE	11300mm DIA
226	PIPE	11350mm DIA
227	PIPE	11400mm DIA
228	PIPE	11450mm DIA
229	PIPE	11500mm DIA
230	PIPE	11550mm DIA
231	PIPE	11600mm DIA
232	PIPE	11650mm DIA
233	PIPE	11700mm DIA
234	PIPE	11750mm DIA
235	PIPE	11800mm DIA
236	PIPE	11850mm DIA
237	PIPE	11900mm DIA
238	PIPE	11950mm DIA
239	PIPE	12000mm DIA
240	PIPE	12050mm DIA
241	PIPE	12100mm DIA
242	PIPE	12150mm DIA
243	PIPE	12200mm DIA
244	PIPE	12250mm DIA
245	PIPE	12300mm DIA
246	PIPE	12350mm DIA
247	PIPE	12400mm DIA
248	PIPE	12450mm DIA
249	PIPE	12500mm DIA
250	PIPE	12550mm DIA
251	PIPE	12600mm DIA
252	PIPE	12650mm DIA
253	PIPE	12700mm DIA
254	PIPE	12750mm DIA
255	PIPE	12800mm DIA
256	PIPE	12850mm DIA
257	PIPE	12900mm DIA
258	PIPE	12950mm DIA
259	PIPE	13000mm DIA
260	PIPE	13050mm DIA
261	PIPE	13100mm DIA
262	PIPE	13150mm DIA
263	PIPE	13200mm DIA
264	PIPE	13250mm DIA
265	PIPE	13300mm DIA
266	PIPE	13350mm DIA
267	PIPE	13400mm DIA
268	PIPE	13450mm DIA
269	PIPE	13500mm DIA
270	PIPE	13550mm DIA
271	PIPE	13600mm DIA
272	PIPE	13650mm DIA
273	PIPE	13700mm DIA
274	PIPE	13750mm DIA
275	PIPE	13800mm DIA
276	PIPE	13850mm DIA
277	PIPE	13900mm DIA
278	PIPE	13950mm DIA
279	PIPE	14000mm DIA
280	PIPE	14050mm DIA
281	PIPE	14100mm DIA
282	PIPE	14150mm DIA
283	PIPE	14200mm DIA
284	PIPE	14250mm DIA
285	PIPE	14300mm DIA
286	PIPE	14350mm DIA
287	PIPE	14400mm DIA
288	PIPE	14450mm DIA
289	PIPE	14500mm DIA
290	PIPE	14550mm DIA
291	PIPE	14600mm DIA
292	PIPE	14650mm DIA
293	PIPE	14700mm DIA
294	PIPE	14750mm DIA
295	PIPE	14800mm DIA
296	PIPE	14850mm DIA
297	PIPE	14900mm DIA
298	PIPE	14950mm DIA
299	PIPE	15000mm DIA
300	PIPE	15050mm DIA
301	PIPE	15100mm DIA
302	PIPE	15150mm DIA
303	PIPE	15200mm DIA
304	PIPE	15250mm DIA
305	PIPE	15300mm DIA
306	PIPE	15350mm DIA
307	PIPE	15400mm DIA
308	PIPE	15450mm DIA
309	PIPE	15500mm DIA
310	PIPE	15550mm DIA
311	PIPE	15600mm DIA
312	PIPE	15650mm DIA
313	PIPE	15700mm DIA
314	PIPE	15750mm DIA
315	PIPE	15800mm DIA
316	PIPE	15850mm DIA
317	PIPE	15900mm DIA
318	PIPE	15950mm DIA
319	PIPE	16000mm DIA
320	PIPE	16050mm DIA
321	PIPE	16100mm DIA
322	PIPE	16150mm DIA
323	PIPE	16200mm DIA
324	PIPE	16250mm DIA
325	PIPE	16300mm DIA
326	PIPE	16350mm DIA
327	PIPE	16400mm DIA
328	PIPE	16450mm DIA
329	PIPE	16500mm DIA
330	PIPE	16550mm DIA
331	PIPE	16600mm DIA
332	PIPE	16650mm DIA
333	PIPE	16700mm DIA
334	PIPE	16750mm DIA
335	PIPE	16800mm DIA
336	PIPE	16850mm DIA
337	PIPE	16900mm DIA
338	PIPE	16950mm DIA
339	PIPE	17000mm DIA
340	PIPE	17050mm DIA
341	PIPE	17100mm DIA
342	PIPE	17150mm DIA
343	PIPE	17200mm DIA
344	PIPE	17250mm DIA
345	PIPE	17300mm DIA
346	PIPE	17350mm DIA
347	PIPE	17400mm DIA
348	PIPE	17450mm DIA
349	PIPE	17500mm DIA
350	PIPE	17550mm DIA
351	PIPE	17600mm DIA
352	PIPE	17650mm DIA
353	PIPE	17700mm DIA
354	PIPE	17750mm DIA
355	PIPE	17800mm DIA
356	PIPE	17850mm DIA
357	PIPE	17900mm DIA
358	PIPE	17950mm DIA
359	PIPE	18000mm DIA
360	PIPE	18050mm DIA
361	PIPE	18100mm DIA
362	PIPE	18150mm DIA
363	PIPE	18200mm DIA
364	PIPE	18250mm DIA
365	PIPE	18300mm DIA
366	PIPE	18350mm DIA
367	PIPE	18400mm DIA
368	PIPE	18450mm DIA
369	PIPE	18500mm DIA
370	PIPE	18550mm DIA
371	PIPE	18600mm DIA
372	PIPE	18650mm DIA
373	PIPE	18700mm DIA
374	PIPE	18750mm DIA
375	PIPE	18800mm DIA
376	PIPE	18850mm DIA
377	PIPE	18900mm DIA
378	PIPE	18950mm DIA
379	PIPE	19000mm DIA
380	PIPE	19050mm DIA
381	PIPE	19100mm DIA
382	PIPE	19150mm DIA
383	PIPE	19200mm DIA
384	PIPE	19250mm DIA
385	PIPE	19300mm DIA
386	PIPE	19350mm DIA
387	PIPE	19400mm DIA
388	PIPE	19450mm DIA
389	PIPE	19500mm DIA
390	PIPE	19550mm DIA
391	PIPE	19600mm DIA
392	PIPE	19650mm DIA
393	PIPE	19700mm DIA
394	PIPE	19750mm DIA
395	PIPE	19800mm DIA
396	PIPE	19850mm DIA
397	PIPE	19900mm DIA
398	PIPE	19950mm DIA
399	PIPE	20000mm DIA
400	PIPE	20050mm DIA
401	PIPE	20100mm DIA
402	PIPE	20150mm DIA
403	PIPE	20200mm DIA
404	PIPE	20250mm DIA
405	PIPE	20300mm DIA
406	PIPE	20350mm DIA
407	PIPE	20400mm DIA
408		



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**DATASHEET -A
ANNEXURE - VI**



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DATA SHEET-A

SL NO.	DESCRIPTION	PARAMETERS
1.0	SULPHURIC ACID STORAGE TANKS	
1.1	Numbers	Three (3) Nos.
1.2	Type	Horizontal cylindrical with dished ends.
1.3	Type of fluid to be handled	98% w/w Commercial Sulphuric Acid.
1.4	Effective capacity	52 M ³ each
1.5	Design Code	BS : 2594 or equivalent
1.6	Material of Construction	
1.6.1	Shell	Mild steel as per IS 2062 or ASTM A 515 Gr.70.
1.6.2	Dished Ends	Mild steel as per IS 2062 or ASTM A 515 Gr.70.
1.7	Thickness	10 mm (minimum)
1.8	Instruments	As per P& ID.
1.9	Accessories	Moisture absorber, breather, manhole, vent, drain, sample connection, level transmitter, operating platform, ladders , lifting lugs (4 nos minimum) etc.
2.0	SULPHURIC ACID TRANSFER PUMPS	
2.1	Number	Two (2) [1W+1S].
2.2	Location	Outdoor.
2.3	Fluid to be handled	98% w/w Commercial Sulphuric Acid.
2.4	Service	To unload Concentrated Sulphuric Acid from Tank Car to Sulphuric Acid Storage Tank.
2.5	Type of Pump	Horizontal Centrifugal Non Clog type
2.6	Design standard	As per IS-5659 & IS-5120.
2.7	Rated Capacity	10 M ³ /HR
2.8	Range of operation	20 % - 120 %.
2.9	Head to be developed at rated capacity	20 MWC (minimum).
2.10	Material of construction	
2.10.1	Casing	CI to IS 210 Gr. FG 260
2.10.2	Impeller	Alloy-20.
2.10.3	Shaft	Alloy-20
2.10.4	Strainer	Carbon Steel (2X100 %, 50 BS).
2.11	Type of drive	The drive motor of each Pump will be Energy Efficient-1 as per IS 12615.
2.12	Pressure gauge	One per pump with teflon diaphragm seal
2.13	Pressure Dampener	One per pump
2.14	Accessories required for each pump	Coupling guard, drain plug, vent valve, suction hoses, isolation valves, Y- type strainers, pressure gauges, pulsation dampener etc.
2.15	Reinforced rubber hosed	Minimum two nos of size 50 NB of minimum 20 meters length with isolation valves
3.0	SULPHURIC ACID DAY TANKS	
3.1	Numbers	Two(2)
3.2	Type	Vertical cylindrical with dished bottom & cover at top.
3.3	Type of fluid to be handled	98% w/w Commercial Sulphuric Acid.
3.4	Effective capacity	5200 litres each
3.5	Material of Construction	
3.5.1	Shell	Mild steel as per IS 2062 or ASTM A 515 Gr.70.
3.5.2	Dished Ends	Mild steel as per IS 2062 or ASTM A 515 Gr.70.
3.6	Thickness	8 mm (minimum).
3.7	Instruments	As per P & ID.



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3.8	Accessories	Moisture absorber, breather, manhole, vent, drain, sample connection, level transmitter, operating platform, ladders , lifting lugs (4 nos minimum) etc.
4.0	SULPHURIC ACID INJECTION PUMPS	
4.1	Number	Three (3) [2W+1S].
4.2	Location	Outdoor.
4.3	Fluid to be handled	98% w/w sulphuric acid.
4.4	Service	To inject concentrated sulphuric acid into CW Fore bay.
4.5	Duty	As per Vendor's recommendations.
4.6	Type of Pump	Positive displacement, diaphragm type.
4.7	Rated Capacity	225 LPH each.
4.8	Range of Capacity Adjustment	0 % - 100 %.
4.9	Head to be developed at rated capacity	20 MWC (minimum)
4.10	Material of construction	
4.10.1	Housing	CI
4.10.2	Pump head	Alloy-20.
4.10.3	Plunger	Alloy-20.
4.11	Type of drive	The drive motor of each Pump will be Energy Efficient-1 as per IS 12615.
4.12	Pressure gauge	One per pump with teflon diaphragm seal
4.13	Pressure Dampener	One per pump
4.14	Accessories required for each pump	Coupling guard, drain plug, vent valve, suction hoses, isolation valves, Y- type strainers, pressure gauges, pulsation dampener etc.
5.0	SCALE INHIBITOR/CORROSION INHIBITOR TANKS	
5.1	Numbers To be provided	Two (2)
5.2	Type	Vertical cylindrical with dished bottom & cover at top.
5.3	Type of fluid to be handled	Commercial Scale Inhibitor/ corrosion inhibitor Solution.
5.4	Effective capacity	2000 Liters each.
5.5	Material of Construction	FRP
5.6	Thickness	6 mm (minimum).
5.7	Feed Funnel	Shall be provided over the top cover to feed Scale Inhibitor/corrosion inhibitor Solution.
5.8	Instruments	As per P&ID
5.9	Stirrer per tank	Slow speed stirrer driven by motor drive and reduction gear. Speed of stirrer = 200 RPM Max. Material of Construction of each stirrer and agitator = Stainless Steel – 316.
5.10	Drive motor of each stirrer	The drive motor of each stirrer will be Energy Efficient-1 as per IS 12615
5.11	Accessories	Moisture absorber, breather, manhole, vent, drain, sample connection, level transmitter, operating platform, ladders , lifting lugs (4 nos minimum) etc.
6.0	SCALE INHIBITOR / CORROSION INHIBITOR INJECTION PUMPS	
6.1	Number	Two (2) [1W+1S].
6.2	Location	Indoor.
6.3	Capacity	50 LPH (each).
6.4	Service	To inject Scale Inhibitor Solution into Cooling water pump suction pit.
6.5	Duty	As vendor's recommendations.



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6.6	Type of Pump	Positive displacement, diaphragm type.
6.7	Range of Capacity Adjustment	0 % - 100 %.
6.8	Suction Condition	Flooded.
6.9	Head to be developed at rated capacity	20 MWC (minimum)
6.10	Material of construction	
6.10.1	Housing	CI
6.10.2	Pump head	SS-316
6.10.3	Plunger	SS-316
6.11	Type of drive	The drive motor of each Pump will be Energy Efficient-1 as per IS 12615.
6.12	Pressure gauge	One per pump with teflon diaphragm seal
6.13	Pressure Dampener	One per pump
6.14	Accessories required for each pump	Coupling guard, drain plug, vent valve, suction hoses, isolation valves, Y- type strainers, pressure gauges, pulsation dampener etc.
7.0	BIO DISPERSANT DOSING SYSTEM	
7.1	Numbers	One (1)
7.2	Type	Vertical cylindrical with dished bottom & cover at top.
7.3	Type of fluid to be handled	Commercial Bio Dispersant Solution.
7.4	Effective capacity	1500 Liters
7.5	Material of Construction	SS 304
7.6	Thickness	6 mm (minimum)
7.7	Feed Funnel	Shall be provided over the top cover to feed Bio Dispersant Solution.
7.8	Instruments	As per P & ID
7.9	Accessories	Moisture absorber, breather, manhole, vent, drain, sample connection, level transmitter, operating platform, ladders , lifting lugs (4 nos minimum) etc.
8.0	BIO DISPERSANT INJECTION PUMPS	
8.1	Number	Two (2) [1W+1S].
8.2	Location	Indoor.
8.3	Fluid to be handled	Commercial Bio Dispersant Solution.
8.4	Service	To inject Bio Dispersant Solution into CW Forebay.
8.5	Duty	As vendor's recommendations.
8.6	Type of Pump	Positive displacement, diaphragm type.
8.7	Rated Capacity	5 LPH (each).
8.8	Range of Capacity Adjustment	0 % - 100 %.
8.9	Head to be developed at rated capacity	20 mwc (minimum)
8.10	Material of construction	
8.10.1	Housing	CI
8.10.2	Pump head	SS-316
8.10.3	Plunger	SS-316
8.11	Type of drive	The drive motor of each Pump will be Energy Efficient-1 as per IS 12615.
8.12	Pressure gauge	One per pump with teflon diaphragm seal
8.13	Pressure Dampener	One per pump



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8.14	Accessories required for each pump	Coupling guard, drain plug, vent valve, suction hoses, isolation valves, Y- type strainers, pressure gauges, pulsation dampener etc.
9.0	BIOCIDE TANKS	
9.1	Numbers	One (1)
9.2	Type	Vertical cylindrical with dished bottom & cover at top.
9.3	Type of fluid to be handled	Commercial Biocide Solution.
9.4	Effective capacity	1000 Liters
9.5	Material of Construction	FRP
9.6	Thickness	6 mm (minimum)
9.7	Feed Funnel	Shall be provided over the top cover to feed Biocide Solution.
9.8	Instruments	As per P & ID.
9.9	Accessories	Fume absorbers, carbon dioxide absorber, manhole, vent, drain, sample connection, level transmitter, operating platform, ladders , lifting lugs (4 nos minimum) etc.
10.0	MATERIAL OF CONSTRUCTION OF PIPING	
10.1	For H2SO4 dosing and unloading system	Carbon steel to ASTM A 105 Gr. B sch. 80 (minimum). Dimension standard : ANSI B 36.10
10.2	For Scale inhibitor/Corrosion inhibitor, & Bio Dispersant dosing system	Stainless steel to ASTM A 312 TP 304 sch. 80 (minimum). Dimension standard : ANSI B 36.19
10.3	For Biocide dosing system	Stainless steel to ASTM A 312 TP 316 sch. 80 (minimum). Dimension standard : ANSI B 36.19
10.4	For Service water	Carbon steel ,ERW to IS: 1239 Heavy grade
11.0	MATERIAL OF CONSTRUCTION OF FLANGES	
11.1	For H2SO4 dosing and unloading system	Carbon steel to ASTM A 105.
11.2	For Scale inhibitor/Corrosion inhibitor, & Bio Dispersant dosing system	Stain less steel to ASTM A 182 F304.
11.3	For Biocide dosing system	Stain less steel to ASTM A 182 F316.
12.0	MATERIAL OF CONSTRUCTION OF VALVES	
12.1	For H2SO4 dosing and unloading system	Carbon steel to ASTM A 105.
12.2	For Scale inhibitor/Corrosion inhibitor, & Bio Dispersant dosing system	Stain less steel to ASTM A 182 F316
12.3	For Biocide dosing system	Stain less steel to ASTM A 182 F316
13.0	MATERIAL OF CONSTRUCTION OF PIPE FITTINGS	
13.1	For Scale inhibitor/Corrosion inhibitor, & Bio Dispersant dosing system	Stainless steel to ASTM A182F 304. Dimension – ASME B 16.11
13.2	For Biocide dosing system	Stainless steel to ASTM A182F 316. Dimension – ASME B 16.11
13.3	Fittings For Acid dozing system	
	• Up to 50 NB	ASTM A 105. Dimension - ASME B 16.11
	• Above 65 NB	ASTM A 234 Gr WPB Dimension - ASME B 16.9
14.0	Structural Steel	IS 2062 Gr. B
15.0	Nuts and Bolts (heavy duty)	SS304
16.0	PIPE DIFFUSERS	
16.1	For Scale Inhibitor / Corrosion Inhibitor Dosing system	10 Nos (MOC: SS 316)



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16.2	For H2SO4 dosing system, Bio dispersant dosing system & Biocide dosing system perforated pipe will be provided near dosing point	
17.0	HAND PUMP	
17.1	Nos	Four nos (Two nos for Scale / corrosion inhibitor dosing tanks, One number for Bio dispersant dosing tank and one number for Biocide dosing tank.)
17.2	Type	Hand operated chemical barrel pump
17.3	Working principle	Self-priming, hand operated
17.4	MOC	SS 316 & Teflon
17.5	Accessories	Hose pipe of 15 m with each hand pump
18.0	SAFETY EQUIPMENT	Six (6) sets of safety equipment [(Personal Protection Equipment (PPE)) comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall also be provided. A personnel water drench shower/safety shower and eye bath shall also be provided by the bidder.

Note: -1: All drains from each dosing system shall be connected to a lime pit, which is connected to nearest station surface drain.

Note: -2:

- The dosing point shall be suitable for proper mixing in the forebay & pump suction pit.
- All gasket used in the chemical site shall be from chemical proof material to relevant chemical.
- Silica gel shall be provided by the bidder in vent line of the acid storage tanks, acid day tanks, Scale/corrosion inhibitor dosing tanks, Biocide dosing tanks and Bio dispersant dosing tanks.
- Bulk H₂SO₄ tank shall be kept such a height to ensure gravity flow to each acid day tanks.



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**QUALITY ASSURANCE PLAN
ANNEXURE- VII**

MANUFACTURER'S NAME & ADDRESS :		STANDARD QUALITY PLAN					PROJECT : 2X800 MW YERMARUS STPP				
ITEM : CW CHEMICAL TREATMENT.		Q.P. NO : PE-QP-362-156-A001		PACKAGE : CONTRACT NO. CONTRACTOR							
REV. : 0		DATE : 1 OF 10									
PAGE : 1 OF 10											
S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY**	REMARKS	
1	2	3	4	5	6	7	8	9	M C N	10	
1.0	<u>WELDER'S QUALIFICATION</u>										
1.1	WELDING PROCEDURE SPECIFICATION (WPS)	CORRECTNESS	MA	SCRUTINY	100%	ASME IX	ASME IX	QW 482	P	V V	
1.2	WELDER PERFORMANCE QUALIFICATION RECORD (PQR)	WELD SOUNDNESS	MA	PHYSICAL TEST	ASME IX	ASME IX	ASME IX	QW 483 QW 484	P	V V	
2.0	<u>TANKS, BOTTOM ENDS, FLANGES</u>										
2.1	<u>RAW MATERIAL :</u>										
2.1.1	PLATE	CHEMICAL & PHY. PROPERTIES INTERGRANULAR CORROSION TEST	MA MI	CHEMICAL & PHY. TEST CORROSION TEST	1/PLATE 1/PLATE	APPD. DWG/DATA SHEET APPD. DWG/DATA SHEET	APPD. DWG/DATA SHEET APPD. DWG/DATA SHEET	MFG. TC/LAB REPORT	P	V V	
2.1.2	PIPE FOR NOZZLE	CHEMICAL & PHY. PROPERTIES MICRO STRUCTURE CORROSION TEST HYDRO TEST	MA MI NA	CHEMICAL & PHY. TEST GRAIN STRUCTURE CORROSION TEST LEAKAGE	1/HEAT/SIZE 1/HEAT/SIZE 1/HEAT/SIZE 100%	APPD. DWG/DATA SHEET APPD. DWG/DATA SHEET APPD. DWG/DATA SHEET APPD. DWG/DATA SHEET	APPD. DWG/DATA SHEET APPD. DWG/DATA SHEET APPD. DWG/DATA SHEET APPD. DWG/DATA SHEET	MFG. TC/LAB REPORT DO DO DO MFG. TC/LAB REPORT	P P P P P	V V V V V V V V V V	
* RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.										IDENTIFICATION BY BHEL	
** M: MANUFACTURER/SUB-CONTRACTOR C: CONTRACTOR/NOMINATED INSPECTION AGENCY INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION AS APPROPRIATE. "C/P" CUSTOMER SHALL IDENTIFIED IN COLUMN "N".										\$ REFER NOTE-6	
FOR BHEL										DOC NO.	
MANUFACTURER/ SUB CONTRACTOR										REVIEWED BY	
SIGNATURE										NAME & SIGN OF APPROVING AUTHORITY	


MANUFACTURER'S NAME & ADDRESS :		STANDARD QUALITY PLAN					PROJECT : 2X800 MW YERMARUS STPP			
ITEM : CWI CHEMICAL TREATMENT.		OP. NO : PE-QP-382-156-A001		PACKAGE : CONTRACTOR NO.		CONTRACTOR				
REV. : 0		DATE : 2 OF 10		PAGE : 2 OF 10						
S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY**	REMARKS
1	2	3	4	5	6	7	8	9	M C N	11
2.2	IN PROCESS									
2.2.1	BOTTOM ENDS	DIMENSIONS SURFACE DEFECTS ON WELDMENTS	MA	MEASUREMENT WITH TEMPLATE DP TEST	100%	APPD.DWG.	APPD.DWG.	MFG.TC/LAB REPORT	P V V	
2.3	FINAL ASSEMBLY :									
2.3.1		DIMENSIONS & ORIENTATION LEAKAGE	MA	MEASUREMENT WATER FILL FOR 2 HOURS	100%	APPD.DWG.	APPD.DWG.	MFG.TC	P V V	
3.0	STIRRER :									
3.1	RAW MATERIAL FOR SHAFT	CHEMICAL & PHY. PROPERTIES INTERGRANULAR CORROSION TEST	MA	CHEMICAL & PHY. TEST CORROSION TEST	1/BAR/ HEAT DO	APPD. DWG/DATA SHEET ASTM A 282 PR'E	APPD. DWG/DATA SHEET ASTM A 282 PR'E	MFG.TC/LAB REPORT DO	P V V	
3.2	IMPELLER	CHEMICAL PROP.	MA	CHEMICAL MECHANICAL TEST	1/PLATE	ASTM A 240 GR.TP 304	ASTM A 240 GR.TP 304	MFG.TC/LAB REPORT	P V V	
		FOR BHEL	LEGEND :			FOR CUSTOMER USE		DOC NO.		
			* RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.							
			** M : MANUFACTURER/SUB-CONTRACTOR C : CONTRACTOR/NOMINATED INSPECTION AGENCY							
			INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION AS APPROPRIATE. "CHP" CUSTOMER SHALL IDENTIFIED IN COLUMN "N".							
MANUFACTURER/ SUB CONTRACTOR		SIGNATURE	CONTRACTOR			N: OWNER		NAME & SIGN OF APPROVING AUTHORITY		

MANUFACTURER'S NAME & ADDRESS :		STANDARD QUALITY PLAN						PROJECT : 2X800 MW YERMARUS STPP		
ITEM : CW CHEMICAL TREATMENT.		Q.P. NO : PE-QP-362-156-A001		PACKAGE CONTRACT NO. CONTRACTOR		REMARKS		AGENCY**		
REV. : 0		EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORMS		FORMAT OF RECORD		
DATE : 3 OF 10		TYPE/METHOD CHECK		CATEGORY		CHARACTERISTICS CHECKED		S.NO.		
COMPONENTS/ OPERATION		3		4		5		6		
7		8		9		10		11		
3.3	COMPLETE UNIT WITH MOTOR	PERFORMANCE IN WATER FILL TANK - VIBRATION - WOBBLING - POWER CONSUMPTION OR CURRENT DRAWN	MA	MEASUREMENT VISUAL MEASUREMENT	100% 100% 100%	APPD.DWG./DATA SHEET APPD.DWG./DATA SHEET	APPD.DWG./DATA SHEET	MFG.TC MFG.TC	P V V	MAKE OF MOTOR SHALL BE AS PER APPDLIST
4.0	MOTORS :	ROUTINE & TYPE TEST, DEGREE OF PROTECTION	MA	VERIFICATION OF TEST CERTIFICATES	100% FOR ROUTINE TEST & 1/2 SIZE FOR TYPE TEST & DEGREE OF PROTECTION	APPD.DWG./DATA SHEET	APPD.DWG./DATA SHEET	MFG.TC/LAB REPORT	P V V	MAKE OF MOTOR SHALL BE AS PER APPDLIST
5.0	METERING PUMP & PRESSURE RELIEF VALVE : (PUMPS SHALL BE PROCURED FROM BHEL APPD.SOURCE)									
5.1	RAW MATERIAL :	CHEMICAL & PHY. PROPERTIES SURFACE TEST	MA	CHEMICAL & MECH. TEST UT ON BAR > 25 MM DIA DP ON MIC SURFACE	1/BAR 100% 100%	APPD.DWG./DATA SHEET ASTM A 388 ASME - E - 165	APPD.DWG./DATA SHEET REF. NOTE # 1 NO SURFACE DEFECTS	MFG.TC/LAB REPORT MFG.TC/LAB REPORT MFG.TC/LAB REPORT	P V V	
5.1.1	WETTED PARTS									
FOR BHEL		LEGEND :		RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.		FOR CUSTOMER USE		DOC NO.		
MANUFACTURER/ SUB CONTRACTOR		SIGNATURE		CONTRACTOR		N: OWNER		REVIEWED BY		NAME & SIGN OF APPROVING AUTHORITY

MANUFACTURER'S NAME & ADDRESS :		STANDARD QUALITY PLAN					PROJECT : 2X800 MW YERMARUS STPP				
ITEM : CW CHEMICAL TREATMENT.		Q.P. NO : PE-QP-362-156-A001		PACKAGE CONTRACT NO. CONTRACTOR							
		REV. : 0									
		DATE :									
		PAGE :		5 OF 10							
S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY**	REMARKS	
1	2	3	4	5	6	7	8	9	M C N	11	
6 VALVES											
6.1	RAW MATERIAL :										
6.1.1	BODY, BONNET COVER	CHEMICAL & MECH PROPERTIES	MA	CHEMICAL & MECH TEST	1/HEAT	APPD.DWG./DATA SHEET (BY BHEL) DO	APPD.DWG./DATA SHEET (BY BHEL) DO	MFG. TC/LAB REPORT	P V V		
6.1.2	TRIM MATERIAL	HEAT TREATMENT	MA	HEAT TREATMENT	1/HEAT	APPD.DWG./DATA SHEET (BY BHEL) DO	APPD.DWG./DATA SHEET (BY BHEL) DO	LAB REPORT/MGF TC			
6.2	ASSEMBLY	CHEMICAL PROPERTIES	MA	CHEMICAL TEST	100%	APPD.DWG./DATA SHEET (BY BHEL) DO	APPD.DWG./DATA SHEET (BY BHEL) DO	MFG TC	P V V		
7.0	FITTING :	HYDRO TEST		LEAKAGE (BODY SEAT, AIR SEAT)	100%	APPD.DWG./DATA SHEET (BY BHEL) DO	APPD.DWG./DATA SHEET (BY BHEL) DO	MFG TC			
7.1	RAW MATERIAL	AIR TEST		MEASUREMENT	100%	APPD.DWG./DATA SHEET (BY BHEL) DO	APPD.DWG./DATA SHEET (BY BHEL) DO	MFG TC			
		DIMENSIONS				APPD.DWG./DATA SHEET (BY BHEL) DO	APPD.DWG./DATA SHEET (BY BHEL) DO	MFG TC			
		CHEMICAL & MECH PROPERTIES	MA	CHEMICAL & MECH TEST	1/HEAT	APPD.DWG./DATA SHEET (BY BHEL) DO	APPD.DWG./DATA SHEET (BY BHEL) DO	MFG TC/LAB REPORT	P V V		
		HEAT TREATMENT	MA	HEAT TREATMENT	100%	APPD.DWG./DATA SHEET (BY BHEL) DO	APPD.DWG./DATA SHEET (BY BHEL) DO	MFG TC/LAB REPORT			
		INTERGRANULAR	MI	CORROSION TEST	1/HEAT	APPD.DWG./DATA SHEET (BY BHEL) DO	APPD.DWG./DATA SHEET (BY BHEL) DO	MFG TC/LAB REPORT			
		CORROSION TEST			100%	APPD.DWG./DATA SHEET (BY BHEL) DO	APPD.DWG./DATA SHEET (BY BHEL) DO	MFG TC/INSP REPORT			
		DIMENSIONS	MA	MEASUREMENT	100%	APPD.DWG./DATA SHEET (BY BHEL) DO	APPD.DWG./DATA SHEET (BY BHEL) DO	MFG TC/INSP REPORT			
		FOR BHEL	LEGEND :			FOR CUSTOMER USE		DOC NO.			
			* RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.								
MANUFACTURER/ SUB CONTRACTOR		CONTRACTOR	C : CONTRACTOR/NOMINATED INSPECTION AGENCY		N : OWNER						
		SIGNATURE							NAME & SIGN OF APPROVING AUTHORITY		

MANUFACTURER'S NAME & ADDRESS :		STANDARD QUALITY PLAN							PROJECT : 2X800 MW YERMARUS STPP		
ITEM : CW CHEMICAL TREATMENT.		Q.P. NO : PE-QP-362-156-A001		REV. : 0		DATE : 6 OF 10		PACKAGE CONTRACT NO. CONTRACTOR			
S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY**	REMARKS	
1	2	3	4	5	6	7	8	9	M C N	11	
8.0	STRAINERS :										
8.1	RAW MATERIAL FOR BODY	PHY.& CHEM. PROPERTIES	MA	PHY. & CHEM. TEST	1/BARS/SIZE	APPD.DWG./DATA SHEETS	APPD.DWG./DATA SHEETS	LAB REPORT	P V V		
8.2	SCREEN	CHEMICAL	MA	CHEMICAL	1/SIZE	APPD.DWG./DATA SHEETS	APPD.DWG./DATA SHEETS	MFG.TCLAB REPORT	P V V		
8.3	FINAL INSPECTION	MESH SIZE	MA	MEASUREMENT	1/SIZE	APPD.DWG./DATA SHEETS	APPD.DWG./DATA SHEETS	MFG.TCLAB REPORT	P V V		
		DIMENSIONS	MA	MEASUREMENT	100%	APPD.DWG./DATA SHEETS	APPD.DWG./DATA SHEETS	MFG.TC	P V V		
		LEAKAGE		HYDRO TEST	100%	APPD.DWG./DATA SHEETS	NO LEAKAGE	MFG.TC			
9.0	PIPE (SEAMLESS) MATERIAL (REF. NOTE -2)	CHEMICAL	MA	CHEMICAL	1/HEAT/SIZE	APPD.DWG./DATA SHEETS	APPD.DWG./DATA SHEETS	MFG.TCLAB REPORT	P V V	IDENTIFICATION BY BHEL \$ REFER NOTE-6	
		MENICICAL TEST		MENICICAL TEST	1/HEAT/SIZE	APPD.DWG./DATA SHEETS	APPD.DWG./DATA SHEETS	MFG.TCLAB REPORT	P V V		
		MICRO STRUCTURE		GRAINS STRUCTURE	1/HEAT/SIZE	APPD.DWG./DATA SHEETS	FOR HEAT TREATMENT	MFG.TCLAB REPORT	P V V		
		INTERGRANULAR		CORROSION TEST	1/HEAT/SIZE	APPD.DWG./DATA SHEETS	ASTM A 262 PR 'E'	MFG.TCLAB REPORT	P V V		
		CORROSION TEST							P V V		
		HYDRO TEST		LEAKAGE	100%	NO LEAKAGE	NO LEAKAGE	MFG.TCLAB REPORT	P W V		
		FOR BHEL	LEGEND : * RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.				FOR CUSTOMER USE	DOC NO.			
MANUFACTURER/ SUB CONTRACTOR		CONTRACTOR	** M : MANUFACTURER/SUB-CONTRACTOR C : CONTRACTOR/NOMINATED INSPECTION AGENCY				N : OWNER				
		SIGNATURE	INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION AS APPROPRIATE, "CHP" CUSTOMER SHALL IDENTIFIED IN COLUMN "N".				REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY			

STANDARD QUALITY PLAN										
MANUFACTURER'S NAME & ADDRESS :		ITEM : CW CHEMICAL TREATMENT.				PROJECT : 2X800 MW YERMARUS STPP				
S.NO.		COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	REMARKS
1		2	3	4	5	6	7	8	9	10
12.0	LEVEL SWITCH:									
12.1	MAT. FOR WETTED PARTS INCLUDING FLOAT		CHEM.PROPERTIES	MA	CHEM.TEST	1/HI/ATR	APPD.DATA SHEET/DWG.	APPD.DATA SHEET/DWG.	MFG.TC/LAB REPORT	P V V
12.2	PERFORMANCE		FUNCTIONAL	MA	VISUAL	100%	APPD.DATA SHEET/DWG.	APPD.DATA SHEET/DWG.	MFG.TC	P V V
			IR-HV-IR		ELECTRICAL MEASUREMENT		DO	DO	MFG.TC	
			DIMENSIONS		MEASUREMENT TYPE TEST		DO	DO	MFG.TC	
			DEGREE OF PROTEC.						MFG.TC/LAB REPORT	
13.0	DIFF PRESSURE SWITCH MATERIAL FOR WETTED			MA	VERIFICATION		APPD.DATA SHEET/DWG.	APPD.DATA SHEET/DWG.	MFG COMPLIANCE CERTIFICATE	P V V
	PARTS PERFORMANCE		CALIBRATION	MA	PERFORMANCE	100%	APPD.DATA SHEET/DWG.	APPD.DATA SHEET/DWG.	MFG TC	P V V
14.0	CONTROL PANEL:		DIMENSIONS, CONTINUITY, IR-HV-IR	MA	MEASUREMENT, ELECTRICAL	100%	APPD.DWG./DATA SHEETS	APPD.DWG./DATA SHEETS	LAB REPROT	P W V
			FUNCTIONAL, DEGREE . OF PROT, VERIFICATION OF MAKE, RATING OF COMPONENTS							
			SIMULATION TEST \$\$							
			PAINT SHADES, THICK ADHESION							
15.0	COMPLETE SKID ASSEMBLY:		DIMENSIONS & ORIENTATION	OR	MEASUREMENT	-100%	APPD.DWG./ DATA SHEET	APPD.DWG./ DATA SHEET	INSPECTION REPORT	P W W
			LEAKAGE CHECK		VISUAL & HYDRO TEST		DISCH.PIPING - 1.5 x	NO LEAKAGE		
			ON WELDMENTS				DISCH.PR. OF PUMP	NO LEAKAGE		
			FUNCTIONAL TESTS				SUCTION PIPING - 3 KG/CM2			
FOR TECHNO CONSULTANTS										DOC NO.
LEGEND :										
* RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.										FOR CUSTOMER USE
** M : MANUFACTURER/SUB-CONTRACTOR										
C : CONTRACTOR/NOMINATED INSPECTION AGENCY										N: OWNER
INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION AS APPROPRIATE, "CHP" CUSTOMER SHALL IDENTIFIED IN COLUMN "N".										REVIEWED BY
MANUFACTURER/ SUB CONTRACTOR										NAME & SIGN OF APPROVING AUTHORITY
SIGNATURE										

MANUFACTURER'S NAME & ADDRESS :		STANDARD QUALITY PLAN				PROJECT : 2X800 MW YERMARUS STPP
		ITEM : CW CHEMICAL TREATMENT.	QP NO : PE-QP-362-156-A001 REV. : 0 DATE : PAGE : 10 OF 10	PACKAGE CONTRACT NO. CONTRACTOR		
P - PERFORMANCE V - VERIFICATION CR - CRITICAL		W - WITNESS MA - MAJOR MI - MINOR CHP-D : (CUSTOMER/BHEL/OWNER) HOLD POINT				
<p>NOTE:1 ; WHEN BACK WALL ECHO IS SET TO 100% OF FSH IN SOUND AREA, DEFECT ECHO SHALL NOT EXCEED 20% OF FSH. MAX BACH WALL ECHO IS 20% OF FSH. TOTAL NO OF DEFECTS SHALL BE MAX. 5 NO IN ONE METER LENGTH. DISTANCE BETWEEN TWO DEFECTS SHALL BE 3 MIN TIMES THE DIA OF BAR.</p> <p>NOTE: 2 ; NDT REQUIREMENT ON THE PIPING WELDING SHALL BE AS a) ON BUTT WELD 25% FP AND 25% RT FOR PUMP SUCTION SIDE AND FOR PUMP DISCHARGE SIDE 100% RT AND 100% DP TEST. b) 100% DP ON FILLER WELD JOINTS NORMS SHALL BE AS PER ASME SECTION VIII.</p> <p>NOTE:3: LEVEL GAUGE, PRESSURE GAUGE, LEVEL SWITCH, CONTROL PANEL & ALL INSTRUMENTS SHALL BE PROCURED FROM OWNER/BHEL APPROVED MAKE.</p> <p>NOTE 4: SIMULATION TEST WILL BE CARRIED OUT WITH 24 VDC SUPPLY TO CONTROL PANEL MANUFACTURER'S PLACE.</p> <p>NOTE 5 FUNCTIONAL TEST WILL BE CARRIED OUT WITHOUT 24 VDC I.e, ONLY CONTINUITY TEST WILL BE SHOWN AT TECHNO'S WORK.</p> <p>NOTE 6 FOR PIPES PURCHASED DIRECTLY FROM MANUFACTURER'S OR AUTHORISED DEALERS, APART FROM TC REVIEW, CHECK WILL BE AS PER CLASS 2.1.2 AND 10.0; HOWEVER FOR HYDRAULIC TEST MANUFACTURER TO SHALL BE REVIEWED . IN CASE ON IMPORTED PIPES PURCHASED FROM OPER MARKET CHECK TESTION AS PER CLAUSE 2.1.2 AND 10.0 (INCLUDING HYDRAULIC TEST) SHALL BE CARRIED OUT ON EACH LENGTH ;P HYDRAULIC TEST SHALL BE WITNESS BY BHEL.</p> <p>NOTE 7 FOR RAW MATERIAL (BARS/PIPES/CASTINGS/FORGINGS) WHERE HEAT TREATMENT ARE CARRIED OUT BY MATERIAL PRODUCERS ON BULK QUANTITIES, THEIR TEST CERTIFICATE SHALL BE REVIEWD (EXCEPT TIME TEMPERATURE CHART).</p>						
MANUFACTURER/ SUB CONTRACTOR		FOR BHEL		LEGEND : * RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION. ** M : MANUFACTURER/SUB-CONTRACTOR C : CONTRACTOR/NOMINATED INSPECTION AGENCY INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION AS APPROPRIATE, "CHP" CUSTOMER SHALL IDENTIFIED IN COLUMN "N".		
SIGNATURE		CONTRACTOR		FOR CUSTOMER USE	DOC NO.	NAME & SIGN OF APPROVING AUTHORITY



TITLE:
**TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT SYSTEM.
2X800 MW YERMARUS STPP**

BHEL DOCUMENTS NO.: PE-TS-362-156-A001.

VOLUME **II-B**

SECTION –C2

REV. NO. 01

DATE: 10/03/13

SECTION C2

SPECIFIC TECHNICAL REQUIREMENTS FOR ELECTRICAL



**TECHNICAL SPECIFICATION FOR
2 X 800 MW YERAMARUS SUPER CRITICAL TPP
CIRCULATING WATER TREATMENT SYSTEM
(ELECTRICAL PORTION)**

SPECIFICATION NO. PE-TS-362-156-A001
VOLUME II B
SECTION-C
REV 01 DATE:10/03/2013
PAGE 1 OF 1

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER/ PURCHASER

- 1.1 Scope for supply, and erection & commissioning of various equipment forming part of electrical system for this package shall be as per Annexure-I to Section – C [Scope of Work (Electrical)].
- 1.2 Make of various equipment/ items in the scope of bidder shall be to approval of owner during detailed engineering stage without any commercial implications.
- 1.3 Bidder shall furnish all AC as well as DC loads required for the system at different voltage levels (eg. 415V AC, 240 V AC, 220 V DC etc.) of all types, such as motor feeders, supply feeders in PEM format along with the offer.
- 1.4 All electrical equipment shall be suitable for the power supplies, fault levels and climatic conditions indicated in project information enclosed with the specification.
- 1.5 All drawings, data sheets, Quality Plan, calculations, test reports, test certificates, etc. shall be submitted during detailed engineering stage as per formats enclosed. The same shall be subject to approval without any commercial implications.
- 1.6 Technical requirements shall be as per specifications listed in Clause 4.1, 4.2 & 4.3 below.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

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

4.0 LIST OF ENCLOSURES

- 4.1 Electrical scope between BHEL & vendor (Annexure-I).
- 4.2 Technical specification no. PE-SS-999-506-E101, Data Sheets (A & C) for 415V Electric Motors.
- 4.3 Quality Plan for motors.
- 4.4 Load data format (Annexure-II).



TITLE:
**TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT SYSTEM.
2X800 MW YERMARUS STPP**

BHEL DOCUMENTS NO.: PE-TS-362-156-A001.

VOLUME **II-B**

SECTION -C2

REV. NO. 01

DATE: 10/03/13

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

ANNEXURE - I**ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**

PROJECT: 2X800MW YERAMARUS
SUPER CRITICAL TPP

PACKAGE: CIRCULATING WATER TREATMENT
FOR SKID MOUNTED SYSTEM

REV: 1 DATE: 10/03/13

S.NO DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	BHEL	BHEL	DOL starters for motors and 415V supply feeders for the requirements like control panel will be provided by BHEL. The starters for motors shall be located in MCC. Any other voltage level(AC/DC) required has to be arranged by vendor. Vendor to furnish the load list.
2	Vendor	Vendor	Located near motor, as applicable.
3	Vendor	Vendor	
4	BHEL	BHEL	
5	Vendor	Vendor	1. Erection material for special cables shall be in scope of bidder. 2. Laying and termination of special cables at both end of equipment by vendor.
5	BHEL	BHEL	Laying of cable trays between vendor equipments by vendor.
6	Vendor	Vendor	
7	Vendor	Vendor	
8	Vendor	Vendor	
9	a,b,c by Vendor	-	Cable listing for control cables for vendor-supplied equipment (soft copies in the BHEL cable schedule format) shall be furnished during detail engineering by vendor.
10	Vendor	-	Layout details between vendor supplied equipment by vendor.
11	Vendor	Vendor	1. Double compression Tinned brass conforming to BS: 6121 cable glands heavy duty type. 2. Aluminium Conductor Cables: Heavy duty Aluminium tubular terminal end for solder-less crimping 3. Copper Conductor Control Cables: Copper Cable lugs for control cable termination shall be PVC insulated sleeve type.

12	Any other item for completeness of system.	Vendor	Vendor	Supply and E&C of any other item for completeness of electrical work (although not mentioned specifically but required for trouble free operation of system) shall be deemed to be included in the scope of vendor without any extra charge.
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Note:

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



TITLE:
**TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT SYSTEM.
2X800 MW YERMARUS STPP**

BHEL DOCUMENTS NO.: PE-TS-362-156-A001.

VOLUME **II-B**

SECTION –C2

REV. NO. 01


DATE: 10/03/13

ELECTRICAL LOAD FORMAT


2X800 MW YERMARUS STPP
CW CHEMICAL TREATMENT SYSTEM.
DATASHEET FOR MOTORS

SL.NO.	PARAMETERS	UNIT	LT MOTORS	HT MOTORS
	MOTOR			
1	DESIGN AMBIENT TEMP	DEG. C	50	50
2	VOLTAGE SUPPLY AND VARIATION	KVOLT	0.415± 10%	11/3.3± 10%
3	FREQUENCY WITH VARIATION	Hz	50± 5%	50± 5%
4	COMBINED VOLTAGE & FREQUENCY VARIATION (sum of absolute values)		10%	10%
5	MAX ACCEPTABLE RATING OF MOTOR	KW	AT 415 V 174 KW & below	AT 3.3 KV 175 KW upto & including 1499 KW AT 11 KV 1500 KW & above
6	SYSTEM FAULT LEVEL AND ITS DURATION	KA	50kA, 1sec	50kA, 3sec
7	SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION		50 KA, 0.25 sec	50 KA, 0.25 sec
8	CLASS OF INSULATION & TEMP RISE LIMITED TO		Class-F and temp rise limited to Class-B	Class-F and temp rise limited to Class-B
9	MIN. STARTING VOLTAGE		80%	80%
10	MOTOR RATING FOR SINGLE PHASE SUPPLY		0.2 kW & Below	--
11	MAXIMUM LOCKED ROTOR CURRENT	% OF FLC	600% subject to 20% tol.	600% inclusive of IS tol.
12	ACCEPTABLE NOISE LEVEL	DB	Noise level for all motors shall be limited to 85dB(A) at 1 m	Noise level for all motors shall be limited to 85dB(A) at 1 m
13	TYPE OF STARTER PROVIDED IN MCC		DOL	DOL
14	DOP OF ENCLOSURE		IP-55 & IP-54 for outdoor & indoor resp.	IP-55 & IP-54 for outdoor & indoor resp.
15	SPACE HEATER REQUIREMENT	<30kW	30KW & ABOVE	YES
16	PAINT SHADE		during detailed engineering	during detailed engineering
17	SPECIAL REQUIREMENT		LT motors shall be Energy Efficient motors, Efficiency class-Eff 1, conforming to IS 12615.	n.a


THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

		CUSTOMER : RPCL			PROJECT : 2X800 MW YERMARUS STPP			SPECIFICATION :			
QUALITY PLAN		BIDDER/ VENDOR			TITLE CW/CHEMICAL TREATMENT SYSTEM.			NUMBER : PE-TS-362-156-A001			
SHEET 1 OF 2		SYSTEM			QUALITY PLAN			SPECIFICATION			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION		
									AGENCY	P	W
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	PAINING	1.SHADE	MA	VISUAL	SAMPLE	MANUF'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									


THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

		QUALITY PLAN		CUSTOMER : RPCL		PROJECT : 2X800 MW YERMARUS STPP		SPECIFICATION :	
		SHEET 2 OF 2		BIDDER/ VENDOR SYSTEM		TITLE CW/CHEMICAL TREATMENT SYSTEM.		NUMBER : PE-TS-362-156-A001	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	TITLE CWT
1	2	3	4	5	6	7	8	9	SECTION AGENCY
									P W V
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2 1 -
<p>NOTES:</p> <p>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</p> <p>2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.</p> <p>3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.</p>									
<p><u>Legends for Inspection agency</u></p> <p>1. BHEL/CUSTOMER</p> <p>2. VENDOR (MOTOR MANUFACTURER)</p> <p>3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)</p> <p>P. PERFORM</p> <p>W. WITNESS</p> <p>V. VERIFY</p>									
BHEL		PARTICULARS		BIDDER/VENDOR					
		NAME							
		SIGNATURE							
		DATE							
BIDDER'S/VENDORS COMPANY SEAL									


[THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001]

		QUALITY PLAN		CUSTOMER : RPCL		PROJECT : 2X800 MW YERMARUS STPP		SPECIFICATION :		
COMPONENT/OPERATION		SHEET 1 OF 9		BIDDER/ VENDOR SYSTEM		TITLE CW CHEMICAL TREATMENT SYSTEM.		NUMBER : PE-TS-362-156-A001		
SL. NO.	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	TITLE CWT	
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	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-	-DO-	3	-
	3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT		3	- 2
1.2	HARDWARES	MA	VISUAL	100%			FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-
	2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	MANFR'S DRG./SPEC	RELEVANT IS/SPEC.	SUPPLIERS TC & LOG	3	- 2
1.3	CASTING	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	MANFR'S DRG./SPEC	RELEVANT IS/	SUPPLIER'S TC	3	- 2
	3.DIMENSIONS	MA	MEASUREMENT	100%			MANUF'R'S DRG.	LOG BOOK	3	- 2
1.4	PAINT & VARNISH	MA	VISUAL	100% CONTINUOUS			MANUF'R'S DRG./SPEC	LOG BOOK	3	- 2
	1.MAKE, SHADE, SHELF LIFE & TYPE	MA								
BHEL		PARTICULARS		BIDDER/VENDOR						
		NAME								
		SIGNATURE								
		DATE								


THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

		CUSTOMER : RPCL		PROJECT : 2X800 MW YERMARUS STPP		SPECIFICATION :					
QUALITY PLAN		BIDDER/ : VENDOR		TITLE CW CHEMICAL TREATMENT SYSTEM.		NUMBER : PE-TS-362-156-A001					
SHEET 2 OF 9		SYSTEM		QUALITY PLAN		SPECIFICATION					
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	VOLUME III REMARKS	
1	2	3	4	5	6	7	8	9	10	11	
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND. 2. CHEM. & PHYSICAL PROPERTIES 3. DIMENSIONS 4. INTERNAL FLAWS	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
			MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2
			MA	MEASUREMENT	100%	-DO-	MANUF'R'S DRG.	LOG BOOK	3	-	2
			CR	UT	-DO-	ASTM-A388	MANUF'R'S SPEC. BHEL SPEC.	-DO-	3	2	1
			MA	VISUAL	-DO-	MANUF'R'S DRG. SPEC.	MANUF'R'S DRG. SPEC.	-DO-	3	-	2
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING 2. PHYSICAL COND. 3. DIMENSIONS (WHEREVER APPLICABLE) 4. PERFORMANCE/ CALIBRATION	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2
			MA	MEASUREMENT	SAMPLE	MANUF'R'S DRG./ SPEC.	MANUF'R'S DRG. / SPEC.	-DO-	3	-	2
			MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2
BHEL		PARTICULARS		BIDDER/VENDOR							
		NAME									
		SIGNATURE									
		DATE									
		BIDDER'S/VENDORS COMPANY SEAL									


THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

		QUALITY PLAN		CUSTOMER : RPCL		PROJECT : 2X800 MW YERMARUS STPP		SPECIFICATION :	
SHEET 3 OF 9		BIDDER/ VENDOR SYSTEM		TITLE CW CHEMICAL TREATMENT SYSTEM.		TITLE CW CHEMICAL TREATMENT SYSTEM.		NUMBER : PE-TS-362-156-A001	
COMPONENT/OPERATION		CAT.		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		REFERENCE DOCUMENT	
CHARACTERISTIC CHECK		3		4		5		6	
SL. NO.		2		3		1		2	
1		1		2		3		4	
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	2
1.8	2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	2
	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-
	2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUF'S DRG. .	MANUF'S DRG.	-DO-	3	2
1.9	3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IS	RELEVANT IS	SUPPLIER'S TC	3	2
	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	2*
	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					
		NAME							
		SIGNATURE							
		DATE							


THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

		QUALITY PLAN		CUSTOMER : RPCL		PROJECT : 2X800 MW YERMARUS STPP		SPECIFICATION :					
								BIDDER/ VENDOR		TITLE CW CHEMICAL TREATMENT SYSTEM.		NUMBER : PE-TS-362-156-A001	
												SPECIFICATION	
												TITLE CWT	
SL. NO.	COMPONENT/OPERATION	SHEET 4 OF 9	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	VOLUME III			
										AGENCY	REMARKS		
1	2	3	4	5	6	7	8	9	10	11			
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	MANFR'S DRG./ APPROVED DATASHEET	-DO-	Log Book	3	-	2		
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	-DO-	-DO-	3	-	2		
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	-DO-	3	-	2		
		3.SURFACE FINISH	MA	VISUAL	100%	-	-DO-	FREE FROM VISUAL DEFECTS	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	-DO-	MANUF'S DRG	3	-	-		
		3.TEMP. WITH- STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	-DO-	MANUF'S SPEC./ BHEL SPEC.	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	-DO-	MANUF'S DRG./ SPECS.	3	-	-		
		2.SURFACE COND.	MA	VISUAL	100%	-	-DO-	FREE FROM VISUAL DEFECTS	3	-	-		
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	-DO-	MANUF'S DRG	3	-	-		
BHEL													
PARTICULARS													
NAME													
SIGNATURE													
DATE													
BIDDER'S/VENDORS COMPANY SEAL													


THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

<div><div>QUALITY PLAN</div><div></div></div>		CUSTOMER : RPCL		PROJECT : 2X800 MW YERMARUS STPP		SPECIFICATION :		NUMBER : PE-TS-362-156-A001			
QUALITY PLAN		BIDDER/ VENDOR		TITLE CW/CHEMICAL TREATMENT SYSTEM.		SPECIFICATION		TITLE CWT			
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	REMARKS	
									P	W	V
1	2	3	4	5	6	7	8	9	1011		
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-	RELEVANT SPEC./ ASTM-E165	MANUF'S SPEC./ BHBL SPEC./	-DO-	2	-	1
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANF'S SPEC/BHBL SPEC./ RELEVANT STAND	BHBL 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	-	-
BHBL											
BIDDER/VENDOR											
PARTICULARS											
NAME											
SIGNATURE											
DATE											
BIDDER'S/VENDORS COMPANY SEAL											


THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

		QUALITY PLAN		CUSTOMER : RPCL		PROJECT : 2X800 MW YERMARUS STPP		SPECIFICATION :	
		BIDDER/ VENDOR		TITLE CW CHEMICAL TREATMENT SYSTEM.		NUMBER : PE-TS-362-156-A001		SPECIFICATION TITLE CWT	
SHEET 6 OF 9		SYSTEM		CAT.		TYPE/ METHOD OF CHECK		EXTENT OF CHECK	
COMPONENT/OPERATION		CHARACTERISTIC CHECK		3		4		5	
1		2		3		4		5	
2.4		SHEET STACKING		1.COMPLETENESS		MA		MEASUREMENT	
				2.COMPRESSION & TIGHTENING		MA		MEASUREMENT	
				3.CORE LOSS & HOTSPOT		MA		ELECT.TEST	
2.5		WINDING		1.COMPLETENESS		CR		VISUAL	
				2.CLEANLINESS		CR		-DO-	
				3.IR-HV-IR		CR		ELECT. TEST	
				4.RESISTANCE		CR		-DO-	
				5.INTERTURN INSULATION		CR		-DO-	
				6.SURGE WITH STAND AND TAN. DELTA TEST		CR		-DO-	
2.6		IMPREGNATION		1.VISCOSITY		MA		PHY. TEST	
				2.TEMP. PRESSURE VACUUM		MA		PROCESS CHECK	
				3.NO. OF DIPS		MA		-DO-	

THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

<div></div>		CUSTOMER : RPCL		PROJECT : 2X800 MW YERMARUS STPP		SPECIFICATION :							
		BIDDER/ VENDOR		TITLE CW CHEMICAL TREATMENT SYSTEM.		NUMBER : PE-TS-362-156-A001							
QUALITY PLAN		BIDDER/ VENDOR		QUALITY PLAN		SPECIFICATION							
SHEET 7 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION CWT							
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	VOLUME III REMARKS
1	2	3	4	5	6	7	8	9	10	11			
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1		
		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			
2.9	COMPLETE ROTOR ASSEMBLY	3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	1			
		1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2	1			VERIFICATION FOR MV MOTOR ONLY
2.10	ASSEMBLY	2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2	1			
		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									
NAME													
SIGNATURE													
DATE													
BIDDER'S/VENDORS COMPANY SEAL													

THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

		QUALITY PLAN SHEET 9 OF 9		CUSTOMER : RPCL		PROJECT : 2X800 MW YERMARUS STPP		SPECIFICATION : NUMBER : PE-TS-362-156-A001		
				BIDDER/ VENDOR : SYSTEM :		TITLE CW CHEMICAL TREATMENT SYSTEM.		SPECIFICATION TITLE CWT		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	REMARKS
									P W V	
1	2	3	4	5	6	7	8	9	10	11
<p>NOTES:</p> <p>1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.</p> <p>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.</p> <p>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.</p> <p>4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.</p> <p><u>Legends for Inspection agency</u></p> <p>1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)</p> <p>P. PERFORM W. WITNESS V. VERIFY</p>										
<p>BHEL</p>										
PARTICULARS NAME				BIDDER/VENDOR						
SIGNATURE				BIDDER'S/VENDORS COMPANY SEAL						
DATE				BIDDER'S/VENDORS COMPANY SEAL						



TITLE:

**TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT SYSTEM.
2X800 MW YERMARUS STPP**

BHEL DOCUMENTS NO.: PE-TS-362-156-A001.

VOLUME **II-B**

SECTION -C3

REV. NO. 01

DATE: 10/03/13

SECTION C3: SPECIFIC TECHNICAL REQUIREMENTS FOR C&I



TITLE:

**TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT SYSTEM.
2X800 MW YERMARUS STPP**

BHEL DOCUMENTS NO.: PE-TS-362-156-A001.

VOLUME **II-B**

SECTION -C3


REV. NO. 01


DATE: 10/03/13


SCOPE OF SUPPLY OF C&I ITEMS


S.NO.	C&I ITEMS	SCOPE
1	COMPLETE RELAY BASED SYSTEM	VENDOR
2	NECESSARY CONTROLLER/INDICATOR FOR ALL ANALOG SIGNALS	VENDOR
3	ALL REQD. INSTRUMENTATION	VENDOR
4	COMMISSIONING & SUPERVISION	VENDOR


*** ANY ITEM MENTIONED IN TECHNICAL SPECIFICATION BUT NOT LISTED ABOVE SHALL BE IN VENDOR'S SCOPE UNLESS MUTUALLY AGREED.**


RPCLYTPS 	RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC	SHEET 1 OF 10
1.00.00	<u>Technical Specifications for Field instruments:</u> <p>All instruments offered by the bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven as mentioned in design criteria. Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance. They shall comply with the acceptable international standards and shall be subject to Employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specifications.</p> <p>The Contractor shall furnish all Instrumentation/ Control equipment & accessories under this specification as per technical specification, ranges, makes & model as approved by the Employer during detailed engineering. The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/ erection of these transmitters shall be furnished, even if not specifically asked for, on as required basis. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.</p>	
2.00.00	<u>Smart Electronic Transmitters for Measurement of Pressure, Differential Pressure(DP) & Flow/Level(DP Type):</u>	
2.00.01	<p>Micro-processor based indicating type (LCD display), rack mounted with accuracy of +/- 0.1% of span, Repeatability : +0.05% of FSR or better, Linearity :+0.1% of FSR or better. Hysteresis: +0.1% of FSR or better. external zero and span adjustment, self diagnostics, temperature sensor for compensation. Power supply 24 V DC; output signal of 4- 20 mA DC. IP 65 or equivalent degree of protection with epoxy coating, 316 SS/ haste alloy/ other suitable sensing element. Accessories like snubbers for pump discharge applications and chemical diaphragm with 15 m PVC covered SS armoured capillary for corrosive and oil services, etc. Material for accessories will be SS. HART protocol output shall be available in each transmitter.</p> <p>In case it becomes necessary to use a DP transmitter for pressure measurement then a 3-valve manifold should be used in place of 2-valve manifold. LVDT type is not acceptable.</p>	
2.00.02	<p>Wherever, the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.</p>	
2.00.03	<u>In Detail Technical Specification:</u> 1) Type of Transmitter: Microprocessor based 2 wire type HART protocol compatible,	


<p>RPCL/YTPS</p> 	<p align="center">RAICHUR POWER CORPORATION LIMITED YERMARUS STPS – 2 X 800 MW</p>	
	<p>TITLE SPECIFICATIONS FOR INSTRUMENTS / LOCAL PANELS / JUNCTION BOXES / PLC</p> <ol style="list-style-type: none"> 2) Accuracy : - +/- 0.1 % of span 3) Output Signal Range: 4-20 mA DC(Analog) <i>Superimposed digital on HART protocol</i> 4) Turn Down Ratio : 10:1 for vacuum/very low pressure applications 30:1/100:1 for other applications 5) Stability: +/-0.1% of calibrated span for 6 months up to 70 KSC & 6) Zero and Span Drift: +/- 0.015% per Deg.C at max. span and 0.11% per Deg.C at Minimum Span 7) Load Impedance: 500 ohm (Min) 8) Housing: Weather proof as per IP-65 with durable corrosion resistant coating 9) Over Pressure - 150 % of Max. operating pressure 10) Connection(Electrical)- Plug and socket type 11) Process Connection - 1/2 inch NPT (F) 12) Span and Zero: Continuous, tamper proof, Remote Adjustability as well as manual from instrument with zero suppression and elevation facility. 13) Accessories <ol style="list-style-type: none"> a) Diaphragm seal, pulsation dampeners syphon etc. as required by service and operating condition. b) 2/3/5 Valve manifold as applicable 14) Diagnostics: Self Indicating Feature 15) Power Supply: 24 V DC +/- 10% 16) Adjustment : Calibration facility via Centralized PC based HART management system. <p>3.00.00 <u>Displacement Type Level Transmitters:</u></p> <p>Displacement/DP Type Smart Electronic Level Transmitters shall be provided for level measurement of condenser hotwell level, LP Heaters, HP Heaters and other vacuum services, shall be considered by the Contractor. If any more transmitters over and above the quantity indicated are required for the safe and efficient operation and maintenance the same shall be included. The type/ranges/make of transmitters and services for which these transmitters are required shall be as decided and approved by the owner during detailed engineering.</p> <p>Microprocessor based smart type, displacement type level transmitters of float length of 14 inches or 32 inches with an accuracy of +/-0.5% of span, 4-20 mA DC output (2 wire system), +24 V DC supply, isolated and ungrounded electrical circuits, zero adjustment (100% of sensing element) for control application and measurement purposes for all services of condensate and drains, particularly where two phases of steam and water are present. IP 65 or equivalent degree of protection for enclosure. Displacer/float material of 316SS. The material of accessories will be SS.</p>	<p align="right">SHEET 2 OF 10</p>


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4.00.00	<u>Thermocouple Assembly with Thermowell</u> <p>Duplex type with accuracy of $\pm 0.5\%$ of span (as per IEC-584 class-I for turbine applications) response time of 2 to 6 sec, Spring loaded mineral insulated thermocouple assembly with 316 SS thermowell housed in aluminium casing (epoxy coated) having a process connection of M33 x 2 thread or 150 RF flanged. Material of accessories will be SS. IP 65 or equivalent degree of protection for enclosure. Thermowell with hex head of fabricated assembly for air and flue gas system, for rest of the services bar stock assembly ungrounded. Thermowell material shall be solid tungsten carbide for mill outlet temperature measurement. For Air & Flue Gas measurements, thermowells shall be made of Inconel. For metal temperature measurement, thermocouple pads weldable to M.S pipes shall be provided with 15 m thermocouple extension wires. Element size shall be 18 AWG. Insulation resistance at 540°C shall not be less than 5 M ohms. For Turbine applications process connection shall be welded as per DIN 43763.</p> <p>Temperature devices provided with thermowell shall be calibrated with the associated thermowell as an assembly. The thermowell construction shall meet the ANSI 19.3-1994 (latest) requirements. Thermocouple termination head shall be 300 mm above the pipe insulation to avoid cable damage in hot zones.</p> <p><u>Thermo wells</u> shall be provided along with Temperature elements of RTD & Thermocouples except for metal/bearing/winding temperature measurements.</p> <ol style="list-style-type: none"> 1. For measurement of flue gas temperature, Inconel coated with tungsten carbide or suitable abrasion resistant thermo wells shall be provided. 2. For measurement of pulveriser outlet temperature tungsten carbide block thermo wells abrasion resistant not tungsten carbide coated thermowell shall be used. Also the terminals of Thermocouple shall not be at the top of Mills itself. The thermocouple wires are to be laid up to JB through SS tubing of required diameter and the head shall be placed nearer to the JB. Compensating cable exposed to atmosphere in the conventional method melts away due to high temperature at the top of Mill. 3. For measurement of water & steam temperature SS thermo wells or better, shall be used 	


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5.00.00	<u>Resistance Temperature Detectors (RTD) with Thermowell:</u> Duplex type with accuracy of $\pm 0.5\%$ of span, response time 1-2 seconds; Spring loaded mineral insulated three (3) wire RTD assembly with 316 SS Thermowell housed in aluminium casing (epoxy coated) having a process connection of M33 x 2 thread or 150 RF flanged. IP 65 or equivalent degree of protection for enclosure. Material of accessories will be SS. Thermowell with hex head with screwed cover & SS chain, barstock assembly. Element lead size will be 18 AWG. The insulation resistance at 540° shall not be less than 5M ohms. Repeatability over full range shall be better than 0.02%. RTDs shall be ungrounded. RTD shall be supplied as an assembly complete with thermowell meeting ANSI 19.3-1994 (latest) requirements.	
6.00.00	<u>Test Thermowells:</u>	
	Pipe/equipment mounted temperature test wells of 316 SS with a process connection of M33x2 thread, except for Turbine applications process connection shall be welded as per DIN 43763. Material of accessories will be SS. Thermowell with hex head of fabricated assembly for air and flue gas system, for rest of the services bar stock assembly. The thermowell construction shall meet the ANSI 19.3-1994 (latest) requirements. The thermowells shall be hardfaced/sterlited to avoid erosion for boiler area applications	
7.00.00	<u>Pressure Indicators:</u>	
	Direct reading, pipe mounted Pressure gauges of aluminium casing with six (6) inch phenolic dial (white dial with black numerals), 316 SS Bourdon tube, AISI304 /nylon movements and micrometer type adjustable pointer with an accuracy of $\pm 0.5\%$ of span including accessories like syphons for steam services, snubbers for pump discharge applications and chemical diaphragm for corrosive and oil services and name plate. Material of accessories will be SS. IP65 or equivalent degree of protection for enclosure. Over range protection will be 50% above maximum pressure.	
8.00.00	<u>Pressure Switches:</u>	
	Non indicating type, field mounted Pressure Switches of aluminium casing (epoxy coated), and 316 SS element and accuracy of $\pm 1\%$ of span, including accessories like syphons for steam services, snubbers for pump discharge applications and chemical diaphragm for corrosive and oil services and name plate. Material of accessories will be SS. Auto reset micro switch with internal adjustment for set values with 2 SPDT contacts rated for 0.2 A at 220 V DC. IP 65 or equivalent degree of protection for enclosure. Over range protection 50% above maximum pressure. Scale for setting shall be provided.	


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9.00.00	<u>Differential Pressure Indicators:</u> Direct reading type, pipe mounted, bellows or diaphragm operated differential pressure indicators; aluminium casing (epoxy coated) with six (6) inch dial (white dial with black numerals), with micrometer type pointer, 316 SS pressure element; an accuracy of $\pm 0.5\%$ of span including accessories like snubbers for pump discharge application, chemical diaphragm with 15 m PVC covered SS armoured capillary for each limb for corrosive and oil services and 5 way manifold. Material of accessories will be SS. IP 65 or equivalent degree of protection. Over range protection will be 50% above maximum pressure.	
10.00.00	<u>Differential Pressure Switches:</u> Bellows or diaphragm operated non-indicating field mounted type; aluminium casing (epoxy coated); 316 SS pressure element nylon movement; an accuracy of $\pm 1\%$ of span with an adjustable contact including accessories like snubbers for pump discharge applications, chemical diaphragm with 15 m capillary for each limb for all corrosive and oil services and 5 way manifold. Material of accessories will be SS. Auto reset micro switch with adjustable set values with 2 SPDT contacts rated for 0.2 A at 220 V DC. IP 65 or equivalent degree of protection over range protection 50% above maximum pressure. Repeatability shall be $\pm 0.5\%$ FSR.	
11.00.00	<u>Thermometers:</u> Indicating type, field mounted, filled system with 5metre capillary and six (6) inch dial housed in aluminium casing (epoxy coated) with an accuracy of $\pm 1\%$ of span, response time of 2-4 seconds, auto temperature calibration, linear calibration over the range and 316 SS thermowell having a process connection of M33 x 2 thread. Material of accessories will be SS. IP 65 or equivalent degree of protection for enclosure. Thermowell with Hex head of fabricated assembly for air and flue gas system for rest of the services bar stock assembly. The thermowell construction shall meet the ANSI 19.3-1994 (latest) requirements.	
12.00.00	<u>Temperature Switch:</u> Non Indicating type, field mounted, filled system with 5 metre capillary housed in Aluminium casing (epoxy coated) with an accuracy of $\pm 1\%$ span, auto temperature calibration, linear calibration over the range and 316 SS thermowell having a process connection of M33x2 thread. Micro switch with reset type with adjustable set values with 2 SPDT contacts rated for 0.2 A, 220 DC. IP 65 or equivalent degree of protection for enclosure. Thermowell with hex head of fabricated assembly for air and flue gas system, for rest of the services bar stock assembly. Material of accessories will be SS. The thermowell construction shall	


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	<p>meet the ANSI 19.3-1994 (latest) requirements.</p> <p>13.00.00 <u>Level gauges:</u></p> <p>Tubular type level gauges for low pressure upto 7 kg/cm² & reflex type for high pressure water & steam services & vacuum services with automatic ball check valves, illuminator (240 AC), pyrex / borosilicate glass, mica shield, brass guard rods & brass holders. Material of accessories (name plate, etc.) will be SS. Tubular glass OD will be 5/8". Vent & drain valves shall be provided. Connection shall be screwed or flanged (ANSI class 150 RF). Enclosure shall be IP 65.</p> <p>14.00.00 <u>Level Switches:</u></p> <p>External float operated level switches for tanks and vessels and top mounted level switches and underground tanks. The top mounted level switches shall be supplied with steel tubes to suit Purchaser's requirement. Micro switch with 2 SPDT contacts rated for 0.2 A, 220 V DC. Material of float & float chord will be 316 SS & cage material shall be fabricated steel and the material of accessories will be SS. IP 65 or equivalent degree of protection for enclosure.</p> <p>Accessories like name plate, drain valve for external case type level switches, mating flange, gaskets (asbestos), fasteners, bolts & nuts, etc. shall be supplied.</p> <p>15.00.00 <u>Flow Glasses:</u></p> <p>Online flow glasses for pipe size up to 4" with a rotary wheel (not a flapper type) suitable for installation on vertical or horizontal pipe lines, material pyrex tempered glass. Body material will be carbon steel, rotor & wetted parts will be bronze. The material of accessories will be SS. IP 65 or equivalent degree of protection for enclosure. Upto 50 NB size, connection shall be screwed above 50 mm NB size it shall be flanged - ANSI, 150 RF. Accessories like name plate, mating flanges with gaskets (neoprene), bolts & nuts, etc. shall be supplied. Enclosure shall be IP65.</p> <p>16.00.00 <u>Flow Elements:</u></p> <p>SS 316 flow nozzles for all steam and feed water services with D and D/2 pressure tapplings; 316SS flow orifice plate assembly for all water services with flange tap connections; B ratio of 0.5 & 0.7. Element material of SS 316. The material of accessories will be SS. All the flow elements shall have 3 pairs of differential pressure tapplings complete with root valves. Orifice plate shall not be less than 3 mm thick for nominal pipe diameter upto</p>	

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	<p>300 mm & not less than 6 mm thick for pipe diameter > 300 mm. The flow elements shall be supplied as assemblies with High/low pressure tappings, root valves as required. Performance Guarantee flow elements shall be provided separately. Butt welded edges shall be prepared as per ANSI 16.25 & flanged connections shall be as per ANSI 16.5 standards. Orifice assembly complete with nipples & valves to be supplied by Bidder shall be one metre long with ANSI class 150 RF SS flanges at the ends including gaskets, bolts & nuts. Isolating valves shall have SW end connection. Accessories like name plate, gaskets, bolts & nuts, reservoirs (condensing chambers), 6 nos. shut off valves per assembly, nipple, welding adapters, etc. shall supplied.</p> <p>Bidder shall submitted certified flow calculation and differential pressure Vs. flow curves for each element for OWNER's approval. Sizing calculation, precise flow calculation for all the flow elements, fabrication and assembly drawings and installation drawings shall be submitted for OWNER's approval. Bidder shall provide three Tappings per flow elements.</p> <p>17.00.00 <u>Flow Switches:</u></p> <p>Indicating, Differential pressure, flapper type on line flow switches for line sizes up to 80 mm with an accuracy of +/-2% of span and dial size of min. 50 mm having 316 SS flapper housed in die cast aluminium. Micro switch with adjustable range with 2 SPDT contacts rated for 0.2 A, 220 V DC. IP 65 or equivalent degree of protection for enclosure. The material of accessories will be SS.</p> <p>18.00.00 <u>Solenoid Valves:</u></p> <p>Direct operated single/dual coil solenoid valves with shut off class (leakage) IV or better, body material of bronze, plunger material of 316 SS rated for continuous duty. IP 65 or equivalent protection class for enclosure. Insulation class of 'F' for the solenoid. Body ratings shall suit the pressure and temperature conditions.</p> <p>The operating voltage shall be for 24VDC/ 220VDC/230VAC/110VAC depending on the service.</p> <p>19.00.00 <u>Local Instrument Enclosure & Racks/CJCB,s:</u></p> <p>Transmitters mounted in the field shall be suitably grouped together and mounted in Local Instrument Racks (LIR). These local instrument racks shall be furnished as per the actual requirements finalised during detailed engineering stage. The exact grouping of instruments in a particular instrument rack shall be as finalised during detailed engineering stage subject to Employer's approval.</p> <p>The internal layout shall be such that the impulse piping/ blowdown lines are accessible from backside of the rack and the transmitters etc. are accessible from front side for easy maintenance. Bulkheads especially</p>	

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	<p>designed to provide isolation from process line vibration shall be installed on instrument racks to meet the process sensing line connection requirement. Vibration dampeners shall be installed for each rack.</p> <p>The instrument racks shall be free standing type constructed of suitable 5 mm thick channel frame of steel and shall be provided with a canopy to protect the equipment mounted in racks from falling objects, water etc. The canopy shall not be less than 3 mm thick steel, and extended beyond the ends of the rack. Bulk heads, especially designed to provide isolation from process line vibration shall be provided. Exact fabrication details shall be as finalised during detailed engineering stage. The junction box for racks also shall conform to IP 65 protection class.</p> <p>Racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein. Centre posts or any member which would reduce access shall not be provided.</p> <p>Each transmitter rack housing instruments requiring purge air for continuous air purging, shall be provided with common purge air header, redundant air filter regulators of sufficient capacity, required pressure gauges, valves, fittings, SS tubings and individual purge meters for each purge line etc. as required.</p> <p>A 15 mm NB service air header shall be furnished in each rack housing air & flue gas and coal mill instruments. The header shall be furnished complete with a pressure regulating valve, pressure gauge, and valve quick disconnect connections. A hose for connecting each header to the draft instrument line four-way valves shall be furnished. The hose shall be self-storing nylon tubing having a burst pressure of 15 kg/sq.cm. The size of the hose shall be 1/2" minimum. The service air header shall originate at a bulkhead penetration or fitting located on one of the bulkhead plates.</p> <p>The contractor shall prepare the piping drawings and the general arrangement layout drawings for each of the racks. Special attention shall be given in the piping layout to avoid air traps in liquid filled piping or water pockets in piping intended to be dry. Drawings shall indicate the arrangement of all equipment, piping, valves and fittings within, the racks and shall be subject to Employer's approval.</p> <p>All liquid filled blow down lines, except those measuring vacuum shall be connected to a two inch header which is extended through one end of the enclosure and turned downward for directing the blowdown into a drain. The material of the blow down header shall be carbon steel as per ASTM A 106 Gr C.</p>	

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20.00.00	<u>Junction Boxes:</u> Wall/column mounted junction boxes having 12/24/36/48 terminals and cable entry only at the bottom and sealed with fire proof compound; Cage clamp terminals suitable for cable terminations up to 2.5 sqmm.; IP 65 or equivalent degree of protection for enclosure. Separate terminal blocks shall be used for analog and digital signal signals. Separate JB's for different voltage levels shall be supplied. Removable gland plate shall be supplied. JB shall have single lockable door with gasket, able to open side ways, with common keys. Painting inside will be glossy white & outside - IS-5 shade 631. Shield bus for screw connection shall be provided. Terminal size shall be suitable for 0.5 mm ² to 2.5 mm ² wire. Terminal blocks shall be vertical. JB shall have provision to add 20% additional terminals. Accessories like metal tag (SS), clamps, fixtures, bolts (SS), nuts (SS), gaskets (neoprene), lock & key, fire proof compound for sealing, etc. shall be supplied. The grouping of instruments in JB's is subject to Purchaser's approval. All the field Junction boxes shall have double doors. All JB's shall be provided with individual canopies to avoid ingress of water. The case, cover/door constructed from cold rolled sheet steel of 3 mm thick and shall have gland plate of 3 mm CRCA at the bottom. 21.00.00 <u>Inter Posing Relays (IPR):</u> Electro magnetic type IPRs with plug-in type connections, suitable for channel/rail mounting in cabinets; coil rating 24V D.C; 2 set of silver plated change over contacts rated for 0.2A 220 V DC. Free wheeling diode across relay coil(copper) and self reset type status indicator flag (electronic) shall be provided. Neon/LED indicating lamps shall be provided to indicate energise condition of relay. All commands to the Drives viz., Unidirectional drives, Bi-Directional drives, Solenoids and critical output contacts between systems for interlock and protection shall be through IPR. All relays shall be mounted on relay base (silver plated) internally wired to the external cabling termination block in cabinet. Wiring connection shall be screwed & termination shall be suitable for 0.5 mm ² to 2.5 mm ² size wiring. Facility to simulate relay operation manually shall be provided. Relays of different contact interrogation voltages shall be separated by a barrier in IPR cabinet. Accessories like name plate (SS) with tag & service inscription, relay base mounting rail/channel, nuts & bolts, etc. shall be supplied. Three nos. change over contacts shall be wired to external TB with screwed terminations only. Status lamps shall be provided.	

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22.00.00	<u>Local Panels:</u> Indoor/Outdoor located, free standing vertical type local panels with 3 mm thick sheet material of cold rolled steel; antivibration pads of 15 mm thick; fluorescent lighting; Double doors with neoprene gaskets at every 1.5 m; blower & louvers in each section with brass mesh; fire proof compound (50 mm thick) for sealing cable entry (bottom); fire detector for each section; space heater with thermostatic control for each section (strip type). IP 65 degree of protection for enclosure. Removable cover plates with locking facility shall be provided along the bottom of the front desk continuously to facilitate maintenance work. The length of each cover plate shall not exceed 1 m. CFL of 40 W shall be provided from one end of the panel to the other end at continuous length and shall be operated by the door switches as well as by manual switches. Name plates shall be provided for all instruments/inserts with Tag. No.& short description of service engraved. These shall be phenolic overlays(1.6mmthick), black background with white lettering & shall be fixed to the panel by stainless steel screws (counter sunk). Each section of the panels shall be provided with one each 3 pin receptacles for 240V, 1P 50 c/s & 110 V, 1P, 50 c/s. Panel shall be delivered totally wired. All instruments, inserts and annunciation windows shall be mounted & wiring connections at these hardware shall be terminated at site by vendor. Quantity shall be as required. 23.00.00 <u>Programmable Logic Controllers (PLC):</u> The microprocessor shall be based on 32 bit processing. The programme memory shall be non-volatile memory. The PLC shall perform protection logic, interlock and sequential control functions such as binary logic operation, set/reset operation, timers, counters, logic blocks, maths functions, boolean functions & timer functions. PLC shall complete with processor, I/O cards, memory modules, racks, mounting accessories. The scan time for digital inputs shall not be more than 60msec and execution 120msec. The system shall be loaded to maximum 60% under worst loading conditions. The redundant processors, redundant communication cards, redundant bus, redundant Power Supply cards for PLC system shall be considered. Further, I/O cards shall be redundant for critical inputs and outputs used for protection, interlock & commands for critical services. The system shall have self diagnosis features. The operation, monitoring and programming shall be performed from the MMI Monitor station. The system shall be connected to DCS using hot redundant bi-directional OPC communication link and shall have time synchronisation with master clock system. The required hardware for this connectivity shall be included. Independent redundant UPS with 1 hour Battery backup shall be provided for each of local PLC systems. PLC system with MMI, laser printer shall be included. For PLC system without MMI OWS, a hand held programmer shall be provided.	

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<p>Input/Output Modules as required in the control system for all type of field input (4-20 mA, RTD, T/C, Digital contacts etc.) and output from the control system are to be provided as per requirement. Electrical isolation for 1.5 KV with optical coupler between the plant put/output and surge protection as per IEEE 472. The hardware design shall be such that it is able to withstand power line disturbance. The system shall conform to ANSI/IEEE C 62.4 (Immunity to power supply line disturbance).</p> <p>Contractor shall provide at least 20% wired spare capacity of input/output modules over and above the system requirement. Contractor shall provide built in diagnostic for easy fault detection.</p> <p>System shall be able to operate in non air conditioned area. However where PLC panels/ I-O racks are located at local areas in dusty and hot zone, PLC panels/I-O racks shall be provided with air condition with suitable protection class. Contractor may provide Annunciation System as integral part of PLC. Field contacts shall be acquired through PLC only. The Annunciation sequence logic shall be implemented as a part of PLC controllers. The No. of Annunciation facia windows and provision of original input will be on as required basis.</p> <p>Contractor shall provide electronic grounding for PLC which shall be separate from Electrical grounding as per IS or IEEE Standard.</p> <p>The Factory Acceptance Test for PLC system shall consist of a) Hardware & Software as per BOM b) Spare capacity in cabinet for new module c) Current & Power Consumption d) Power Failure Test e) Healthiness of Hardware/all module f) On line removal of I/O card g) Accuracy Test h) Diagnostic Test i) Functional Test j) Verification of Software k) Redundancy Test of Controller l) Redundancy Test of power supply m) CPU loading duty cycle n) Power failure auto restart. Any other Test as per QAP. The Type test reports also shall be submitted for review.</p>		



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36.00.00 PH Measurement:

Microprocessor based system with system accuracy of 0.02 pH, auto temperature compensation, auto zero check, manual zero and span calibration, integral indicator, automatic ultrasonic cleaner, isopotential adjustment having flow type cells. Housing for electrode and analyser shall be IP65. Output shall be isolated 4-20 mA DC linear signal connected to DCS. Accessories shall include preamplifier, screened junction box for electrode.

37.00.00 Conductivity Measurement:

Micro-processor based system with an accuracy of ± 1 FSD, auto temperature compensation, auto calibration, zero check and integral indicator having gate valve insertion type (withdrawable) cell for hotwell conductivity measurements and flow line (screwed) type cell for other services. Housing for cell and analyser shall be weather and water proof. Output shall be isolated 4-20 mA DC linear signal connected to DCS.

38.00.00 Dissolved Oxygen Measurement:

Micro-processor based system with an accuracy of ± 1 ppb, having features like auto temperature compensation, auto zero & span calibration and integral indicator. Fault diagnosis data shall include faults in analogue/digital circuits, faults in calibrated values, power supply failure and sample failure. Housing for cell and analyser shall be IP65 or equal. Output shall be isolated 4-20 mA DC linear signal connected to DCS.



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39.00.00 Silica Analyser:

Micro-processor based system with an accuracy of ± 2 ppb, response time better than 12 min for 90% change, six/three numbers of sample streams having features like auto zero & span calibration, ambient temperature compensation and integral indicator. Self diagnostic features shall include alarm for no reagent, calibration fault and silica concentration low/high. Analyser housing shall be weather and water proof. Output shall be isolated 4-20 mA DC linear signal connected to DCS.

40.00.00 Hydrazine Analyser:

Polarographic type, Solid state/micro-processor based system with an accuracy of $\pm 5\%$ FSD, repeatability of $\pm 2\%$ FSD, response time of 90% of any change indicated in 6 min having features like auto zero & span calibration, ambient temperature compensation, and integral indicator etc. Fault diagnosis data shall include faults in analog/digital circuits, faults in calibrated valves, power supply failure and sample failure. Analyser housing shall be weather and water proof. Output shall be isolated 4-20 mA DC linear signal connected to DCS.

41.00.00 Sodium Analyser:

The Analyser shall be continuous flow through sample, single stream with accuracy ± 10 and response time less than 2 minutes for 90% of full scale readings. The range shall be 0-20 / 0-200 ppb. The analyser shall have features like auto zero & span calibration, ambient temperature compensation, and integral indicator etc. Fault diagnosis data shall include faults in analog/digital circuits, faults in calibrated valves, power supply failure and sample failure. Analyser housing shall be weather and water proof. Output shall be isolated 4-20 mA DC linear signal.

42.00.00 Oxygen Analyser:

Direct insertion, insitu type analyser with an accuracy of $\pm 1\%$ FSD, repeatability of 0.5 FSD, response time of 90% within 5 secs, auto and manual calibration having zirconia probe sensing element, IP 65 or equivalent degree of protection for enclosure. output shall be isolated 4-20 mA DC linear signal to DCS. Accessories like back purge system shall be provided.

THIS IS A PART OF THE TECHNICAL SPECIFICATION NO. PE-TS-362-156-A001

SPECIFICATION FOR ULTRA SONIC TYPE LEVEL TRANSMITTER


Ultrasonic Type level Transmitter


Sl.No.	Features	Essential/Minimum requirement
1.	Type of Transmitter	Non contact Microprocessor based 2 wire type, HART protocol compatible Ultrasonic transmitter. Also refer note-3.
2.	Output signal	4-20mA DC (Analog) along with superimposed digital signal (based on HART protocol)
3.	Sensor Accuracy	+/- 0.5% of calibrated span.

THIS IS A PART OF THE TECHNICAL SPECIFICATION NO. PE-TS-362-156-A001

Sl.No.	Features	Essential/Minimum requirement
4.	Sensor Repeatability	3mm or better
5.	Power supply	24 V DC +/-10%
6.	Temperature compensation	To be provided within transducer
7.	Configuration	
8.	Housing	Weather proof as per IP-55 with durable corrosion resistant coating.
9.	Adjustment/Calibration/maintenance	From hand held calibrators/ centralized PC based system (as applicable)
10.	Zero and Span adjustment	Continuous, tamper proof, remote as well as manual adjustability from instrument. It shall be possible to calibrate the instrument without any level in the tank/sump etc.
11.	Sensor Material	Corrosion resistant material to suit individual application requirement.
12.	False signal tolerance	Transmitter shall be capable of ignoring false echoes from internal tank/sumps obstructions such as pipes, heating coils or agitator blades. Also transmitter shall have adjustable damping circuitry
13.	Range	Range of transmitter shall be capable of covering the complete level span of tank taking care of blocking distance, frequency attenuation due to surface, obstructions, vapors etc.
14.	Display	LCD display with integral keypad to be provided.
15.	Diagnostics	Loss of echo alarm etc.
16.	Load Impedance	500 ohms minimum
17.	Electrical Connection	Plug and socket
18.	Accessories	<ul style="list-style-type: none"> All weather canopy for protection from direct sunlight and direct rain. All mounting hardware and accessories required for erection and commissioning mounting fittings materials shall be SS 316. <p>For hazardous area, explosion proof enclosure as described in NEC article 500</p>

INSTRUMENTS QUALITY PLANS


STANDARD QUALITY PLAN FOR PRESSURE AND DIFFERENTIAL PRESSURE GAUGES														
 PEM :: C&I		QUALITY PLAN NO.: PE-QP-999-145-J026 VOLUME IIB SECTION C-3 REV. NO. 01 DATE: 16.05.2007 SHEET 1 OF 2												
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks		
									P	W	V			
1.0	Material / Components													
1.1	Casing, Bourdon tube, and Movement	1. Chemical composition	MA	Chemical Test	One Sample from each lot	Approved drg. / data sheet / BHEL Spec.	Relevant raw material std.	Test Certificate	3/2	---	2,1#	# Compliance certificate to be verified.		
		2. Workmanship, finish and dimensions	MA	Visual, Measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report / Log Book	3/2	---	2,1#			
1.2	Switch⊕	Contact type & number	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Test Certificate/ Inspection Report	3	---	2,1#	⊕ Applicable for gauge with switch device		
2.0	Assembly	1. Marking – Tag No., Model, Range	MA	Visual	100%	- do -	- do -	Inspection Report	2	1	---			
		2. Workmanship	MA	Visual	100%	- do -	- do -	- do -	2	1	---			
		3. Dial size, scale graduation	MA	Visual	100%	- do -	- do -	- do -	2	1	---			
		4. End connections	MA	Measurement	100%	- do -	- do -	- do -	2	1**	1	**10% of total quantity with minimum of 2 piece / type & size		
		⊕5. Switch – contact type & nos.	MA	Visual	100%	- do -	- do -	Inspection Report	2	1	---			
3.0	Routine Test	1. Calibration, accuracy, Hysteresis, overload, set point adjustment⊕ / repeatability	CR	Measurement	100%	- do -	- do -	- do -	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 PRESSURE AND DIFFERENTIAL PRESSURE GAUGES										QUALITY PLAN NO.: PE-QP-999-145-1026 VOLUME IIB SECTION 3 REV. NO. 01 DATE: 16.05.2007 SHEET 2 OF 2				
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					
		2. Hydraulic Test	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec.	No Leakage	Inspection Report	2	1**	1					
		Ø3. IR, HV	CR	Measurement	100%	Relevant standard	Relevant standard	- do -	2	1**	1					
4.0	Type Test	1. Enclosure Protection Class	CR	Verification	Each type	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Test Certificate	2	---	1•				• Type Test Certificate to be verified	
		2. Blow out disc	CR	Verification	Each type	- do -	- do -	- do -	2	---	2•					
		Ø3. Switch contact rating	CR	Verification	Each type	- do -	- do -	- do -	2	---	2•					
5.0	Painting	Shade & Finish	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec. / Manufacturer's std.	Approved drg. / data sheet / BHEL Spec. / Manufacturer's std.	Inspection Report	2	---	2					
6.0	Packing	Soundness	MA	Visual	100%	- do -	- do -	- do -	2	---	---					

LEGEND: * CR - Critical characteristics
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 MI - Minor characteristics

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 V - Agency Verifying the Test.

1 - BHEL
 2 - Vendor
 3 - Sub-vendor

 PEM :: C&I		STANDARD QUALITY PLAN FOR PRESS AND DIFF PRESS SWITCHES										QUALITY PLAN NO.: PE-QP-999-145-I031 VOLUME IIB SECTION C 3 REV. NO. 01 DATE: 16.05.2007 SHEET 1 OF 3			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency's			Remarks			
									P	W	V				
1.0	Raw Material/ Component	1. Chem. Composition	MA	Chemical Analysis	1 sample from each lot	BHEL Spec. / Approved data sheet	Relevant material standard	Test Report	3/2	---	2,1	Relevant compliance certificate to be verified.			
		2. Make, Marking, Damage and Cracks	MA	Visual	100%	BHEL spec. / manufacturer standard	BHEL spec. / manufacturer standard	Log Book	2	---	---				
		3. Leakage (Element Conn.)	MA	Pressure Test	100%	Manufacturer standard	No Leak	Log Book	2	---	---				
	Micro Switch	1. No. and type of contacts	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Log Book	3/2	---	2,1				
		2. Continuity	CR	Electrical	100%	Manufacturer standard	To have continuity	Log Book	3/2	---	2,1				
2.0	Final Inspection														
2.1	Assembly	1. Marking: Range, Model, Tag No. Sl.No.	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	---	10% to be witnessed by BHEL			
		2. Correct assembly, workmanship and finish	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	1	---	- do -			


LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics	\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.	1 - BHEL 2 - Vendor 3 - Sub-vendor
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STANDARD QUALITY PLAN FOR PRESS AND DIFF PRESS SWITCHES													QUALITY PLAN NO.: PE-QP-999-145-1031							
													VOLUME IIB		SECTION 63		REV. NO. 01		DATE: 16.05.2007	
													SHEET 2		OF 3					
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									
2.2	Routine Test	3. Connection	MA	Visual & Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	—	10% to be witnessed by BHEL								
		4. Scale Marking	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	---	- do -								
		5. Cleanliness	MA	Visual	100%	Manufacturer standard	Free from scratches dirt etc.	Log Book	2	1	---	- do -								
		6. Overall Dimension	MA	Measurement	100%	BHEL Spec. / Approved drg.	BHEL Spec. / Approved drg.	Inspection Report	2	1	---	- do -								
		1. Overload	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	- do -								
		2. Repeatability	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	- do -								
		3. Set point adjustment	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	- do -								
		4. Differential	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	- do -								

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V - Agency Verifying the Test.


1 - BHEL
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3 - Sub-vendor

STANDARD QUALITY PLAN FOR PRESS AND DIFF PRESS SWITCHES												
 PEM :: C&I		QUALITY PLAN NO.: PE-QP-999-145-1031										
		VOLUME IIB										
		SECTION 03										
		REV. NO. 01 DATE: 16.05.2007										
		SHEET 3 OF 3										
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
		5. Contact Rating	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	---	1	Manufacturer compliance certificate to be verified.
		6. Insulation Resistance & HV	CR	Electrical	100%	Relevant standard	Relevant standard	Test Report	2	1	1	10% to be witnessed by BHEL
		7. Calibration Test	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	- do -
		8. Accuracy Test	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	- do -
2.3	Type Test	1. Weatherproofness	CR	Measurement	1 sample / design	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	3/2	---	1	Vendor to furnish test report for verification
3.0	Packing	Soundness of packing	MA	Visual	100%	BHEL Spec.	BHEL Spec.	Log Book	3/2	2	---	

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 PEM :: C&I		STANDARD QUALITY PLAN FOR RESISTANCE TEMPERATURE DETECTOR AND THERMOWELL										QUALITY PLAN NO.: PE-QP-999-145-1025 VOLUME IIB SECTION 63 REV. NO. 00 SHEET 1 OF 2 DATE: 15.03.99	
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency's			Remarks	
									P	W	V		
1.0	Raw Material / Component												
1.1	Resistance sheath	Material composition	CR	Chemical testing	Sample	Approved data sheet, BHEL Spec.	Relevant material std.	Test Certificate	3,2	---	2,1	▲ Relevant compliance certificate to be verified.	
1.2	Protective Sheath	Material composition	MA	Chemical testing	Sample	Approved data sheet, BHEL Spec.	Relevant material std.	Test Certificate	3,2	---	2,1		
1.3	Terminal Head	Material composition	MA	Chemical testing	Sample	Approved data sheet, BHEL Spec.	Relevant material std.	Test Certificate	3,2	---	2,1		
1.4	Thermowell⊕	1. Chemical properties	CR	Chemical composition	One sample / Lot	Approved data sheet, BHEL Spec.	Relevant material std.	Test Certificate	3,2	---	2,1		
		2. Dimensions (wall thickness concentricity of bore, OD & length)	MA	Measurement	100%	Approved drg., BHEL Spec.	Approved drg., BHEL Spec.	Inspection report	2	1	1	▲ BHEL to witness 25% Samples	
		3. Threading	MA	Thread matching	100%	Approved data sheet/drg., BHEL Spec.	Approved data sheet/drg., BHEL Spec.	Inspection Report	2	2,1	1		
		4. Leak Test	CR	Hydro test at 1.5 times design press.	100%	Approved drg., BHEL Spec.	Approved drg., BHEL Spec.	Inspection Report	3,2	2/1	---	⊕ IBR certificate wherever specified to be verified.	
2.0	Final Inspection												
2.1	RTD Assembly	1. Workmanship	MA	Visual	100%	BHEL Spec.	BHEL Spec.	Log Book	2	2,1	1		
		2. Marking	MA	Visual	100%	BHEL Spec.	BHEL Spec.	Log Book	2	2,1	1		

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 MI - Minor characteristics
 P - Agency Performing the Test.
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 V - Agency Verifying the Test.
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 2 - Vendor
 3 - Sub-vendor

THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

STANDARD QUALITY PLAN FOR RESISTANCE TEMPERATURE DETECTOR AND THERMOWELL												QUALITY PLAN NO.: PE-QP-999-145-I025				
												VOLUME IIB				
												SECTION 2.3				
												REV. NO. 00				
												DATE: 15.03.99				
												SHEET 2 OF 2				
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					
2.2	Routine Tests	3. Dimensions	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	2,1*	1					
		1. Calibration (Resis Vs. Temp.)	CR	Measurement	100%	Approved drg. IS:2848	BHEL Spec. IS:2848	Test Report	2	2	1					
		2. Insulation Resistance	MA	Electrical	100%	IS:2848	IS:2848	Test Report	2	1	---					
		3. Resistance Tolerance	MA	Thermal Elect.	100%	IS:2848	IS:2848	Test Report	2	1	---					
		4. Thermal Response time	CR	Measurement	Sample	IS:2848	IS:2848	Test Certificate	2	1	---					
2.3	Type Test	1. Immersion error Test	MA	Measurement	Sample	IS:2848	IS:2848	Test Certificate	3/2	---	1					
		2. Thermoelectric Effect	MA	Measurement	Sample	IS:2848	IS:2848	Test Certificate	3/2	---	1					
		3. Vibration Test	CR	Measurement	Sample	IS:2848	IS:2848	Test Certificate	3/2	---	1					
		4. Enclosure protection test	CR		Sample	BHEL Spec.	BHEL Spec., Approved data sheet.	Test Certificate•	3/2	---	1	• Test certificates to be verified.				
3.0	Packing	Soundness of packing	MA	Visual	100%	BHEL Spec.	BHEL Spec.	Log Book	3/2	2	---					

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STANDARD QUALITY PLAN FOR LEVEL SWITCHES														QUALITY PLAN NO.: PE-QP-999-145-I033							
PEM :: C&I														VOLUME IIB							
														SECTION 23							
														REV. NO. 00							
														DATE: 15.03.99							
SHEET 1 OF 3																					
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks									
									P	W	V										
1.0	Raw Material/ Component																				
1.1	Non Wetted Parts	Physical, Chemical properties	MA	Physical, Chemical Analysis	1/ Cast	BHEL Spec/ Approved drg. / data sheet	Relevant material standard	Test Report	3/2	--		2,1*	*Relevant compliance certificate to be verified.								
1.2	Float Assembly & Wetted Parts	Physical for float only & chemical properties for all wetted parts including float assembly	MA	Physical, Chemical Analysis	1/Batch	AISI:316 / BHEL spec. / drg. / Approved data sheet	AISI:316 / BHEL spec. / drg. / Approved data sheet / Relevant material std.	Test Certificate	3/2	--		2,1*									
1.3	Chamber	Dimensions & leak tightness	MA	Measurement, visual, hyd. test	100%	BHEL Spec/ Approved drg. / data sheet	BHEL Spec/ Approved drg. / data sheet	Internal inspection report	3/2	2	1										
1.4	Float	Leak tightness	MA	Hyd. test	100%	BHEL Spec/ Approved drg. / data sheet	No leakage	Internal inspection report	3/2	2	1										
1.5	Switch	1.. Make, type and rating	MA	Visual	100%	BHEL / Mfr. spec.	BHEL / Mfr. spec.	Internal inspection report	3/2	--		2,1									
2.0	Final Inspection	2. Contact Continuity	CR	Electrical	100%	BHEL / Mfr. spec.	BHEL / Mfr. spec.	To have continuity	3/2	--		2,1									
2.1	Assembly	1. Marking: Range, Model, Tag No. Sl.No.	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	--										
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics														\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.				1 - BHEL 2 - Vendor 3 - Sub-vendor			

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 2 - Vendor
 3 - Sub-vendor


THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

STANDARD QUALITY PLAN FOR LEVEL SWITCHES													QUALITY PLAN NO.: PE-QP-999-145-1033				
<div> PEM :: C&I</div>													IIB				
													SECTION C.3				
													REV. NO. 00 DATE: 15.03.99				
													SHEET 2 OF 3				
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						
2.2	Routine Test	2. Correct assembly, workmanship and finish	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	1	---						
		3. Connection	MA	Visual & Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	---						
		4. Scale Marking	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	1	---						
		5. Cleanliness	MA	Visual	100%	Manufacturer standard	Free from scratches dirt etc.	Log Book	2	1	---						
		6. Overall Dimension	MA	Measurement	100%	BHEL Spec. / Approved drg.	BHEL Spec. / Approved drg.	Inspection Report	2	1	---						
		1. Overload	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1❖	1	❖ BHEL to witness 25% sample.					
		2. Repeatability	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1❖	1						
		3. Set point adjustment	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1❖	1						

LEGEND:		*	CR	- Critical characteristics																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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STANDARD QUALITY PLAN FOR LEVEL SWITCHES												QUALITY PLAN NO.: PE-QP-999-145-1033												
PEM :: C&I												VOLUME	IIB	SECTION	REV. NO.	DATE:	15.03.99							
												SHEET	3	OF	3									
												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										
2.3	Type Test	4. Differential	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test Report	2	1	1	1	Manufacturer compliance certificate to be verified.											
		5. Contact Rating	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection Report	2	---	1													
		6. Insulation Resistance & HV	CR	Electrical	100%	Manufacturer standard	Manufacturer standard	Test Report	2	1	1													
3.0	Packing	1. Weatherproofness	CR	Measurement	1 sample / design	BHEL Spec. / Approved data sheet	IS : 2147 / NEMA-4	Test Report	3/2	---	1	1	Vendor to furnish test report											
		Soundness of packing	MA	Visual	100%	BHEL Spec.	BHEL Spec.	Log Book	3/2	2	---													


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

 PEM :: C&I		STANDARD QUALITY PLAN FOR THERMOCOUPLE WITH THERMOWELL										QUALITY PLAN NO.: PE-QP-999-145-1003	
												VOLUME IIB	
												SECTION 03	
												REV. NO. 00 DATE: 15.03.99	
												SHEET 1 OF 2	
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
									P	W	V		
1.0	Raw Material / Component												
1.1	Thermocouple wires	Material composition	CR	Chemical testing	Sample	BHEL Specs. / Appd. data sht.	Relevant material standards	Test Certificate	3/2	---	2, 1	▲ Relevant compliance certificate to be verified.	
1.2	Protective Sheath	Material composition	MA	Chemical testing	Sample	BHEL Specs. / Appd. data sht.	Relevant material standards	Test Certificate	3/2	---	2, 1		
1.3	Terminal Head	Material composition	MA	Chemical testing	Sample	---	Relevant material standards	Test Certificate	3/2	---	2, 1		
1.4	Thermowell ⊕	1. Chemical properties	CR	Chemical test	Sample	BHEL Specs / Approved data sheet	Relevant material standard	Test Certificate	3/2	---	2, 1		
		2. Dimensions (wall thickness concentricity of bore, OD and length)	MA	Measurement	100%	BHEL Specs / Approved drgs.	BHEL Specs / Approved drgs.	Log Book	2	1	1		
		3. Threading	MA	Thread matching	100%	BHEL Specs / Approved data sheet.	BHEL Specs / Approved data sheet.	Inspection Report	2	2, 1	1		
		4. Leak Test	CR	Hyd. test at 1.5 times design press.	100%	BHEL Specs / Approved data sheet.	BHEL Specs / Approved data sheet.	Inspection Report	3/2	2, 1	---	⊕ IBR certificate if specified to be verified.	

LEGEND: * CR - Critical characteristics
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MI - Minor characteristics

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


1 - BHEL
2 - Vendor
3 - Sub-vendor

 PEM :: C&I		STANDARD QUALITY PLAN FOR THERMOCOUPLE WITH THERMOWELL										QUALITY PLAN NO.: PE-QP-999-145-1003 VOLUME IIB SECTION 2.3 REV. NO. 00 DATE: 15.03.99 SHEET 2 OF 2			
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				
2.0	Final Inspection														
2.1	Thermocouple Inspection	Workmanship	MA	Visual	100%	BHEL Specs	BHEL Specs.	Log Book	2	2,1*	1	•BHEL to witness 25% samples.			
		Marking	MA	Visual	100%	BHEL Specs	BHEL Specs / Approved drgs.	Log Book	2	2,1*	1				
		Dimensions	MA	Measurement	100%	BHEL Specs / Approved drgs.	BHEL Specs / Approved drgs.	Log Book	2	2,1*	1				
2.2	Routine Tests	1. Continuity and Polarity	MA	Measurement	100%	----	Compliance	Test Report	2	2,1	---				
		2. Accuracy Test (EMF vs. Temp.	CR	Thermal & Elect	100%	BHEL Specs	Relevant standards	Test Report	2	2,1	---				
		3. Insulation resistance between Element and sheath	MA	Thermal & Elect	100%	----	Relevant standards	Test Report	2	1	---				
		4. Response Time Test	MA	Thermal & Elect	10%	BHEL Specs / Approved data sheet	Relevant standards	Test Report	2	2	1				
2.3	Type Tests	Enclosure protection test for Head	CR	Testing	Sample	BHEL Specs	BHEL Specs / Approved data sheet	Test Certificate	3/2	---	1				
3.0	Packing	Soundness of packing	MA	Visual	100%	BHEL Spec.	BHEL Spec.	Log Book	3/2	2	---				

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 V - Agency Verifying the Test.


1 - BHEL
 2 - Vendor
 3 - Sub-vendor

 PEM :: C&I		STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER										QUALITY PLAN NO.: PE-QP-999-145-I001			
		Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency's			Remarks	
VOLUME IIB												P	W	V	
SECTION 0.3															
REV. NO. 00															
DATE: 12.10.99															
SHEET 1 OF 7															
1.0	RAW MATERIAL INSPECTION														
1.1	Body/Casing, Cable Gland and Mounting Bracket	1. Chemical & Mech. Properties 2. Dimensions 3. Visual 4. Degree of Protection (If applicable) 5. Leak Tightness	MA MA MA CR MA	Analysis Measurement Visual IS-2147 IS-2148 Hydro Test	1 / Lot 10% Min. 3 Nos. 100% 1 / Type 100%	Tech. Specn. Data Sheet, Mfr. standard Manufacturer drg. BHEL Spec. / Approved data sheet BHEL Spec. / Approved data sheet BHEL Spec. / Approved data sheet	Tech. Specn. Data Sheet, Mfr. standard Manufacturer drg. BHEL Spec. / Approved data sheet BHEL Spec. / Approved data sheet BHEL Spec. / Approved data sheet	Test certificate Log Book Log Book Test certificate Log Book	3 2 2 3 2	---	2 ---	2 ---	Compliance report verification by BHEL.		
1.2	Sensor (Diaphragm, Capsule, Bellows, Strain, Gauge, Capacitance etc.)	1. Material Properties (Chemical & Mechanical) 2. Dimension 3. Performance 4. Type Test	MA MA CR CR	Analysis Measurement Function Mech. & Elect.	1 / Lot 1 / Lot 100% 1/Type	BHEL Spec. / Approved data sheet BHEL Spec. / Approved data sheet BHEL Spec. / Approved data sheet BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet BHEL Spec. / Approved data sheet BHEL Spec. / Approved data sheet BHEL Spec. / Approved data sheet	Test certificate Test certificate Test certificate Test certificate	3/2 2 2 3/2	---	2 ---	2 ---			

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1 - BHEL or their agent
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3 - Sub-Vendor

	STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER			
	QUALITY PLAN NO.: PE-QP-999-145-I001			
	VOLUME	IIB		
	SECTION	03		
	REV. NO.	00	DATE:	12.10.99
SHEET		2	OF	7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
1.3	Gasket	1. Dimension	MA	Measurement	Sample	Manufacturer standard	Manufacturer standard	Test certificate	3/2	---	2	
		2. Sheer Hardness	MA	Analysis	Sample	Manufacturer standard	Manufacturer standard	Test certificate	3/2	---	2	
1.4	Electrical & Electronic Components	1. Marking & Rating	MA	Visual	10%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
		2. Electrical Parameters	CR	Electrical Tests	10%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
		3. Dimensions	MA	Measurement	10%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
		4. Solderability	MA	Electrical	3 / Type	Manufacturer standard	Manufacturer standard	Log Book	2	---	---	
1.5	PCBs	1. Visual	MA	Visual	100%	---	---	---	3/2	---	2	
		2. Dimensions	MA	Measurement	10%	Manufacturer standard	Manufacturer standard	Log Book	3/2	---	2	
		3. Type Test	CR	Mech. & Elect. Tests	1 / Type / Batch	IS:7405 BS:4025	IS:7405 BS:4025	Test certificate	3/2	---	2	


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

 PEM :: C&I		STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER							QUALITY PLAN NO.: PE-QP-999-145-J001 VOLUME IIB SECTION C3 REV. NO. 00 DATE: 12.10.99 SHEET 3 OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency's			Remarks
									P	W	V	
2.0	In-Process Inspection											
2.1	Electrical Unit											
2.1.1	Etched PCB	1. Dimension – Trade width, Gap etc. 2. Defect of undercuts 3. Quality and plating of plating through holes. 4. Screen printing	MA MA CR CR	Measurement Visual Visual Visual	Sample Sample 100% 100%	Manufacturer standard Manufacturer standard Manufacturer standard Manufacturer standard	Manufacturer standard Manufacturer standard Manufacturer standard Manufacturer standard	Inspection report Inspection report Inspection report Inspection report	2 2 2 2	--- --- --- ---	--- --- --- ---	Compliance verification report by BHEL
2.1.2	Component Mounting and soldering	1. Correctness of components 2. Mounting and orientation 3. Soldering defects and finish	MA MA CR	Visual Visual Visual	100% 100% 100%	Manufacturer standard Manufacturer standard Manufacturer standard	Manufacturer standard Manufacturer standard Manufacturer standard	Inspection report Inspection report Inspection report	2 2 2	--- --- ---	--- --- ---	
2.1.3	Assembled PCBs	Functional check	CR	Visual	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	---	---	
*Soaking means subjecting PCB (Assembled) at 70 Deg. C for 72 hours at energised condition and rapid temperature cycle test at 70 Deg. C and (-) 20 Deg. C for 30 minutes at each temp. (Five such cycles).												

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 3 - Sub-vendor

 PEM :: C&I		STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER										QUALITY PLAN NO.: PE-QP-999-145-I001 VOLUME IIB SECTION 6.3 REV. NO. 00 DATE: 12.10.99 SHEET 4 OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
2.1.4	Conformal coating	Uniformity and finish of conformal coating on both sides	CR	Visual	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	---	---				
2.2	Mounting, Fitting, Assembly of various mechanical parts	1. Correct Mounting 2. Defects 3. Dimensions	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---				
			MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---				
			MA	Measurement	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---				
2.3	Interconnection – Sensor to Electronic unit	Correctness of Interconnection	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---				
2.4	Interconnection – Pneumatic unit / Electronic unit and output / Local indicator.	Correctness of Interconnection	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	---				
												Compliance verification report by BHEL			

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THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER												QUALITY PLAN NO.: PE-QP-999-145-1001			
												VOLUME IIB			
												SECTION 03			
												REV. NO. 00			
												DATE: 12.10.99			
												SHEET 5 OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
3.0	Complete Transmitter	1. Workmanship	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1		---			
		2. Dimension	MA	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1		---			
		3. Type / Model	CR	Visual	10%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1		---			
		4. Range	CR	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1		---			
		5. Calibrated Range	CR	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1		---			
		6. Local Indicator / Scale marking	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1		---			
		7. Process connection type	CR	Measurement	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1		---			
		8. Wetted parts material	MA	Analysis (Chemical, Mechanical)	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2		---	1			
		9. Mounting bracket type	MA	Visual / Dimension	10%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1		---			
		10. Calibration	CR	Electrical / Pneumatic	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report / Log Book	2	1		---			
		11. Soaking	CR	Electrical	100%	BHEL Spec.	BHEL Spec.	Inspection report / Log Book	2	1		---			


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STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER															QUALITY PLAN NO.: PE-QP-999-145-1001							
															IIB							
															SECTION C-3							
															REV. NO. 00				DATE: 12.10.99			
															SHEET 6				OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks										
									P	W	V											
3.2	Acceptance Tests	1. Accuracy	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1											
		2. Repeatability	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1											
		3. Dead Band	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1											
		4. Hysteresis	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1											
		5. HV & IR	CR	Electrical	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	1	1											
		6. Linearity	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1											
		7. Supply voltage variation effect	CR	Electrical	100%	BHEL Spec.	BHEL Spec.	Inspection report	2	1	1											
		8. Temperature variation effect over range	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Inspection report	2	1	1											
		9. Over range	CR	Electrical	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	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 or their agent
 2 - Vendor
 3 - Sub-vendor

 PEM :: C&I		STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER										QUALITY PLAN NO.: PE-QP-999-145-1001 VOLUME IIB SECTION 03 REV. NO. 00 SHEET 7 OF 7 DATE: 12.10.99			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
3.3	Type Test	1. Surge withstand capability	CR	Elect. & Mech	1 / Type	ANSI-C.37	ANSI-C.37	Inspection Report	3	---	2,1				
		2. Radio frequency interference	CR	Elect. & Mech	1 / Type	ANSI-C.37	ANSI-C.37	Inspection Report	3	---	2,1				
		3. Vibration effect	CR	Elect. & Mech	1 / Type	BHEL Spec.	BHEL Spec.	Inspection Report	3	---	2,1				
		4. Electro Magnetic field effect	CR	Elect. & Mech	1 / Type	BHEL Spec.	BHEL Spec.	Inspection Report	3	---	2,1				
		5. Degree of protection	CR	Mech. & Elect.	1 / Type	IS:2147	BHEL Spec.	Inspection Report	3	---	2,1				
		6. Explosion proofness (If applicable)	CR	Mech. & Elect.	1 / Type	IS:2148	BHEL Spec.	Inspection Report	3	---	2,1				
		7. Dry Heat	CR	Thermal	1 / Type	IS:9000	ANSI-C.37	Inspection Report	3	---	2,1			85 Deg. C for 16 Hrs.	
		8. Damp Heat	CR	Thermal	1 / Type	IS:9000	ANSI-C.37	Inspection Report	3	---	2,1			40 Deg. C; 6 cycle	
4.0	Packing	1. Packing Material	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	2				
		2. Packaging and Marking	MA	Visual & Measurement	100%	Manufacturer standard	Manufacturer standard	Log Book	2	---	2				

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 V - Agency Verifying the Test.


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 2 - Vendor
 3 - Sub-vendor

STANDARD QUALITY PLAN FOR LEVEL GAUGES											
 PEM : C&I		QUALITY PLAN NO.: PE-QP-999-145-1028 VOLUME IIB SECTION 03 REV. NO. 00 DATE: 01.11.2000 SHEET 1 OF 2									
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$ P W V	Remarks	
1.0	Material / Components										
1.1	Body, Cover, Interns, Flanges, Gaskets	1. Physical, Chemical Properties 2. Workmanship, finish and dimensions	MA	Physical, Chemical Test Visual, Measurement	One Sample from each lot 100%	Approved drg. / data sheet / BHEL Spec. Manufacturing standards / drgs.	Approved drg. / data sheet / BHEL Spec. Manufacturing standards / drgs.	Test Certificate Inspection Report / Log Book	3/2 3/2	2, 1# 2, 1# # Compliance certificate to be verified.	
1.2	Glass Tube	Strength, Transparency, dimensions	MA	Toughness & Thermal shock, Visual, Measurement	one sample from each lot 100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Test Certificate/ Inspection Report	3 ---	2, 1#	
2.0	Assembly	1. Marking – Tag No., Model, Range 2. Workmanship 3. Scale graduation 4. Glass Opaque painting 5. Dimensions and end connections	MA	Visual Visual Visual Visual Measurement	100% 100% 100% 100% 100%	- do - - do - - do - - do - - do -	- do - - do - - do - - do - - do -	Inspection Report - do - - do - - do - - do -	2 2 2 2 2	1 1 1 1 1 For Reflex type	
3.0	Routine Test	1. Calibration 2. Hydro Test	CR	Measurement Measurement	100% 100%	- do - - do -	- do - - do -	- do - - do -	2 2	1** 1 **10% quantity with minimum of 1 piece / type & size	
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics										\$ P W V	1 - BHEL 2 - Vendor 3 - Sub-vendor


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

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

1 - BHEL
2 - Vendor
3 - Sub-vendor

		STANDARD QUALITY PLAN FOR LEVEL GAUGES										QUALITY PLAN NO.: PE-QP-999-145-1028			
												IIB			
												SECTION 03			
												REV. NO. 00			
												DATE: 01.11.2000			
												SHEET 2 OF 2			
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				
4.0	Painting	Shade & Finish	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report	2	1**	1				
5.0	Packing	Soundness	MA	Visual	100%	- do -	- do -	- do -	2	--	--				


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

 PEM :: C&I		STANDARD QUALITY PLAN FOR TEMPERATURE GAUGE AND THERMOWELL										QUALITY PLAN NO.: PE-QP-999-145-1027											
		VOLUME IIB		SECTION 6.3		REV. NO. 01		DATE: 16-05-2007		SHEET 1 OF 4		Agency \$											
		P		W		V		P		W		V											
		Acceptance Norms		Reference documents		Extent of Check		Type/Method of Check		* Category		Characteristics Checked		Component / operation		Sl. No.							
1.0 Raw Material / Component																							
1.1		Capillary Bulb and Thermowell		1. Chemical composition		CR		Chemical analysis		one sample/ lot		BHEL spec. / approved data sheet		Relevant raw material std.		Test report		3/2		2,1		Relevant compliance certificate to be verified by BHEL	
		2. Marking,		MA		MA		Visual		100%		BHEL spec. / Mfr. Standard		BHEL spec. / Mfr. Standard		Log Book		2		---			
		3. Dimensions		MA		MA		Measurement		100%		BHEL spec. / approved doc		BHEL spec. / approved doc		Log Book		2		---			
1.2		Casing and Bezel		1. Material		MA		Chemical analysis		Sample		BHEL spec.		BHEL spec.		Test report		3/2		2,1		Relevant compliance certificate to be verified by BHEL	
		2. Defects		MA		MA		Visual		100%		Mfr. Standard		Mfr. Standard		Log Book		2		---			
		3. Dimension		MA		MA		Measurement		Sample		BHEL spec. / approved doc.		BHEL spec. / approved doc.		Log Book		2		---			
		4. Threading		MA		MA		Thread matching		100%		-----do-----		-----do-----		Log Book		2		---			
1.3		Dial		1. Size, range, scale length, least-count, spacing and graduation.		MA		Measurement and Visual		Sample		BHEL spec.		BHEL spec.		Log Book		2		---			
		2. Colour		MA		MA		Visual		100%		BHEL spec.		BHEL spec.		Log Book		2		---			
		3. Resistance to dry heat and hot water		MA		MA		Oven & Bath		Sample		Mfr. Standard		Mfr. Standard		Test report		3/2		---			

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 MI - Minor characteristics

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 V - Agency Verifying the Test.


1 - BHEL
 2 - Vendor
 3 - Sub-vendor

 PEM :: C&I		STANDARD QUALITY PLAN FOR TEMPERATURE GAUGE AND THERMOWELL						QUALITY PLAN NO.: PE-QP-999-145-4027					
		Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$ P W V		
		VOLUME IIB SECTION 63 REV. NO. 01 DATE: 16-05-2007 SHEET 2 OF 4											
1.4	Complete sensing element	1. Correct assembly and workmanship. 2. Dimensions 3. Welding & other defects	MA MA MA	Visual Measurement Visual	100% 100% 100%	Mfr. Standard drawing Mfr. Standard drawing Mfr. Standard	Mfr. Standard drawing Mfr. Standard drawing Mfr. Standard	Log Book Log Book Log Book	2 2 2	---	---	---	BHEL to witness 10 % random samples. ⊕ IBR cert. wherever specified to be verified. BHEL to witness 10% samples.
1.5	Thermowell ⊕	1. Dimensions of wall thickness, concentricity of bore OD & Length. 2. Leak Test 3. Threading	MA CR MA	Measurement Hyd. test at 1.5 times of design pressure. Thread matching	100% 100% 100%	BHEL spec. / approved data sheet / Drg. BHEL spec. / approved data sheet / Drg. BHEL spec. / approved data sheet / Drg.	BHEL spec. / approved data sheet / Drg. BHEL spec. / approved data sheet / Drg. BHEL spec. / approved data sheet / Drg.	Log Book Inspection report Inspection report	2 3/2 2	1 2,1 2,1	1 1 1		
2.0	Final Inspection												
2.1	Assembly	1. Correct assembly, workmanship and finish	MA	Visual	100%	BHEL spec. / approved data sheet	BHEL spec. / approved data sheet	Inspection report	2	1	---		

LEGEND: * CR - Critical characteristics
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MI - Minor characteristics

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

1 - BHEL
2 - Vendor
3 - Sub-vendor

 STANDARD QUALITY PLAN FOR TEMPERATURE GAUGE AND THERMOWELL		QUALITY PLAN NO.: PE-QP-999-145-1027										
		VOLUME IIB										
		SECTION 2.3										
		REV. NO. 01 DATE: 16-05-2007										
SHEET 3 OF 4												
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
		2. Mounting and connection	MA	Visual and measurement	100%	-----do-----	-----do-----	Inspection report	2	1	---	
		3. Dial Scale	MA	Visual	100%	-----do-----	-----do-----	Log Book	2	1	---	
		1. Cleanliness	MA	Visual	100%	-----do-----	Free from scratches, dirt etc.	Log Book	2	---	2	
		5. Marking (S.No., Tag No.)	MA	Visual	100%	BHEL spec. / approved data sheet	BHEL spec. / approved data sheet	Log Book	2	1	---	
2.2	Routine Test	1. Accuracy	MA	Measurement	100%	BHEL spec. / Approved data Sheet.	BHEL spec. / Approved data Sheet.	Test Report	2	1	1	BHEL to witness 10% random Samples.
		2. Overload	CR	Measurement	10%	125% of FSD for range upto 400 Deg. C. 110% of FSD for range between 400 to 500 Deg. C. 100% of FSD for range above 500 Deg. C.	No Damage	Test Report	2	1	---	


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 V - Agency Verifying the Test.

1 - BHEL
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 3 - Sub-vendor


THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

STANDARD QUALITY PLAN FOR TEMPERATURE GAUGE AND THERMOWELL

STANDARD QUALITY PLAN FOR TEMPERATURE GAUGE AND THERMOWELL										QUALITY PLAN NO.: PE-QP-999-145-1027							
<div><div>PEM :: C&I</div></div>										VOLUME IIB							
										SECTION 03							
										REV. NO. 01		DATE: 16-05-2007					
										SHEET 4		OF 4					
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks					
		3. Response Time	MA	Measurement	10%	ASME PTC19.3	ASME PTC19.3	Test Report	2	1	1	BHEL to witness 10% random samples.					
2.3	Type Test	1. Ambient temperature compensation 0-60 Deg. C	MA	Measurement	Sample	Bulb at constant temp. & case temp varied 0-60 Deg. C	No variation in measurement	Test Certificate	2	---	1	Existing test certificate (Not more than 5 year old) shall be furnished.					
		2. Weather proofness	CR	Measurement	Sample	BHEL spec. / Approved data sheet.	BHEL spec. / Approved data sheet.	Test Certificate	3/2	--	1	---					
3.0	Packing	Soundness of packing	MA	Visual	100%	BHEL Spec.	BHEL Spec.	Log Book	3/2	2	---	Refer Note-1					

Note: 1. In the absence of BHEL specification for painting, vendor to obtain BHEL's approval on their painting specification / procedure.

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

STANDARD QUALITY PLAN FOR TEMPERATURE SWITCH													
 PEM :: C&I		QUALITY PLAN NO.: PS-QP-999-145-1032 VOLUME IIB SECTION 03 REV. NO. 00 DATE: 02.11.2000 SHEET 1 OF 2											
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks	
									P	W	V		
1.0	Material / Components												
1.1	Casing, Sensing Element and Thermowell	1. Physical, Chemical Properties 2. Workmanship, finish and dimensions Contact type & no.	MA	Physical, Chemical Test	One Sample from each lot 100%	Approved drg. / data sheet / BHEL Spec. Manufacturing standards / drgs.	Approved drg. / data sheet / BHEL Spec.	Test Certificate	3/2	---	2.1#	# Compliance certificate to be verified.	
1.2	Switch		MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report / Log Book	3	---	2.1#		
2.0	Assembly	1. Marking – Tag No., Model, Range 2. Workmanship 3. Scale graduation 4. Dimensions and end connections	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	- do -	Inspection Report	2	1	---		
			MA	Visual	100%	- do -	- do -	- do -	2	1	---		
			MA	Visual	100%	- do -	- do -	- do -	2	1	---		
			MA	Measurement	100%	- do -	- do -	- do -	2	1**	1	**25% quantity with minimum of 1 piece / type & size	
3.0	Routine Test	5. Switch – contact type & nos. 1. Calibration, accuracy, repeatability, overload, set point adjustment, differential	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report	2	1**	1		
			CR	Measurement	100%	- do -	- do -	- do -	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.		

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

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

1 - BHEL
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3 - Sub-vendor


STANDARD QUALITY PLAN FOR TEMPERATURE SWITCH												QUALITY PLAN NO.: PS-QP-999-145-I032							
												IIB							
												VOLUME							
												SECTION 3							
												REV. NO. 00							
												DATE: 02.11.2000							
												SHEET 2 OF 2							
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								
4.0	Type Test	2. HydroTest	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec.	No Leakage	Inspection Report	2	1**	1								
		3. IR, HV	CR	Measurement	100%	- do -	Approved drg. / data sheet / BHEL Spec.	- do -	2	1**	1								
		1. Enclosure Protection Class (weather proof-ness, explosion proof-ness, etc.)	CR	Verification	Each type	- do -	- do -	Test Certificate	2	---	1*	•Type Test Certificate to be verified							
		2. Ambient temperature compensation (0 - 60°C)	CR	Verification	Each type	- do -	- do -	- do -	2	---	1*								
		3. Switch contact rating	CR	Verification	Each type	- do -	- do -	- do -	2	---	1*								
5.0	Painting	Shade & Finish	MA	Visual	100%	- do -	- do -	Inspection Report	2	1**	1								
6.0	Packing	Soundness	MA	Visual	100%	- do -	- do -	- do -	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			

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


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

1 - BHEL
2 - Vendor
3 - Sub-vendor

THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

 PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										QUALITY PLAN NO.: PE-QP-999-145-1056 VOLUME IIB SECTION C-3 REV. NO. 01 DATE: 18-05-2007 SHEET 1 OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency's			Remarks			
									P	W	V				
INCOMING															
1.0	Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	3	---	2				
		2. Bend Test	CR	Mech. test	Sample	IS:1079 IS:513	IS:1079 IS:513	Log Book	2	---	---				
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---				
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---	---				
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---	---				
		6. Mill marking	MA	Visual	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---	1				
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	IS:2062	IS:2062	Log Book	2	---	---				
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---				
		3. Straightness	MA	Measurement	100%	Factory Std.	Factory Std.	Log Book	2	---	---				
		4. Mill marking	MA	Visual	100%	IS:2062	IS:2062	Log Book	2	---	1				
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---				
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---				


LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics	\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.	1 - BHEL 2 - Vendor 3 - Sub-vendor
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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL												
 PEM :: C&I		QUALITY PLAN NO.: PE-QP-999-145-1056										
		VOLUME IIB										
		SECTION C3										
		REV. NO. 01 DATE: 18-05-2007										
		SHEET 2 OF 7										
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks
									P	W	V	
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc.	3. Conductor a) Resistance b) Size c) Sheet colour	MA MA MA	Electrical Measurement Visual	100% 100% 100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---	
		4. Type / Routine Test Certificates	MA	Verification	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	3	---	2	
		1. Verification at make and Type	CR	Visual	Sample	BHEL Spec. and BOM	BHEL Spec. and BOM	Log Book	2	---	---	
		2. Verification of Test Certificates	CR	Scrutiny of Type / Routine T.Cs.	100%	Relevant IS	Relevant IS	Log Book	2	---	---	
		3. Operation / Functional check	CR	Electrical	Sample+ 100% @	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	+ for relay & contactors only
		4. I.R.	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	@ for all components except relays & contactors.
		5. H.V.	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	
		6. Calibration	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	1	
		7. Pick up / Drop off Voltage	MA	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	2	---	---	
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												

THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL												QUALITY PLAN NO.: PE-QP-999-145-1056			
												VOLUME IIB			
												SECTION 3			
												REV. NO. 01			
												DATE: 18-05-2007			
												SHEET 3 OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make 2. Surface defects 3. IR / HV on Terminal Blocks	MA MA MA	Visual Visual Electrical	Sample Sample Sample	BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue BHEL Spec. & Mfrs. Catalogue	Log Book Log Book Log Book	2 2 2	--- --- ---	--- --- ---				
IN PROCESS															
6.0	Blanking / Bending / Forming	1. Dimensions 2. Surface defects after bending	MI MA	Measurement Visual	100% 100%	Approved Mfr. drgs. Factory Standard	Approved Mfr. drgs. Factory Standard	Log Book Log Book	2 2	--- ---	--- ---				
7.0	Nibbling / Punching	1. Cutout Sizes 2. Deburring	MI MA	Measurement Visual	100% 100%	Approved Mfr. drgs. Approved Mfr. drgs.	Approved Mfr. drgs. Approved Mfr. drgs.	Log Book Log Book	2 2	--- ---	--- ---				
ASSEMBLY															
8.0	Frame Assembly & Sheet fixing	1. Dimensions 2. Alignment 3. Welding Quality 4. Surface defects	MA MA MA MA	Measurement Measurement Visual Visual	100% 100% 100% 100%	Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards Approved drg. / Mfr. Standards	Log Book Log Book Log Book Log Book	2 2 2 2	--- --- --- ---	2 2 2 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															

THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										QUALITY PLAN NO.: PE-QP-999-145-J056 VOLUME IIB SECTION 03 REV. NO. 01 DATE: 18-05-2007 SHEET 4 OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
9.0	Pre-treatment and Painting	1. Pretreatment Process	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1				
		2. Process parameters like bath temp. concentration etc.	MA	Measurement	Periodic	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1				
		3. Dipping / Removal Time	MA	Measurement	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1				
		4. Surface quality after every dip	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1				
		5. Primer after phosphating	MA	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1				
		6. Putty Application & Rubbing after primer	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1				
		7. Paint first coat	MA	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1				
		8. Putty Application and Rubbing after first coat of paint	MA	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1				
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	2	---	1				
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics															
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1 - BHEL 2 - Vendor 3 - Sub-vendor															

 PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										QUALITY PLAN NO.: PE-QP-999-145-I056 VOLUME IIB SECTION 3 REV. NO. 01 DATE: 18-05-2007 SHEET 5 OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
10.	Panel Wiring	1. Wiring Layout 2. Wiring Termination (Crimped Lugs) 3. Ferrule numbers 4. Colour of wiring 5. Size of Conductor	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---				
			MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---				
			MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---				
			MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1				
			MA	Measurement	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1				
11.	Component Mounting	1. Correct components 2. Fixing	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---				
			MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---				
12.	FINAL Final Inspection	1. Workmanship 2. Component layout (neatness, accessibility & safety) 3. Components identification Marking / Name plates	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1				
			MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.			
			MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1				

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													IIB			
													SECTION C3			
													REV. NO. 01 DATE: 18-05-2007			
													SHEET 6 OF 7			
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks				
									P	W	V					
	4	Mounting / Proper fixing of all components	MA	Visual	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.				
	5.	Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1					
	6.	Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1					
	7.	Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1					
	8.	Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1					
	9.	Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1					
	10.	Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1					
	11.	Wire Termination	MA	Pulling manually	Sample	----	Firm termination	Inspection Report	2	1	1					
	12.	Continuity	MA	Electrical	100%	----	Continuity OK	Inspection Report	2	1	1					

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 PEM :: C&I		STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL										QUALITY PLAN NO.: PE-QP-999-145-J056					
		Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
												VOLUME IIB	SECTION 03	REV. NO. 01	DATE: 18-05-2007		
												SHEET 7	OF 7				
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	Type Test Certificate	3	--	1						
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant IS.	BHEL approved spec., drg., BOM & relevant IS.	Test Report	2	1	1						
15	FUNCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1						
		2. Instrument Calibration	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1						
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec./drg. & relevant IS.	BHEL approved spec./drg. & relevant IS.	Inspection Report	2	1	1						

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TITLE:
**TECHNICAL GENERALATION FOR
CW CHEMICAL TREATMENT SYSTEM.
2X800 MW YERMARUS STPP**

BHEL DOCUMENTS NO.: PE-TS-362-156-A001.

VOLUME **II-B**

SECTION -D

REV. NO. 01

DATE:10/03/2013

GENERAL TECHNICAL REQUIREMENT

D1: GENERAL TECHNICAL REQUIREMENTS FOR MECHANICAL

D2: GENERAL TECHNICAL REQUIREMENTS FOR ELECTRICAL

D3: GENERAL TECHNICAL REQUIREMENTS FOR C&I



TITLE:

**TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT SYSTEM.**

2X800 MW YERMARUS STPP

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SECTION -D1

REV. NO. 01

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GENERAL TECHNICAL REQUIREMENT-MECHANICAL

BHEL - PS - PPEI: NOIDA, SECTOR-16A, U.P. - 201301



TITLE:

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VOLUME **II-B**

SECTION -D1

REV. NO. 01

DATE: 10/03/2013

1.0 DESIGN PHILOSOPHY:

The treatment shall be designed to minimize the formation of scale and build up of micro – organisms, and prevent fouling, and corrosion of the turbine, condenser and other heat exchanger.

To inhibit scale formation in the CW system it is proposed to dose Sulphuric acid to convert calcium and magnesium bicarbonates into sulphates, which have higher solubility in water. Scale/Corrosion inhibitor and Biocide and H₂SO₄ dosing Systems have been designed to dose required quantity of chemical to maintain CW quality at CW fore bay.

Sulphuric acid will be unloaded from road tankers through unloading pumps.

Scale inhibitor and corrosion inhibitor are a proprietary chemicals and level of its dosage in CW & ACW depends upon the plant operation.

Biocide will be dosed manually (using storage tank with gravity flow) for shock treatment.

2.0 PLANT OPERATION AND CONTROL

The operation of the Circulating Water Treatment Plant will be manual from Relay Based Local Control Panel (LCP) located in Cooling Water pump house. This is a standalone relay based system and there is no interface with DDCMIS. All the analog signals are terminated at LCP and conversion of binary signals shall be at LCP only with suitable arrangements without interference with DDCMIS. All the arrangement required for the same is also in bidder's scope.

The Control Panel for Circulating Water Treatment Plant will be provided for Sulphuric Acid Injection Plant, Scale Inhibitor Injection Plant/Corrosion Inhibitor Injection Plant, Biocide dosing system and Bio Dispersant dosing system. The local control panel houses the following.

- a) Status of all the equipment of Cooling water treatment plant. The status includes ON, OFF, TRIP indication of respective motor / pump/agitator.
- b) Hardwired annunciation for pump trip, level low ,high level,pH indication etc. with adequate number of windows.
- c) Push button for start / stop of pumps, etc.
- d) Pump stroke indicator with local/remote stroke adjustment facility.
- e) Local push button stations for all motor drives.
- f) LED (Seven Segment type) indicators for Analog signals.

The entire Cooling water treatment plant shall be controlled from one number LCP.

All drive motors shall be provided with arrangement of local starting and stopping. Local starting shall be possible through remote/local selector switch in Control Panel. Tripping of drive motors locally shall be permissible irrespective of position of remote/local selector switch. Provision for locking the local stop push buttons after tripping the motor from local push button shall be there.

Annunciation panel showing tripping of different motors, level alarms from level transmitters (ultra sonic type) shall be located in the Control Panel.

The operation of Sulphuric Acid Injection Pumps shall be auto, remote manual and local manual. In the auto mode, the stroke shall be adjusted by sensing pH of Circulating Water. During normal operation, Sulphuric Acid Injection Pumps will operate in the auto-mode and inject sulphuric acid to maintain the pH of circulating water at a desired level so that scale deposition or corrosion can be avoided. Adjustment of stroke shall also be possible manually from Control Panel as well as local manually.

The operation of Scale Inhibitor Injection system shall be local manual from LCP.

The operation of Corrosion Inhibitor Injection system shall be local manual from LCP.

The operation of Biocide & Bio dispersant Injection system shall be local manual from LCP.

Monitoring equipment with reference to scale formation, corrosion and biological growth will be provided to supervise the performance of the treatment Plants.

All effluents from Sulphuric Acid storage tank and Injection area will pass through a lime pit for neutralization before discharging into plant drain.

Pressure switches (PS) shall be provided at the common discharge header of all pumps for auto start of stand by pumps.

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4.0 CODES AND STANDARDS:

Design, manufacture, inspection, testing and performance of all equipment shall conform to codes and standards as specified in the Specification under section -C and Data Sheet - A. Contractor shall strictly adhere to the requirement.

The Cooling water treatment plant along with all associated piping and systems shall be designed, manufactured, inspected, tested, to well established engineering practices and safety codes of the latest applicable Indian/American standards. Design, manufacture, inspection and testing of the equipment shall unless otherwise specified, conform to the latest edition of the codes and standards

ASME Sec VIII Div I	:	Boiler and Pressure vessel code
IS : 9222 Part 1	:	Recommendations for handling and dosing devices for chemicals for water requirement
IS : 3025	:	Methods of sampling and test for water
ASME B 31.1	:	Power Piping
ASME B 36.19	:	Stainless steel pipe
IS : 803	:	Code for design ,fabrication and erection of cylindrical welded storage tanks.
ASME B16.10	:	Welded and seamless wrought steel pipe
ASME B 16.34	:	Valves : flanged ,threaded and welding ends
ASME B 16.5	:	Pipe flanges and flanged fittings
API 675	:	Testing code/ standard for metering pumps

5.0 DESIGN AND CONSTRUCTION REQUIREMENT:

Design requirement and construction features of various equipments shall be as under and Specific requirements shall be as per Section 'C' and Data Sheet - A.

5.1 TANK:

- 5.1.1 It is for preparation of chemical solution and storage of prepared chemical solution for feeding it to the system. Nos. of tanks and their material of construction shall be as per Data Sheet A and P&I diagram.
- 5.1.2 It shall be of cylindrical construction having a cover and dished ends. The cover shall be of bolted type. In case of tank handling solids chemicals cover shall be provided with a hinged opening and also a dissolving basket to be provided in the tank.
- 5.1.3 Each tank shall be provided with inlet (tangential / from top), outlet, drains, vent and overflow nozzles. Each preparation tank shall also be provided with a nozzle with suitable funnel for pouring liquid chemicals. Outlet nozzle shall be at least 25 mm from side of tank (as indicated in P&ID), over flow pipe shall be made in U-shape or lowered inside up to the bottom of tank so that it does not act as vent line.
- 5.1.4 Motorised stirrer of suitable design shall be provided for the systems as mentioned in Data Sheet-A, to prepare a homogeneous solution in the tank.
- 5.1.5 A breather of suitable design shall be provided in the vent line, as the solution level in the tank goes down which absorb gases from air and free of oxygen air goes in to the tank. Material of construction of breather shall SS304.
- 5.1.6 Design code of Horizontal storage tanks is BS 2594 or equivalent and design code for vertical storage tanks is IS 803 or equivalent.

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5.2 METERING PUMPS:

- 5.2.1 It shall meter and feed chemical solution with a high degree of accuracy under any discharge pressure variation.
- 5.2.2 It shall be of positive displacement, plunger type, and variable stroke with electric motor drive through suitable gear box.
- 5.2.3 There shall be provision for adjustment of the stroke length from 0-100% range even while pump is in operation so as to achieve a step less variation of capacity over entire range of operation. Stroke adjustment shall be as specified in section-C & Data Sheet-A. Indication scale for stroke position shall be provided for this purpose. There shall be provision to set and lock the capacity of the pump.
- 5.2.5 Each pump shall be provided with a relief valve which may be built-in or external recirculating type, mounted suitably on the discharge of pump.
- 5.2.6 Each pump shall be provided with isolating valves in suction and discharge as indicated in drawing.
- 5.2.7 Suitable flushing arrangement shall be provided for each pump.
- 5.2.8 Isolation valve for Y-type strainer shall be provided as indicated in P&ID.
- 5.2.9 The material of constriction of strainer for H₂SO₄ handling system is carbon steel. For rest of the systems (Scale/corrosion inhibitor dosing system, bio dispersant dosing system) the material of constriction of each strainer will be SS316.

6.0 INSPECTION / TEST:

- 6.1 All the tests and inspection shall be as per enclosed BHEL Quality Plan.

7.0 SPECIAL TOOLS:

- 7.1 A complete unused set of all special tools and tackles (if any) for maintenance of all the equipments / system covered in this specification shall be supplied.

8.0 PAINTING: -

All equipment including pumps, motors piping supports tanks etc. shall be painted to the specification to be prepared by the bidder and approved by the purchaser.

9.0 PACKING & TRANSPORTATION:

All equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials, the limitations from the point of view of availability of railway wagon sizes in India should be taken into account. The Contractor shall be responsible for any loss or damage during transportation, handling and storage due to improper packing.

10.0 PIPING & VALVES SPECIFICATION

- a) All piping system shall be designed for withstanding the maximum specified pressure and temperature. The minimum thickness requirement shall be adhered to.
- b) The piping system, fittings and accessories shall conform to high standards of engineering, design, workmanship and be capable of performing in continuous commercial operation.
- c) The pipe shall be sized for the following maximum velocities as a general guidance. The pipe sizing shall be done considering individual system requirements and pressure drop calculations and velocity in m/s.

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Description	Velocity
Pump suction	0.5 to 1.5 m/s
Pump Discharge	1.0 to 3.0 m/s

d) Material of construction for pipes and fittings

Description	Material Standard (Refer enclosed sketches)	Dimension Standard
Pipes		
i) For Corrosion/scale inhibitor & Bio dispersant dosing system	ASTM A 312 TP 304	ASME B 36.19
ii) For Acid dosing system	ASTM A 106 Gr B	ANSI B 36.10
Fittings for Corrosion/scale inhibitor & Bio dispersant system Up to 50 NB	ASTM A182F 304	ASME B 16.11
Fittings For Acid dosing system Up to 50 NB	ASTM A 105	ASME B 16.11
Above 65 NB	ASTM A 234 Gr WPB	ASME B 16.9

Notes:

- Any change w.r.t Data sheet A above if found necessary during detailed engineering shall be subject to BHEL/ Customer approval. Any change in the Data Sheet-A during detailed engineering shall be fully adhered to without any commercial & delivery implication.
- Final list of sub-vendor shall be prepared by vendor BASED ON APPROVED VENDOR LIST ENCLOSED IN THIS SPECIFICATION and shall be submitted to BHEL/CUSTOMER for FINAL approval during detail engineering.
- All Quality Plans/check list as applicable shall be submitted to BHEL/CUSTOMER for approval. All comments as given by CUSTOMER/BHEL shall be taken care of by VENDOR without any commercial & delivery implication.
- Service water line shall be provided at one point at 20 meters from Cooling water treatment plant area. All further piping wherever required shall be taken care by Vendor.



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**TECHNICAL SPECIFICATION FOR
HORIZONTAL CENTRIFUGAL PUMPS**



TITLE:
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1.00.0 SCOPE

1.01.0 This specification covers the design, material, construction features, manufacture, inspection, testing the performance at the Vendor's/Sub-Vendor's Works and delivery to site of Horizontal Centrifugal Pumps.

2.00.0 CODES AND STANDARDS

2.01.0 The design, material, construction, manufacture inspection and performance testing of Horizontal Centrifugal Pumps shall comply with all currently applicable statutes, regulations and safety codes in the locality where the Equipment will be installed. Nothing in these specifications shall be construed to relieve the Vendor of this responsibility. The Equipment supplied shall comply with the latest applicable Indian Standards listed below. Other National Standards are acceptable, if they are established to be equal or superior to the Indian Standards.

2.02.0 List of Applicable Standards.

1	IS : 6595	Horizontal Centrifugal Pumps for clear cold fresh water.
2	IS : 5120	Technical requirements of roto dynamic special purpose pumps.
3	API : 610	Centrifugal pumps for general refinery service.
4	IS : 5639	Pumps Handling Chemicals & corrosion liquids.
5	IS : 5659	Pumps for process water.
6	HIS	Hydraulic Institute Standards, USA
7	ASTM-1-165-65	Standards Methods for Liquid Penetration Inspection.

2.03.0 In case of any contradiction with aforesaid standards and the stipulations as per the technical specifications as specified hereinafter the stipulations of the technical specifications shall prevail.

3.00.0 DESIGN REQUIREMENTS

3.01.00 The Pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the HQ characteristics curve over the operating range of 40% to 120% of the duty point. The maximum efficiency of pump shall be preferably be within +/- 10% of the rated design flow as indicated in the data sheets. The capacity & head of each pump will be selected with 20% over all margin.

3.02.00 The total head capacity curve shall be continuously rising from the operating point towards shut-off without any zone of instability and with a minimum shut-off head of 15% more than the design head.

3.03.00 Pumps of a particular category shall be identical and shall be suitable for parallel operation with equal load division. The head Vs capacity and BHP Vs capacity characteristics should match to ensure even load sharing and trouble free operation throughout the range. Components of identical pumps shall be interchangeable.

3.04.00 Pumps shall run smoothly without undue noise and vibration. Peak to peak vibration limits shall be restricted to the following values during operation:

SPEED	Antifriction Bearing	Sleeve Bearing
1500 rpm and below	75.0 micron	75.0 micron
3000 rpm	50.0 micron	65.0 micron



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- 3.05.00 The noise level shall not exceed 80 dBA. Overall sound pressure level reference 0.0002 microbar (the standard pressure reference for air sound measurement) at a distance of 1 M from the equipment.
- 3.06.00 The pumps shall be capable of starting with discharge valve fully open and close condition. Motors shall be selected to suit to the above requirements. Continuous Motor rating (at 50 deg.C ambient) shall be atleast ten percent (10%) above the maximum load demand of the pump in the entire operating range to take care of the system frequency variation and no case less than the maximum power requirement at any condition of the entire characteristic curve of the pump.
- 3.07.00 The kW rating of the drive unit shall be based on continuously driving the connected equipment for the conditions specified. However, in cases where parallel operation of the pumps are specified, the actual motor rating is to be selected by the Bidder considering overloading of the pumps in the event of tripping of operating pump(s).
- 3.08.00 Pumps shall be so designed that pump impellers and other accessories of the pumps are not damaged due to flow reversal.
- 3.09.00 The Contractor under this specification shall assume full responsibility in the operation of pump and motor as a unit.

4.00.00 DESIGN CONSTRUCTION

- 4.01.00 Design and construction of various components of the pumps shall conform to the following general specifications. for material of construction of the components, data sheets shall be referred to.

4.02.00 Pump Casing

- 4.02.01 Pump casing shall have axially or radially split type construction. The casing shall be designed to withstand the maximum shut-off pressure developed by the pump at the pumping temperature.
- 4.02.02 Pump casing shall be provided with a vent connection and piping with fittings & valves. Casing drain as required shall be provided complete with drain valves, piping and plugs. It shall be provided with a connection for suction and discharge pressure gauge as standard feature. It shall be structurally sound to provide housing for the pump assembly and shall be designed hydraulically to minimum radial load at part load operation.

4.03.00 Impeller

- 4.03.01 Impeller shall be closed, semi-closed or open type, and it shall be designed in conformance with the detailed analysis of the liquid being handled.
- 4.03.02 The impeller shall be secured to the shaft, and shall be retained against circumferential movement by keying, pinning or lock rings. On pumps with overhung shaft, impellers shall be secured to the shaft by a lockout or cap screw which tightness in the direction of normal rotation.

4.04.00 Impeller/Casing Wearing Rings

- 4.04.01 Replaceable type wearing rings shall be provided at suitable locations of pumps. Suitable method of locking the wearing ring shall be used. Wearing rings shall be provided in pump casing and/or impeller as per manufacturer's standard practice.



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4.05.00 Shaft

4.05.01 The critical speed shall be well away from the operating speed and in no case less than 130% of the rated speed.

4.05.02 The shaft shall be ground and polished to final dimensions and shall be adequately sized to withstand all stresses from rotor weight, hydraulic loads, vibration and torques coming in during operation.

4.06.00 Shaft Sleeves

4.06.01 Renewable type fine finished shaft sleeves shall be provided at the stuffing boxes/mechanical seals. Length of the shaft sleeves must extend beyond the outer faces of gland packing of seal end plates so as to distinguish between the leakage between shaft and shaft sleeve and that past the seals/gland.

4.06.02 Shaft sleeve shall be fastened to the shaft to prevent any leakage or loosening. Shaft and shaft sleeve assembly should ensure concentric rotation.

4.07.00 Bearings

4.07.01 Heavy duty bearings, adequately designed for the type of service specified in the enclosed pump data sheet and for long, trouble free operation shall be furnished

4.07.02 The bearings offered shall be capable of taking both the radial and axial thrust coming into play during operation. In case, sleeve bearings are offered additional thrust bearings shall be provided. Antifriction bearings of standard type, if provided, shall be selected for a minimum life 16,000 hrs. of continuous operation at maximum axial and radial loads and rated speed.

4.07.03 Proper lubricating arrangement for the bearings shall be provided. The design shall be such that the bearing lubricating element does not contaminate the liquid pumped. Where there is a possibility of liquid entering the bearings suitable arrangement in the form of deflectors or any other suitable arrangement must be provided ahead of bearings assembly.

4.07.04 Bearings shall be easily accessible without disturbing the pump assembly. A drain plug shall be provided at the bottom of each bearings housing.

4.08.00 Stuffing Boxes

4.08.01 Stuffing box design should permit replacement of packing without removing any part other than the gland.

4.08.02 Stuffing boxes of packed ring construction type shall be provided wherever specified. Packed ring stuffing boxes shall be properly lubricated and sealed as per service requirements and manufacturer's standards. If external gland sealing is required, it shall be done from the pump discharge. The Bidder shall provide the necessary piping valves, fittings etc. for the gland sealing connection.

4.09.00 Mechanical Seals

4.09.01 Wherever specified in pump data sheet, mechanical seals shall be provided. Unless otherwise recommended by the tenderer, mechanical seals shall be of single type with either sliding gasket or bellows between the axially moving face and shaft sleeves or any other suitable type. The sealing faces should be highly lapped surfaces of materials known for their low frictional coefficient and resistance to corrosion against the liquid being pumped.

4.09.02 The pump supplier shall coordinate with the seal maker in establishing the seal chamber of circulation rate for maintaining a stable film at the seal face. The seal piping system shall form an integral part of the pump assembly. For the seals under vacuum service, the seal design must ensure sealing against atmospheric pressure even when the pumps are not operating. Necessary provision for seal water supply along with



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complete piping fittings and valves as required shall form integral part of pump supply.

4.10.00 Pump Shaft Motor Shaft Coupling

4.10.01 The pump and motor shafts shall be connected with an adequately sized flexible coupling of proven design with a spacer to facilitate dismantling of the pump without disturbing the motor. Necessary coupling guards shall also be provided.

4.11.00 Base Plate

4.11.01 A common base plate mounting both for the pump and motor shall be provided. The base plate shall be fabricated steel and of rigid construction, suitably ribbed and reinforced. Base plate and pump supports shall be so constructed and the piping unit so mounted as to minimize misalignment caused by mechanical forces such as normal piping strain, internal differential thermal expansion and hydraulic piping thrust. Suitable drain troughs and drip lip shall be provided.

4.12.00 Assembly and Dismantling

4.12.01 Assembly and dismantling of each pump with drive motor shall be possible without disturbing the grouting base plate or alignment.

4.13.00 Drive Motor (Prime Mover)

4.13.01 The kW rating of the drive shall be based on continuously driving the connected equipment for the conditions specified. In case, where parallel operation of the pumps are specified, the actual motor rating is to be selected by the tenderer considering overloading of the pumps in the event of tripping of operating pumps. All the drive motor of each pump will be Energy Efficient-1 as per IS 12615.

5.00.00 TESTING FOR HORIZONTAL CENTRIFUGAL PUMPS

The manufacturer shall conduct all tests required to ensure that the equipment furnished shall conform to the requirements of this specification and in compliance with the requirement of applicable Codes and Standards. The particulars of the proposed tests shall be submitted to the Owner for approval before conducting the tests.

5.01.00 Hydrostatic Tests

All pressure parts shall be hydraulically tested at 200% of pump rated head or at 150% shut off head whichever is higher. The test pressure shall be maintained for 1/2 hr. and no leakage shall be permitted. While arriving at the above pressure, the maximum suction head specified in Data Sheet shall be taken into account.

5.02.00 Performance Tests

- (a.) All the pumps shall be tested in the Manufacture's Works at rated speed for capacity, efficiency and brake horse power. Pumps shall be given running test over the entire operating range covering from the shut off head to the maximum flow. The duration of test shall be minimum one (1) hour. A minimum of seven readings approximately equidistant shall be taken for plotting the curves with one point at design flow. Testing of pumps shall be in accordance with stipulations of Hydraulic Institute Standards or as applicable equivalent
- (b.) The test shall be preferably conducted with the actual motor being furnished.
- (c.) Only those pumps shall be subjected to strip down examination visually to check for mechanical damages after testing at shop in case abnormal noise level and excessive vibration is observed during the performance test. Otherwise strip down examination is limited to bearing inspection only.
- (d.) The pump accessories e.g. the thrust bearing, couplings etc. shall be subjected to tests as per manufacturer's



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standards.

5.03.00 Mechanical Balancing

All rotating components of the pumps shall be statically balanced. In addition to static balancing, rotating components of the pumps shall be balanced dynamically at or near the operating speed. Tenderer shall furnish acceptance norm for this test.

5.04.00 Visual Inspection

Pumps shall be offered for visual inspection by the bidder before shipment. The components of the pumps shall not be painted before inspection.

5.05.00 NPSH Test

NPSH test shall be conducted with water as medium if required. NPSH shall not be mandatory in case type test certificates are furnished for the similar rating of pumps.

5.06.00 Noise and Vibration Measurement

Noise and vibration shall be measured during the performance testing at shop as well as during the site test.

- (a.) The noise level shall not exceed 85 dBA. Noise level measurement will be made as per applicable internationally acceptable standard. The measurement shall be carried out with calibrated integrating sound level meter meeting the requirement of IEC:651 or BS:6051 or IS:9779. Sound pressure level will be measured all round the pump and motor set at a distance of one meter from the nearest surface of the machine and at a height of 1.5 m from the floor level. A minimum of six (6) points should be covered for measurement. The measurement shall be done with a slow response on the A-weighted scale. The average of the A-Weighted sound pressure measurements expressed in decibels to a reference 0.0002 microbars shall not exceed the specified value.

The tests shall be carried out on the machine operating at rated speed and as near as possible to the rated power. Corrections for background noise and correction on account of test environment will be considered in line with applicable standard. For this purpose all the additional data required should necessarily be collected during the test.

- (b) Vibration check will also be done as per HIS. Vibration would be checked at thrust bearing locations on horizontal, radial and vertical direction. The acceptance limits would be as per HIS. The instrument used would be IRD 308 or equivalent with velocity pick-up. Vibration limits to be specified as per the speed of the pump.

5.07.00 Material Test Certificate

- (a) Material of the various pump components shall be tested in accordance with the relevant standards. Test certificates for these shall be furnished for the Owner's approval.
- (b) Where stage inspection is desired by BHEL/customer all material test certificates shall be correlated and verified with the actual material used for construction before starting fabrication by BHEL/customer's inspector who will stamp the material. In case mill test certificate for the material are not available, the supplier shall carry out physical and chemical tests at his own cost from a testing agency, approved by BHEL/Customer, as per the requirement of specified material standard. The sample for physical and chemical testing shall be drawn up in presence of BHEL/Customer's inspector who shall also witness the testing.

5.08.00 Non Destructive Testing

- (a) UT shall be carried out on shafts of diameter more than 50 mm.
- (b) DP tests shall be carried out on shaft and impeller.



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(c) No weld repair shall be allowed on cast iron.

5.08.00 Field Testing

- 5.08.01 After installation, the pumps offered shall be operated to prove satisfactory performance as as individual equipment as well as a system run. If the performance at site is found not to the requirements then the equipment shall be rectified or replaced by the Vendor, at no extra cost to the Owner. The procedure of the above testing will be mutually agreed between the Owner and the contractor. Voice and vibration tests shall also be repeated at site.
- 5.08.02 Based on observation of the trial operation, if modifications and repairs are necessary, the same shall be carried out by the contractor to the full satisfaction of the engineer and then the performance and guarantee tests to be repeated at site as per relevant clauses of the specification.



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TECHNICAL SPECIFICATION FOR

METERING PUMPS



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1.00.0 GENERAL

1.01.01 Specification cover the design, material, construction features, manufacture, inspection, testing the performance at the vendor's/sub-vendor's works, delivery to site, erection, commissioning and testing of metering pumps.

2.00.0 GENERAL DESIGN FEATURES

2.00.01 Pumps shall be simplex positive displacement hydraulically operated diaphragm design, driven by squirrel cage induction motor through suitable speed reduction unit. Maximum pump stroke speed shall not exceed 100 per minute.

2.00.02 The stroke shall be continuously adjustable to give a capacity variation 0-100% range while the pump is running or stopped. Adjustment of capacity shall be done by manual control facility (micrometric adjusting type) to be provided locally for each of the pump. The capacity & head of each pump will be selected with 20% over all margin.

2.00.03 The stroke shall be continuously adjustable to give a capacity variation 0-100% range while the pump is running or stopped. Adjustment of capacity shall be done by manual control facility (micrometric adjusting type) to be provided locally for each of the pump.

2.00.04 Capacity variation may be effected by changing eccentricity of the driving crank or by suitable hydraulic circuit. Pump accuracy shall be industry standard $\pm 1\%$ of capacity setting.

2.00.05 Pumps shall be provided with an integral relief valve, spring operated to release pressure when delivery line blockage occurs.

2.00.06 Crankcase shall be constructed of high quality cast iron, which will also house the gearbox and guides of cross head.

2.00.07 Guided, controlled travel, double-ball check valves or equivalent, shall be provided both on the suction and discharge side.

2.00.08 Material of construction of the various parts shall be as per the details furnished elsewhere in the specification. However all parts coming in contact with acid shall be of Hastelloy 'B' and for alkali it should be of SS-316 only.

2.00.09 Suitable gland seal shall be provided to prevent leakage.

2.00.10 Electric drive motor particulars should follow enclosed electrical chapters.

3.00.00 TESTING**3.01.00 Testing and Inspection at Manufacturer's Works**

3.01.01 The manufacturer shall conduct all tests required to ensure that the equipment furnished conforms to the requirements of this Specification and is in compliance with requirements of the applicable codes. The particulars of the proposed tests and the procedures for the tests shall be submitted to Owner for approval before conducting the tests.

3.01.02 The Owner's representatives shall be given full access to all tests for which the Manufacturer shall inform the Owner allowing adequate time so that if the Owner so desires, his representatives can witness the test.

3.01.03 All materials and castings used for the equipment shall be of tested quality. The test certificates shall be made available to Owner.

3.01.04 The pump casing shall be hydraulically tested at 200% pump operating pressure or 150% of design pressure whichever is higher. The test pressure shall be maintained at least for $\frac{1}{2}$ an hour.



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- 3.01.05 The rotating parts of pump drive shall be subjected to static balancing.
- 3.01.06 All pumps shall be tested at the shop for capacity, volumetric accuracy, repetitive accuracy, power and volumetric efficiency. The tests are to be done according to the requirements of the "Hydraulic Institute" of U.S.A. and Indian Standards as applicable.
- 3.01.07 The pump accessories e.g. gear box, speed reduction unit etc. will be subjected to tests as per manufacturer's standards. The test results shall be furnished to the Owner.
- 3.01.08 The combined variation of the pump and motor should be restricted within limits specified by Hydraulic Institute Standard, USA when the pump operated singly or in parallel.
- 3.01.09 All pumps shall be subject to strip down examination visually to check for mechanical damages after performance testing at shop.
- 3.01.10 Diaphragm of the metering pump shall be type tested as per applicable code/standard.
- 3.01.11 Performance test shall be carried out for the setting of pressure relief valve.
- 3.01.12 Test reports and certificates of all the above-mentioned tests to ensure satisfactory operation of the system shall be submitted to the Owner for approval before dispatch.

3.02.00 Test at Site

After erection at site pumps as detailed under different groups shall be operated to prove satisfactory performance as individual equipment as well as a system. If the performance at site is found to be not to the requirements, then the equipment shall be rectified or replaced by the Vendor at no extra cost to the Owner.



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REV. NO. 01

DATE: 10/03/2013

GENERAL TECHNICAL REQUIREMENT FOR PIPING AND VALVES

BHEL - PS - PPEI: NOIDA, SECTOR-16A, U.P. - 201301



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SPECIFIC PIPING REQUIREMENTS

This Section covers the basic requirements for the all the piping systems, valves and specialities and thermal insulation to be provided for the power plant.

1.0 LINE SIZING

- 1.1 Sizes of pipelines shall be selected such that the velocity of fluid in pipes does not exceed the following limits under conditions of maximum possible volumetric flow:

Steam	
Superheated steam	75 m/s
Saturated steam	40 m/s
Wet steam/Exhaust steam	30 m/s
Water	
Pump suction	1.5 m/s
Pump delivery	3.0 m/s
Boiler feed pump discharge	6.0 m/s
Service/Potable water	1.5 m/s
Oil	
LFO & HFO	2 m/s
Gas	
Compressed air	15 m/s

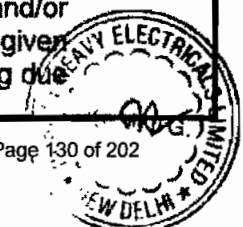
- 1.2 Lower values of velocities than those stated above shall be used to determine line size if dictated by considerations of pressure drop, NPSH, surges, water hammer, etc.
- 1.3 The design flows considered in line sizing shall not be less than the rated capacities of equipment to which the piping is connected such as pumps, blowers, compressors, valves, flow limiting orifices, etc., or, the system heat and/or mass balance diagrams.
- 1.4 Sizes of Boiler feed pump suction piping shall be selected to meet the NPSH requirements of the pumps under transient conditions prevailing on loss of steam supply to feed water tank. Similarly for all pumps, NPSH requirements shall be satisfied in line sizing.

2.0 MATERIALS

The material specifications of pipelines of various systems shall be as specified in Data Sheet - A attached.

3.0 WALL THICKNESS

- 3.1 The calculation of wall thickness required for pipelines subject to internal and/or external pressure shall be based on the formulae and recommendations as given in the applicable codes. Adequate allowances shall be made towards thinning due





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to bending, weakening at branch connections, threading, commercial tolerances on pipe wall thickness, corrosion and erosion, etc. and the same shall be subject to approval by ENGINEER. In any case a minimum corrosion allowance of 1.0 mm shall be considered while selecting the thickness.

- 3.2 In case of carbon steel materials, the nominal wall thickness of pipeline shall be not less than the minimum acceptable values given below:
- 3.3 For power cycle piping, the thickness shall be as per actual thickness calculation to be carried out during detail engineering & shall be subject to owner's approval.

NB mm (inch)	15 (1/2)	20 (3/4)	25 (1)	32 (1 1/4)	40 (1.5)	50 (2)	65 (2.5)	80 (3)	100 (4)	125 (5)
Min Thick mm	3.2	3.2	3.6	3.6	3.6	3.6	3.6	4.0	4.5	5.4
NB mm (inch)	150 (6)	200 (8)	250 (10)	300 (12)	350 (14)	400 (16)	450 (18)	500 (20)	600 (24)	
Min Thick mm	5.4	6.35	6.35	6.35	7.1	7.1	7.1	8.0	8.0	

> NB 600 mm to NB 950 mm - 10.00 mm

> NB 950 mm to NB 1200 mm - 12.00 mm. Sizes of NB 32(1 1/4"), NB 65(2 1/2"), and NB 125(5") shall not be used in the piping system.

4.0 FLEXIBILITY ANALYSIS

- 4.1 Formal flexibility analysis calculations shall be carried out in case of pipelines subjected to restrained thermal expansions or contractions. The following piping systems shall be analysed :

- Pipelines with a maximum operating temperature equal to or greater than 150°C
- Regardless of their operating temperatures, all pipelines connected to sensitive rotating equipment such as turbines, feed pumps etc. for which limiting values of pipe reaction have been specified by the equipment manufacturer
- Any other pipeline which in the opinion of the OWNER/ENGINEER requires a formal analysis.

- 4.2 If it is deemed necessary by the boiler or turbine vendor, a surge analysis shall be carried out by the Contractor to evaluate the effect of closure of valves that are hydrostatically or pneumatically actuated. The pressure rise in the pipeline, additional forces and moments at terminal points and additional stresses shall be calculated. If the stresses or the forces and moments exceed the allowable value, suitable shock absorbers shall be provided by the Contractor.





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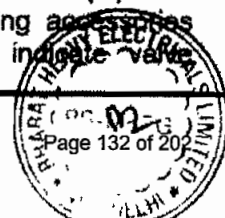
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5.0 LAYOUT AND DETAILING

- 5.1 All pipelines with size greater than NB 50 mm are considered as shop fabricated piping and detailed piping layout drawings shall be prepared for all such pipelines. The drawings shall be to scale and shall be prepared as plan & sections and shall carry the following minimum details:
- 5.1.1 Fully dimensioned layout with locating dimensions referred to plant axis and coordinates
 - 5.1.2 Details of all stub connections and other welded attachments as required for anchors, restraints, hangers supports, etc.
 - 5.1.3 Slope, drains and vents, all vents and drains shall be extended to the nearest drain.
 - 5.1.4 Edge preparation details of weld ends
 - 5.1.5 Mounting and orientation of valves and specialities and maintenance space requirements
 - 5.1.6 Location and tag numbers of hangers, supports, restraints, anchors, etc.
 - 5.1.7 Location and magnitude of cold cuts, if any
 - 5.1.8 Pipe sizes, materials, design parameters, shop and field test requirements
 - 5.1.9 Insulation details
 - 5.1.10 Tolerances, if any
 - 5.1.11 Any specific requirements on shop fabrication and/or field erection
 - 5.1.12 Any other detail considered necessary by the ENGINEER.
- 5.2 Pipelines with a size of NPS 50 mm or smaller are regarded as field routed. CONTRACTOR shall however indicate any specific requirements he may have in regard to the routing of these pipelines.
- 5.3 Detailed bills of material shall be prepared for all piping systems. In case of shop fabricated piping, the bill of material shall correspond to the layout drawing prepared.
- 5.4 While routing piping, the following requirements shall be taken into account:
- 5.4.1 All piping shall be routed so as to avoid interference with other pipes and their hangers and supports, electrical cable trays, ventilation ducting, structural members, equipment, etc. Adequate clearances shall be ensured with respect to the above to accommodate insulation and pipe movements.
 - 5.4.2 All piping shall be grouped where practicable and shall be routed to present a neat and aesthetic appearance.
 - 5.4.3 The piping shall be arranged to provide clearance for the removal of equipment requiring maintenance and for easy access to valves and other piping accessories required for operation and maintenance. Layout drawings shall indicate valve



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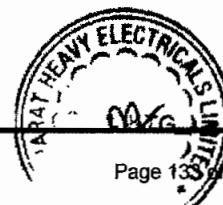
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orientations and availability of access to valves and specialties. Layout of all piping shall ensure that all valves including motor operated valves are located as to be accessible conveniently for operation. Valves for operation and maintenance shall have 1.0 m clear approach space. If any of the valves are not accessible, suitable access platform shall be provided by the CONTRACTOR.

- 5.4.4 Piping shall generally be routed above ground but, where specifically indicated/approved by the ENGINEER the pipes may be arranged in trenches or buried. Pipes at working temperatures above the ambient shall however not be buried.
- 5.4.5 Where steel piping is required to be buried, the pipe work shall be protected from soil corrosion by suitable anti-corrosive treatment as specified.
- 5.4.6 Overhead piping shall have a minimum vertical clearance of 2.3 metres above walkways and working areas and 8.0 metres above roadways unless otherwise approved by the ENGINEER.
- 5.4.7 Drains shall be provided, at all low points and vents at all high points as per actual layout regardless of whether the same have been shown in the flow diagrams or not. Pipelines shall be sloped towards the drain points.
- 5.4.8 Besides at low points, tell tale drains shall be provided at other points as necessary to remove on-line valves and specialties from piping for repair and replacement. Wherever spray water is introduced into steam piping, at a suitable location downstream, drain pots shall be envisaged along with motor operated drain valves and high and low level switches. The drain valves shall be interlocked with the level switches for automatic operation. For operating temperatures of greater than 400°C, drip leg with drains, operated by a motor operated valve shall be provided. At all other drain locations (operating temperatures less than 400°C) traps shall be provided. All traps shall be provided with strainers, isolating, bypass and free blow valves. Traps shall be thermodynamic type.
- 5.4.9 Provision shall be made while preparing piping layout to accept control valves, flow measurement element and any other on-line speciality or equipment. Sufficient upstream and downstream lengths shall be provided for flow measuring devices, control valves, desuperheaters and other specialties as required by the respective equipment manufacturer.
- 5.4.10 At all the screwed valves and screwed connections on equipment, unions shall be provided to facilitate disassembly. Likewise, unions shall also be provided at suitable points on straight length of screwed pipelines.
- 5.4.11 At all points where pipes pass through concrete floors or brick or other walls, suitable floor collars or wall boxes shall be provided. The CONTRACTOR shall design and furnish the details of the floor collars to the ENGINEER/OWNER.
- 5.4.12 In the case of flanged pipe work, boxes shall be large enough to permit the passage of the flange.
- 5.4.13 All pipe racks shall be provided with walkways of 750 mm wide.





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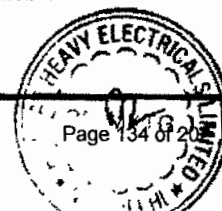
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- 5.4.14 All pipe bends shall have a radius of five nominal pipe diameter unless other wise specified by the Owner / Engineer.
- 5.4.15 All oil piping shall be arranged such that these shall be below or away from the high temperature steam pipes or other heated steam surfaces.
- 5.4.16 All bearing oil drain lines and cooler outlet flow lines shall be provided with visual indicator with rotational wheel (if possible) for observation of flow from local platform or operating floor.
- 5.5 Hangers and Supports**
- 5.5.1 All piping supports, guides, anchors, turnbuckles, rod hangers, spring hangers, rollers, with incidental structural subframing shall be designed by the CONTRACTOR.
- 5.5.2 The hangers and supports shall be spaced in accordance with standard engineering practice as outlined in applicable codes and standards.
- 5.5.3 The CONTRACTOR shall ensure that the location of the hangers and supports shall not increase the forces and moments on the equipment beyond their allowable values.
- 5.5.4 If severe vibration of piping is encountered in systems over which the CONTRACTOR has control or if the piping system is to be subjected to shock loading, hangers shall be supplemented by vibration-control equipment of an approved design.
- 5.5.5 At locations where lateral or axial movement is expected, the hangers shall be provided with suitable linkages to permit swing. All hangers shall be designed to be vertical in the hot position unless otherwise approved by the ENGINEER.
- 5.5.6 In order to minimise any horizontal force components of the dead- weight or any binding of the pin or rocker joints used on the hangers, the hanger rods should be as long as possible. In critical piping systems, the length of the hanger assembly capable of swinging shall not be less than 20 times the maximum expected pipe movement in the horizontal plane at the hanger location. It is recommended in case of main steam piping to provide for a hanger rod length of atleast 5-6 metres wherever feasible.
- 5.5.7 Constant support type of hangers shall be adopted at all locations on critical piping excepting where the smallness of vertical movements of pipe justifies the use of variable spring hangers.
- 5.5.8 As far as practicable, connections of hangers to supporting structure shall be achieved without welding to structural members. If welding is inevitable, adequate factor of safety shall be considered in the design and specification of the weld.
- 5.5.9 The attachment of support brackets to brick walls shall be avoided as far as possible and where this is not possible, details of the attachment shall be furnished to the ENGINEER for his approval. Under unavoidable circumstances, when medium or heavy brackets are bolted to walls, back plates of adequate size and thickness shall be furnished to distribute the load against the wall. Where the use of a back plate is not practical, the brackets shall, be fastened to the wall in an approved manner.





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5.5.10 Diameter of hangers for piping NB 50 mm and smaller shall not be less than 10 mm and for piping with size NB 65 mm and larger shall not be less than 13 mm.

5.5.11 All components for hangers such as turn buckles, clamps, etc. shall be of forged steel.

5.6 Fittings and Flanges

5.6.1 Branch connections in piping shall be made by the use of wrought or forged seamless fittings such as tees, laterals and crosses. Small stubs as may be required for instrument, drain and vent connection may be provided in the form of weld outlet fittings or forged couplings. Intersection welds are acceptable only in the event of non-availability of fittings.

5.6.2 Wherever pipe bends are employed for change of direction the same shall be to a radius of 5 times the pipe diameter.

5.6.3 Mitred bends may be adopted for piping systems upto a design pressure 10 bar(g) only. Mitre angle shall not exceed 22.5 degrees.

5.6.4 Slip-on type of flanges may be only upto a maximum pressure rating of ANSI 300 lbs. In case of higher pressure ratings, weld-neck type of flanges shall be employed.

5.7 Dimensional Standards

5.7.1 Uniform dimensional standards for all piping components shall be employed to ensure compatibility with each other.

5.7.2 Nominal pipes sizes and pipe outside diameters shall generally be as per ANSI B36.10. In case of deviation CONTRACTOR shall bring it to the specific attention of ENGINEER for prior approval stating reasons for the deviation.

5.8 Instrument Connections

5.8.1 Unless otherwise called for by OWNER all thermowell stubs shall have an internal threading to M33 x 2.

5.8.2 All stubs for pressure or flow measurement for pipelines with a maximum working pressure equal to or above 62 bar(g) or with a maximum working temperature equal to or above 350°C shall be NPS 25 mm and double root valves shall be used.

5.8.3 Stubs for pressure or flow measurement on pipelines with a maximum working pressure less than 62 bar(g) and a maximum working temperature less than 350°C shall be of NPS 15 mm size and single root valves can be used.

5.8.4 Measurement stubs on fuel oil lines shall be of NPS 25 mm size and provided with two root valves.

5.9 Drain and Vent Connections

5.9.1 Drain and vent connections on pipelines shall be atleast of NPS 25 mm size





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POWER PLANT PIPING, VALVES AND INSULATION

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- 5.9.2 For pressure and temperature conditions as defined in Clause 5.8.2, double isolating valves shall be used on drain and vent lines. For pressure and temperature conditions as defined in Clause 5.8.3, single isolating valves are considered adequate. Where with single root valve, instrument and root valve are not accessible, double root valve shall be provided with one root valve near the tap off and the second root valve with instrument at accessible point. For fuel oil drain and vent lines double isolation valves shall be provided irrespective of the pressure and temperature.

6.0 WELDING AND HEAT TREATMENT

All heat treatment, welding, post and pre weld temperatures shall be as per the code ASME B31.1.

7.0 INSPECTION & CLEANING

- 7.1 All pipes shall be hydrotested at shops for pressures as per standards and all erected piping shall be tested 1.5 times the design pressure. All other inspection requirements shall be as per the enclosed data sheet - A1.

- 7.2 All hot bent, forged formed, fabricated and straight pipes shall be chemically cleaned, pickled or wire brushed and purged with air blast or shot/grit blast to remove all sand and scale from the inner surface as applicable.

- 7.3 The Contractor shall carryout the following cleaning after hydrotest.

- (a) All piping shall be mass flushed, in addition to the specific cleaning operations as described below, as required.
 - (b) Main steam, cold and hot reheat piping and HP & LP bypass piping shall be steam blown.
 - (c) Extraction steam, condensate, boiler feed suction and discharge, heater drains and vents shall be alkaline flushed.
 - (d) Auxiliary steam piping and associated steam lines, heavy fuel oil piping shall be steam blown.
- Compressed air piping shall be blown by air.
Turbine lubricating oil piping shall be pickled

Contractor has to arrange Chemicals, pumps, piping, Valves, dummy devices, oil etc for acid cleaning, steam blowing, alkali boil out, oil flushing etc.

8.0 PAINTING AND CORROSION ON PROTECTION

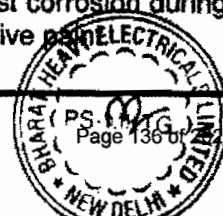
- 8.1 All uninsulated piping systems, hangers and supports shall have two coats of red oxide Zinc Chromate primer (conforming to IS 2074) with minimum dry film thickness (DFT) of 25 per coat and two coats of finish paints using enamel paint to give a minimum total DFT of 100 (after two coats of primer and two coats of finish paint). Shades shall be as per IS 5 or as indicated by Owner /Engineer. Service of the pipe/line designations shall be painted on all pipes at visible locations.

- 8.2 Before application of paint, Contractor shall clean the pipes of all mill scale, dirt dust, soot, grease, rust etc.

- 8.3 All pipe lines, piping components shall be adequately protected against corrosion during manufacture, fabrication, shipment and storage by appropriate protective painting.



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9.0 UNDERGROUND PROTECTION

9.1 Where pipelines are buried, underground protection shall be provided for the piping system as indicated any one of the methods given below:

- (a) Coal tar primer, coal tar enamel, inner wrap of fibre glass, final outer wrap of enamel impregnated fibre glass. Total thickness of coating shall not be less than 4.0 mm.
- (b) With anti-corrosive tape of 4 mm thick conforming to IS-10221 and AWWA C 203-93.

9.2 Pipe surfaces shall be cleaned by shot or sand blasting before application.

9.3 Tests to be carried out after application

- (a) Bond/Adhesion test
- (b) Holiday test

10.0 SPECIFIC REQUIREMENTS OF PIPING SYSTEMS

These shall be as detailed out in data Sheet A1

11.0 THERMAL INSULATION

11.1 CONTRACTOR shall provide thermal insulation for all hot piping and equipment with fluid temperatures greater than 60°C.

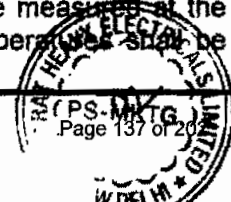
11.2 Specific requirements of thermal insulation are detailed out in Data Sheet-A. Further, the insulation thickness indicated in Data Sheet - A shall be regarded as minimum acceptable thickness. These minimum acceptable thickness are OWNER's estimate based on use of mineral wool blankets as insulating material with a surface temperature of 60°C or less over the insulation finish and Contractor is advised to ensure that the thickness envisaged by OWNER are adequate to guarantee a surface temperature measured over the finish of not greater than 60°C. In case the Contractor estimates that higher insulation thickness are required, the same shall be included. If Contractor is adopting calcium silicate insulation, the thickness shall be calculated with maximum thermal conductivity as given in IS-8154 and temperature shall be over the finish (aluminium cladding).

11.3 Contractor shall submit with his offer a schedule of insulation thickness proposed by him along with supporting calculations. The calculations shall be based on thermal conductivity values certified and guaranteed by the insulation supplier who shall base his guarantee on actual tests conducted by recognised test houses. Calculation of insulation shall be based on standard BS 5970/IS 3677. No credit would be claimed by the insulation manufacturer over and above those actually recognised by international standards. However, if the CONTRACTOR is offering insulation material with superior thermal conductivity this value shall be suitably substantiated by tests.

11.4 CONTRACTOR shall demonstrate to the OWNER/ENGINEER the surface temperature of the insulation at site. For indoor piping, the temperature shall be measured at the middle of one segment of pipe run at different points. These temperatures shall be



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taken as representative temperatures for that length of piping. If the temperature measured is higher than that guaranteed, the whole length shall be replaced or additional thickness added to meet the surface temperature. Two measurements shall be taken at the measuring points (one at the top and another at the bottom).

- 11.5 Contractor should take care while fixing the insulation mats, no welding shall be permitted on HP/LP cylinder & steam chest for fixing nuts, bolts, lugs, for their mats. The strip on the casing, stop valves, where provided and instructed by manufacturer shall be used to weld the insulation pins for thermal insulation.

12.0 VALVES

12.1 DESIGN AND CONSTRUCTION FEATURES

The following design and construction features of valves shall be complied with.

- 12.1.1 All gate and globe valves shall be of rising stem, outside screw and yoke type. The design of valves shall ensure a streamlined passage and gate valves shall have low pressure drop. The seats and discs shall be easily renewable and/or shall be suitable for easy refacing and grinding. Valve discs shall be of such design as to keep the seats tight when the valve body is subjected to pressure, temperature variations and piping stresses. Gate valves shall close in both flow directions.
- 12.1.2 All globe valves shall be capable of being closed against pressure.
- 12.1.3 All valves end details shall be as specified in Data Sheet-A. In the case of all end-welded valves, the stub ends of the valves shall project from the valve body a sufficient amount to ensure that the welding process will not distort the valve body and internal parts.
- 12.1.4 Valves for regulating duties shall be of the globe type with tapered plug type disc.
- 12.1.5 Valves with Stellite hard facing shall be 350BHN. For other facings, minimum hardness 250BHN and differential hardness of 50BHN will be maintained in line with API600
- 12.1.6 Check valves of sizes 400 mm NB and larger shall have dash pot arrangement.
- 12.1.7 All gate and globe valves shall have back-seating arrangement to facilitate easy replacement of packing with the valve in service.
- 12.1.8 All valves shall be so designed that the hand-wheel moves in a clockwise direction to close the valve. The face of the hand-wheel shall be clearly marked with the words 'OPEN' and 'CLOSE' and an arrow to indicate the direction for opening. All hand-wheels shall be fitted with name plate.
- 12.1.9 Piston lift check valves shall have accurately guided pistons so that the pistons are cushioned in their cylinders as they move up.
- 12.1.10 All gate, globe, Y-type and angle valves intended for manual operation and falling under the following categories shall be equipped with a gear operator for ease of operation and to ensure fast and tight closure:



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ANSI PRESSURE RATING	VALVE SIZES FOR WHICH GEAR OP IS REQUIRED
Class 300 and below	350 mm and larger
Class 600 and above	200 mm and larger

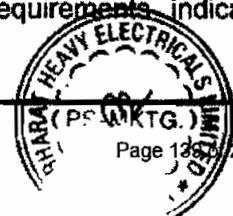
- 12.1.11 All gate valves falling in the following categories shall be provided with integral bypass valve. Bypass size shall conform to MSS-SP-45 as a minimum standard unless otherwise specified in Data Sheet-A3. If the main valve is motor operated, then BPV is also motor operated. Pipe for bypass shall be at least Schedule 80 seamless and of a material of the same nominal chemical composition and physical properties as that used for the main line. Orientation of bypass arrangement shall be subject to the approval of OWNER/ENGINEER.

ANSI PRESSURE RATING	Valve sizes for which BYPASS is required
Class 600 and over	200 mm and larger
Class 300 & 150	350 mm and larger

- 12.1.12 All gate valves of ANSI pressure rating class 150 and 300 shall have solid or flexible wedge and ANSI pressure rating class 600 and above shall have flexible or parallel slide type of wedge.
- 12.1.13 Valves with flexible wedge shall have provision for relieving the pressure in the neck of the valve when the valve is in the closed position.
- 12.1.14 All valves of ANSI pressure rating upto class 600 shall have bolted bonnet construction and class 900 and above shall have bonnet construction of the pressure seal type. Pressure seal valves shall have stainless steel inlay in the gasket area and silver-plated gaskets or other acceptable proven features.
- 12.1.15 All carbon steel valves of ANSI pressure rating upto class 150 and 300 shall have stainless steel trim (13% Cr) unless otherwise specified in Data Sheet and ANSI pressure rating class 600 and above shall have stellited trim (Complied for all valves except 800 class valves of size ≤ 50 mm of forged carbon steel & stainless steel for which 13%Cr trim will be provided with hardness of 250 BHN as per the API Trim)
- 12.1.16 All alloy steel valves shall have stellited seats.
- 12.1.17 All valves of ANSI pressure rating upto class 900 and higher shall have yoke with anti-friction bearing arrangement.
- 12.1.18 Valves that are to be kept in full 'OPEN'/'CLOSE' position shall be provided with a non-detachable locking arrangement. The locking arrangement provided shall be subject to approval by the OWNER.
- 12.1.19 Valves operating under vacuum conditions shall have glands with water sealing. The inlet and outlet connections shall be NB 15mm. The CONTRACTOR shall indicate the maximum and minimum sealing water pressure and the required flow rate.
- 12.1.20 Motor actuators for motor operated valves shall meet requirements indicated elsewhere in the contract.



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12.2 CLEANING

Prior to factory inspection, all manufacturing waste, such as metal chips and filings, welding rods and stubs, rags, debris and all other foreign matter shall be removed from the interior of each valve. All mill scale, rust, oil, grease, chalk, crayon, paint marks and other deleterious material shall be removed from the interior and exterior surfaces. At the time of shipment, valves shall be clean inside and outside.

12.3 INSPECTION AND TESTS

12.3.1 Inspection and tests shall be as per the relevant sections Data Sheet - A.

12.3.2 Defects in excess of acceptance standards shall be removed by suitable means. If removal of surface defects does not result in reduction in wall thickness below 5% of intended thickness of metal at that location, the area shall be blended smoothly into the surrounding surface. Where defect removal results in a wall thickness below the above, resultant cavity may be repaired by welding. The procedure and operator shall be qualified as per applicable standards. Major weld repairs shall be stress relieved or heat treated in accordance with ASME Section VIII Division 1-UCS 56.

12.3.3 The required area shall be re-examined and the acceptance standards shall be as in the original examination.

12.3.4 Weld repairs made as a result of radiographic examination shall be radiographed after welding. Repairing a particular area more than 2 times is not permitted and the component shall be rejected. The acceptance standards for welds shall be as per ASME Boiler and Pressure Vessel Code, Section VIII, Division I, UW - 51.

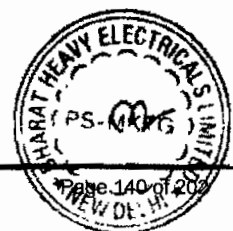
12.3.5 Prior approval shall be obtained from the OWNER/ENGINEER before taking up major weld repairs (major weld repair - when depth of repair exceeds 20% of thickness or 1 inch whichever is smaller). Mapping of major weld repairs is also required.

12.3.6 All valves shall be tested hydrostatically for strength, tightness of seats and tightness of backseating at the pressures indicated in Data Sheet-A, in accordance with MSS-SP 61, "Hydrostatic Testing of Steel Valves". Water used for hydrostatic testing of valves with stainless steel components shall not have chloride content exceeding 20 ppm. Clean potable water may be used for testing of all other valves.

12.3.7 All valves except check valves shall be tested for seat tightness by air at a pressure of 6 bar (g) on both sides of seat.

12.3.8 All check valves shall also be hydrotested at 25% of the seat hydro test pressure.

12.3.9 All valves shall be checked for correctness in respect of specified end details as per applicable standards.





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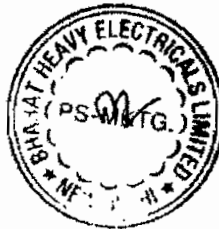
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12.4

PAINTING AND CORROSION PROTECTION

Two coats of primer of thickness 35 microns for each coat shall be applied to all steel and cast iron exposed surfaces as required to prevent corrosion, after release has been given for painting and before despatch. The use of grease or oil, other than light grade mineral oil, for corrosion protection is prohibited. Bores of all valves shall be covered immediately after testing, draining and drying with suitable plastic end covers to avoid ingress of foreign materials.





TITLE:

**TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT
2X800 MW YERMARUS STPP**

BHEL DOCUMENTS NO.: PE-TS-362-156-A001

VOLUME **II-B**

SECTION -D2

REV. NO. 01

DATE: 10/03/2013

SECTION – D2

D2: GENERAL TECHNICAL REQUIREMENTS FOR ELECTRICAL

BHEL – PS - PPEI: NOIDA, SECTOR-16A, U.P. – 201301



TITLE:

**TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT
2X800 MW YERMARUS STPP**

BHEL DOCUMENTS NO.: PE-TS-362-156-A001

VOLUME **II-B**

SECTION -D2

REV. NO. 01

DATE: 10/03/2013

GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS

BHEL – PS - PPEI: NOIDA, SECTOR-16A, U.P. – 201301



RAICHUR POWER CORPORATION LIMITED

YERAMARUS TPS - 2x800 MW

MOTORS

SECTION: D2.23

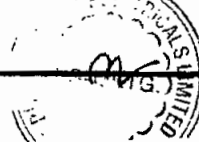
VOLUME: IV

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1.0 A.C. MOTORS

- 1.1 All HT motors shall be suitable for 11kV / 3.3kV, 3 phase, 50 Hz and LV motors shall be suitable for 415V, 3 Phase, 50 Hz power supply.
- 1.2 The motor rating shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment, whichever is higher. Motors shall be capable of starting and accelerating the load with the applicable method of starting without exceeding acceptable winding temperatures when supply voltage is 80% of the rated voltage for motors. Mill motors with higher starting torque requirement shall start with minimum 85 % of rated voltage.
- 1.3 Motors shall be capable of developing the rated full load torque even if the supply voltage drops to 70% of the rated voltage. If such operation is envisaged for a period of one second, the pull out torque of the motor shall be atleast 205% of full load torque.
- 1.4 Motors shall withstand for 1 second the voltage and torque stresses developed due to the vector difference between the motor residual voltage and the incoming supply voltage equal to 150% of the rated voltage during fast change over of buses.
- 1.5 Starting current of all HT motors shall be 600 % inclusive of IS tolerance except for BFP motor and mill motor.
For BFP motor starting current shall be 500 % inclusive of IS tolerance.
For mill motor starting current shall be 600 % subject to IS tolerance.
- 1.6 The locked rotor withstand time under hot condition at 110% rated voltage shall be more than the starting time at minimum permissible voltage specified above by atleast three seconds or 15% of the accelerating time whichever is greater. Provision of speed switch shall be avoided to the extent possible.
- 1.7 The degree of protection for the motor enclosure shall be IP-55 and IP-54 for outdoor & indoor respectively and terminal boxes shall be provided with atleast IP-55. For single core cable termination, gland plates shall be of non-magnetic material. All motors located in hazardous area shall have flame proof design.
- 1.8 All HT motors shall be provided with vibration pads for mounting vibration detectors.
- 1.9 Motors rated 1000 kW and above shall be provided with differential protection. These motors shall be provided with star connected stator windings. The 3 nos. current transformers, one for each phase shall be mounted in a separate compartment in the neutral side terminal box. The three phases shall be connected to form the star point after they pass through the CTs. The CTs shall be of relay accuracy and the CT characteristics shall be compatible with the differential relay. The additional 3 nos. CTs of identical characteristics shall be provided in the 11kV / 3.3 kV switchgear panel. kWh measurement shall be provided on all HT motor feeders.
- 1.10 Wherever provided, Motor can run without FOLS during coasting down to rest only.
- 1.11 For 11kV & 3.3kV motors, 6 nos. duplex/ 12 nos. simplex RTDs for winding shall be provided. Each bearing shall be provided with one no. PT-100 duplex type RTDs for temperature monitoring. These Motor are suitable for maximum 2 % harmonic.

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- 1.12 The maximum double amplitude vibrations for motors shall be as per IS:12075 .
- 1.13 Maximum noise level measured at a distance of 1 metre from the outer surface of the motor shall not exceed 85 dB (A).
- 1.14 Cable boxes of all 11kV & 3.3kV motors shall be provided with quick disconnecting type terminal connectors to facilitate easy disconnection and removal of the motors without requiring unsealing or otherwise disturbing the external cable connections and leaving the phase segregated terminal box intact.
- 1.15 The insulation system for 11000V & 3300 V AC motors shall withstand the negative or positive 0.3 / 3.0 microsecond wave (2.7 pu rated peak line to earth operating voltage) switching surges originating from non-effectively earthed power system. All 11000V & 3300 V AC motors shall have BIL and withstand frequency voltage as per relevant standards.

2.0 DC MOTORS

- 2.1 DC motors shall be suitable for the DC system voltage available in the plant. Motor shall be capable of starting and accelerating the load with the applicable method of starting, without exceeding acceptable winding temperatures, when the supply voltage is in the range of 85% to 110% of rated motor voltage. The field windings for the motors shall be continuously rated without forced ventilation.

3.0 ACTUATOR MOTORS

- 3.1 The actuator motors shall be designed for short time duty (S2) in accordance with IEC 60034-1.
- 3.2 Hand wheel operation shall be provided in addition to motor drive.
- 3.3 The DC and AC actuator shall be provided with accessories viz., Torque limit switch, end of travel switch, adjustable limit switch, hand wheel motor, thermostat, integral starter, valve position indicator, Manual-Auto lever with suitable locking arrangement, etc. Complete actuator shall be tested at factory as per IS 9334.
- 3.4 Two normally open and two normally closed or two changeover potential free contacts corresponding to open and close positions of the valve shall be provided.
- 3.5 Degree of protection for actuator motor enclosure shall be IP-55 and IP-67 for indoor and outdoor respectively.

4.0 TESTS

- 4.1 Tests on all types of motors shall be conducted as per relevant standard.
- 4.2 All type, routine & acceptance tests as per relevant IS shall be conducted on 11 kV & 3.3 kV motors. For LT motors, type test certificates for tests carried out earlier for each rating and frame size & make shall be furnished, and for all motors routine and acceptance tests shall be conducted as per relevant standards.
- 4.3 For 11000V and 3300V AC motors, in addition to all the tests specified above,



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polarisation index test shall be carried out as a routine test on each motor (the minimum value of polarisation index for all motors shall be 2 when determined according to IS : 7816).

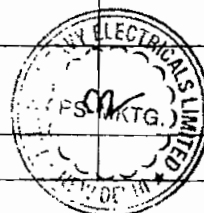
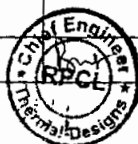
- 4.4 Noise level measurements shall be done on motor as a type test on each type and rating. Vibration measurement shall be done on all motors as a routine test.
- 4.5 Di-electric tests. Existing report of impulse test as per IEC 60034 15 shall be furnished.
- 4.6 All characteristic curves for the motors above 55kW (and lower rating critical drives identified during detailed engineering) including hot and cold withstand characteristics, starting time vs current, current vs speed, speed vs torque at 110%, 100% and 90% of rated voltage, negative withstand characteristics, rotor voltage vs rotor current curves (for wound motors), Efficiency, power factor, slip, current Vs output curve etc., shall be furnished.

5.0 TECHNICAL REQUIREMENTS

The motors shall comply with the particulars indicated below and CONTRACTOR shall furnish the details in respective column given below (to be separately submitted for different type & rating of the motor).

SL. NO.	DESCRIPTION	UNIT	SPECIFICATION REQUIREMENT	CONTRACTOR
I	AC Motors			
1.0	Application/Designation		*	
2.0	Manufacturer		*	
3.0	Type of motors/ frame size		Squirrel cage except for cranes	
4.0	Rated			
	(a) Output	kW	*	
	(b) Speed	rpm	*	
	(c) Voltage	V	*	
	(d) No.of Phases / Frequency		*	
	(e) System neutral		*	
5.0				
5.1	Type of Duty (IS-325 or equivalent)		*	
5.2	Duty designation (IS-325 or equivalent)		*	
6.0	Supply Conditions			

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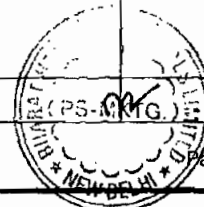
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	(a) Allowable variations in			
	(i) Voltage	%	± 10	
	(ii) Frequency	%	± 5	
	(iii) Combined	%	10(sum of absolute values)	
	(b) Permissible unbalance in supply voltage	%	2	
7.0	Current		*	
	(a) Full load	Amps	*	
	(b) Starting	% FL	*	
8.0	Method of starting		DOL	
8.1	Starting time	Sec	*	
	With rated Voltage			
	With min. Voltage			
	With Max. Voltage			
8.2	Safe stall time under hot/cold condition	Sec	*	
	With rated Voltage			
	With min. Voltage			
	With Max. Voltage			
9.0	Insulation			
9.1	Class of insulation		Class F with temperature rise limited to Class B	
9.2	Temperature rise by winding resistance method	Deg. C	temp. rise limited to Class B	
10.0	Type of cooling (IS : 6362)	Deg. C	TEFC for LV, TEFC / TETV/CACA/CAC W for 11/3.3 KV motors.	
11.0	Degree of protection (IS:4691 or equivalent)		Refer Clause 1.7	
12.0	Suitable for outdoor operation	Yes / No	*	
13.0	Normal winding connection	Star / Delta	*	
14.0	Permissible No. of equally spread starts per hour under normal service conditions		*	
15.0	Efficiency (%)	%	*	



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	Full load			
	75 % Load			
	50 % Load			
	25 % Load			
16.0	Power Factor		*	
	Full Load			
	75 % Load			
	50 % Load			
	25 % Load			
17.0	Torque		*	
	Starting			
	Maximum (Pullout)			
	Pull up			
18.0	Motor reactance (pu)		*	
	Subtransient			
	Transient			
	Steady state			
15.0	Fault level	kA/sec	*	
II	DC MOTORS			
16.0	Rated Voltage	V	220 V DC	
17.0	Class of Insulation	:	Class F with temperature rise limited to class B	
18.0	Temperature rise	:	Class F with temperature rise limited to class B	
19.0	Method of starting	:	*	
Items under AC motors which are applicable for DC motors shall also be listed				


NOTE :

*** Information shall be furnished by contractor during detailed engineering.



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	TITLE: TECHNICAL SPECIFICATION FOR CW CHEMICAL TREATMENT SYSTEM. 2X800 MW YERMARUS STPP	BHEL DOCUMENTS NO.: PE-TS-362-156-A001	
		VOLUME II-B	
		SECTION -D	
		REV. NO. 00	DATE: 17/01/12

**TECHNICAL SPECIFICATION
FOR
LV MOTORS**

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

FOR

LV MOTORS

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



TITLE :
GENERAL TECHNICAL REQUIREMENTS
FOR
LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101
VOLUME NO. : II-B
SECTION : D 2
REV NO. : 00 DATE : 29/08/2005
SHEET : 1 OF 4

1.0 INTENT OF SPECIFICATION

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

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

3.0 DESIGN REQUIREMENTS

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

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

3.3 Starting Requirements

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

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



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FOR
LV MOTORS

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

3.3.3 The following frequency of starts shall apply

- i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)
- iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor

3.4 Running Requirements

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

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

3.5 Stress During bus Transfer

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

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

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

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


4.0 CONSTRUCTIONAL FEATURES

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

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

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

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


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



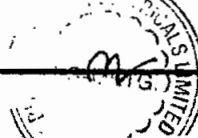
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- 4.9.1 Motors provided for similar drives shall be interchangeable.
- 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.
- 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight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

	<p align="center">RAICHUR POWER CORPORATION LIMITED</p> <p align="center">VERAMARUS TPS - 2x800 MW</p> <p align="center">MOTORS</p>	<p>SECTION: D2.22</p> <p>VOLUME IV</p> <p>Page 1 of 5</p>
<p>1.0</p> <p>1.1</p> <p>1.2</p> <p>1.3</p> <p>1.4</p> <p>1.5</p> <p>1.6</p> <p>1.7</p> <p>1.8</p> <p>1.9</p> <p>1.10</p> <p>1.11</p>	<p>A.C. MOTORS</p> <p>All HT motors shall be suitable for 11kV / 3.3kV, 3 phase, 50 Hz and LV motors shall be suitable for 415V, 3 Phase, 50 Hz power supply.</p> <p>The motor rating shall be arrived at considering 15% margin over the duty point input or 10% over the maximum demand of the driven equipment, whichever is higher. Motors shall be capable of starting and accelerating the load with the applicable method of starting without exceeding acceptable winding temperatures when supply voltage is 80% of the rated voltage for motors. Mill motors with higher starting torque requirement shall start with minimum 85 % of rated voltage.</p> <p>Motors shall be capable of developing the rated full load torque even if the supply voltage drops to 70% of the rated voltage. If such operation is envisaged for a period of one second, the pull out torque of the motor shall be atleast 205% of full load torque.</p> <p>Motors shall withstand for 1 second the voltage and torque stresses developed due to the vector difference between the motor residual voltage and the incoming supply voltage equal to 150% of the rated voltage during fast change over of buses.</p> <p>Starting current of all HT motors shall be 600 % inclusive of IS tolerance except for BFP motor and mill motor.</p> <p>For BFP motor starting current shall be 500 % inclusive of IS tolerance.</p> <p>For mill motor starting current shall be 600 % subject to IS tolerance.</p> <p>The locked rotor withstand time under hot condition at 110% rated voltage shall be more than the starting time at minimum permissible voltage specified above by atleast three seconds or 15% of the accelerating time whichever is greater. Provision of speed switch shall be avoided to the extent possible.</p> <p>The degree of protection for the motor enclosure shall be IP-55 and IP-54 for outdoor & indoor respectively and terminal boxes shall be provided with atleast IP-55. For single core cable termination, gland plates shall be of non-magnetic material. All motors located in hazardous area shall have flame proof design.</p> <p>All HT motors shall be provided with vibration pads for mounting vibration detectors.</p> <p>Motors rated 1000 kW and above shall be provided with differential protection. These motors shall be provided with star connected stator windings. The 3 nos. current transformers, one for each phase shall be mounted in a separate compartment in the neutral side terminal box. The three phases shall be connected to form the star point after they pass through the CTs. The CTs shall be of relay accuracy and the CT characteristics shall be compatible with the differential relay. The additional 3 nos. CTs of identical characteristics shall be provided in the 11kV / 3.3 kV switchgear panel. kWh measurement shall be provided on all HT motor feeders.</p> <p>Wherever provided, Motor can run without FOLS during coasting down to rest only.</p> <p>For 11kV & 3.3kV motors, 6 nos. duplex/ 12 nos. simplex RTDs for winding shall be provided. Each bearing shall be provided with one no.PT-100 duplex type RTDs for temperature monitoring. These Motor are suitable for maximum 2 % harmonic.</p>	

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MOTORS

- 1.12 The maximum double amplitude vibrations for motors shall be as per IS:12075 .
- 1.13 Maximum noise level measured at a distance of 1 metre from the outer surface of the motor shall not exceed 85 dB (A).
- 1.14 Cable boxes of all 11kV & 3.3kV motors shall be provided with quick disconnecting type terminal connectors to facilitate easy disconnection and removal of the motors without requiring unsealing or otherwise disturbing the external cable connections and leaving the phase segregated terminal box intact.
- 1.15 The insulation system for 11000V & 3300 V AC motors shall withstand the negative or positive 0.3 / 3.0 microsecond wave (2.7 pu rated peak line to earth operating voltage) switching surges originating from non-effectively earthed power system. All 11000V & 3300 V AC motors shall have BIL and withstand frequency voltage as per relevant standards.

2.0 DC MOTORS

- 2.1 DC motors shall be suitable for the DC system voltage available in the plant. Motor shall be capable of starting and accelerating the load with the applicable method of starting, without exceeding acceptable winding temperatures, when the supply voltage is in the range of 85% to 110% of rated motor voltage. The field windings for the motors shall be continuously rated without forced ventilation.

3.0 ACTUATOR MOTORS

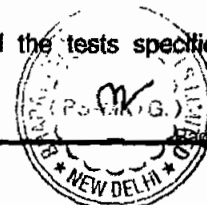
- 3.1 The actuator motors shall be designed for short time duty (S2) in accordance with IEC 60034-1.
- 3.2 Hand wheel operation shall be provided in addition to motor drive.
- 3.3 The DC and AC actuator shall be provided with accessories viz., Torque limit switch, end of travel switch, adjustable limit switch, hand wheel motor, thermostat, integral starter, valve position indicator, Manual-Auto lever with suitable locking arrangement, etc. Complete actuator shall be tested at factory as per IS 9334.
- 3.4 Two normally open and two normally closed or two changeover potential free contacts corresponding to open and close positions of the valve shall be provided.
- 3.5 Degree of protection for actuator motor enclosure shall be IP-55 and IP-67 for indoor and outdoor respectively.

4.0 TESTS

- 4.1 Tests on all types of motors shall be conducted as per relevant standard.
- 4.2 All type, routine & acceptance tests as per relevant IS shall be conducted on 11 kV & 3.3 kV motors. For LT motors, type test certificates for tests carried out earlier for each rating and frame size & make shall be furnished, and for all motors routine and acceptance tests shall be conducted as per relevant standards.
- 4.3 For 11000V and 3300V AC motors, in addition to all the tests specified above,



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polarisation index test shall be carried out as a routine test on each motor (the minimum value of polarisation index for all motors shall be 2 when determined according to IS : 7816).

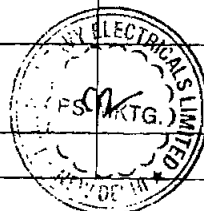
- 4.4 Noise level measurements shall be done on motor as a type test on each type and rating. Vibration measurement shall be done on all motors as a routine test.
- 4.5 Di-electric tests. Existing report of impulse test as per IEC 60034 15 shall be furnished.
- 4.6 All characteristic curves for the motors above 55kW (and lower rating critical drives identified during detailed engineering) including hot and cold withstand characteristics, starting time vs current, current vs speed, speed vs torque at 110%, 100% and 90% of rated voltage, negative withstand characteristics, rotor voltage vs rotor current curves (for wound motors), Efficiency, power factor, slip, current Vs output curve etc., shall be furnished.

5.0 TECHNICAL REQUIREMENTS

The motors shall comply with the particulars indicated below and CONTRACTOR shall furnish the details in respective column given below (to be separately submitted for different type & rating of the motor).

SL. NO.	DESCRIPTION	UNIT	SPECIFICATION REQUIREMENT	CONTRACTOR
I	AC Motors			
1.0	Application/Designation		*	
2.0	Manufacturer		*	
3.0	Type of motors/ frame size		Squirrel cage except for cranes	
4.0	Rated			
	(a) Output	kW	*	
	(b) Speed	rpm	*	
	(c) Voltage	V	*	
	(d) No. of Phases / Frequency		*	
	(e) System neutral		*	
5.0				
5.1	Type of Duty (IS-325 or equivalent)		*	
5.2	Duty designation (IS-325 or equivalent)		*	
6.0	Supply Conditions			

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	(a) Allowable variations in			
	(i) Voltage	%	± 10	
	(ii) Frequency	%	± 5	
	(iii) Combined	%	10(sum of absolute values)	
	(b) Permissible unbalance in supply voltage	%	2	
7.0	Current		*	
	(a) Full load	Amps	*	
	(b) Starting	% FL	*	
8.0	Method of starting		DOL	
8.1	Starting time	Sec	*	
	With rated Voltage			
	With min. Voltage			
	With Max. Voltage			
8.2	Safe stall time under hot/cold condition	Sec	*	
	With rated Voltage			
	With min. Voltage			
	With Max. Voltage			
9.0	Insulation			
9.1	Class of insulation		Class F with temperature rise limited to Class B	
9.2	Temperature rise by winding resistance method	Deg. C	temp. rise limited to Class B	
10.0	Type of cooling (IS : 6362)	Deg. C	TEFC for LV, TEFC / TETV/CACA/CAC W for 11/3.3 KV motors.	
11.0	Degree of protection (IS:4691 or equivalent)		Refer Clause 1.7	
12.0	Suitable for outdoor operation	Yes / No	*	
13.0	Normal winding connection	Star / Delta	*	
14.0	Permissible No. of equally spread starts per hour under normal service conditions		*	
15.0	Efficiency (%)	%	*	



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	Full load			
	75 % Load			
	50 % Load			
	25 % Load			
16.0	Power Factor		*	
	Full Load			
	75 % Load			
	50 % Load			
	25 % Load			
17.0	Torque		*	
	Starting			
	Maximum (Pullout)			
	Pull up			
18.0	Motor reactance (pu)		*	
	Subtransient			
	Transient			
	Steady state			
15.0	Fault level	kA/sec	*	
II	DC MOTORS			
16.0	Rated Voltage	V	220 V DC	
17.0	Class of Insulation	:	Class F with temperature rise limited to class B	
18.0	Temperature rise	:	Class F with temperature rise limited to class B	
19.0	Method of starting	:	*	
Items under AC motors which are applicable for DC motors shall also be listed				

NOTE :

“*” Information shall be furnished by contractor during detailed engineering.



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THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

SPECIFICATION No. PES-505-02



P E M

VOLUME IIB

SECTION D 2

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SHEET

OF

**GENERAL TECHNICAL REQUIREMENTS
OF
MV MOTORS**

SPECIFICATION No.

PES-505-02

PE-666



P E M

HV MOTORS

VOLUME II B

SECTION D 2

REV. No. 1

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1.0 GENERAL

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

1.2 Motors having a voltage rating of 1000V and above are referred to as medium voltage (MV) motors.

2.0 CODES AND STANDARDS

Unless otherwise specified, the latest revisions of codes/standards specified in Annexure-I enclosed are applicable and shall be referred to.

3.0 DESIGN REQUIREMENTS3.1 General Requirements

Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet A and project information (SECTION-B). Outdoor duty motors shall be suitable for outdoor application in extreme site conditions outlined in Volume II Section B. The design ambient temperature shall be as indicated in DATA SHEET 'A'.

3.2 Supply Voltage and Frequency

3.2.1 Unless otherwise specified in Data Sheet 'A'/Section C, voltage & supply variation shall be as follows :

Voltage variations $\pm 10 \%$

Frequency variations $\pm 5 \%$

Combined voltage and frequency variation (sum of absolutes) 10%

3.2.2 Motors shall be capable of running continuously at rated output for each of the conditions specified.

3.2.3 When the motors are operating at the extreme conditions of voltage and frequency variations as given in Data Sheet-A, the temperature rise may be exceeded by 10°C for motors of output upto and including 1000 kW and 5°C for motors of output exceeding 1000 kW.

3.3 Motor Rating

Motor ratings shall be adequate to meet the requirements of the driven equipment. Motors shall be continuously rated at the design ambient temperature specified in DATA SHEET 'A' and other site conditions specified in Volume II, Section-B. Motor ratings shall have at least a 10 % margin over the continuous maximum demand of



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the driven equipment under entire operating range including voltage & frequency variations specified.

3.4 Starting Requirements

3.4.1 Motors shall start smoothly and rapidly. Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly coordinated 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.

3.4.2 Motors shall be capable of starting and accelerating the load with direct-on-line starting. 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 constant value of 80 % rated voltage except for mill motors for which it shall be 85% rated voltage.

3.4.3 The locked rotor current of the motors shall not exceed six times full load current for all auxiliaries except BFP motor, where the starting current is limited to 4.5 times full load current, subject to tolerance as given in IS:325.

3.4.4 The following frequency of starts shall apply:

- a) Two starts in succession with the motor initially at temperature not exceeding the rated load operating temperature.
- b) Three equally spread starts in an hour, the motor initially at a temperature not exceeding the rated load operating temperature (not to be repeated in second successive hour).

3.4.5 Locked rotor withstand time of hot motors at 110 % rated voltage shall be as follows:

- a) For motors with starting time upto 20 seconds. : At least 2.5 sec more than the starting time.
- b) For motors with starting time above 20 seconds. : At least 5 sec more than the starting time.

The starting time of the motor referred above is at minimum voltage. Only in extreme cases where the above requirement cannot be complied with, speed switch of suitable type shall be provided to bypass the locked rotor protection for a preselected time during starting of the motors, subject to mutual agreement between the purchaser and the supplier. The speed switches shall be of approved make and shall have 1NO+1NC or 2 changeover contacts, single pole double throw snap action contacts having maximum interrupting capacity of 5 Amps at 240 V AC and 0.5 Amps at 220 V DC. Provision of speed switch is to be clearly brought out in the offer for purchaser's acceptance.

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3.5 Running Requirements

- 3.5.1 Motors shall run satisfactorily at a supply voltage of 75 % of rated voltage for 5 minutes with full load without injurious heating.
- 3.5.2 Motors shall not stall due to voltage dip in the system causing momentary drop in voltage to 70 % of the rated voltage.

3.6 Stress During Bus Transfer

- 3.6.1 Motors shall withstand the voltage and torque stress developed due to the application of 100 % of the rated voltage when the motor residual voltage has dropped down to 50 % and is in phase opposition to the applied voltage during the auto bus transfer.

3.7 Noise Level

Maximum noise level measured at a distance of 1.5 meters from the outline of the motor shall not exceed 85 db (A) as per BS-4999 Part 51.

3.8 Vibration

The double amplitude of motors vibration shall be within the limits specified in IS: 12075 or as agreed between manufacturer and supplier.

4.0 CONSTRUCTIONAL FEATURES

- 4.1 Degree of protection : Motors shall conform to degree of protection IP: 55 as per IS: 4691, without any sealing compound at joints.

4.2 Enclosure and Cooling

- 4.2.1 a) Motors of rating less than 2000 kW shall have one of the following enclosure and cooling:
- (i) Totally enclosed fan cooled (TEFC) conforming to IC 0141 as per IS 6362.
 - (ii) Totally enclosed, tube ventilated (TETV), integral heat exchanger conforming to IC 0151 as per IS:6362.
 - (iii) Totally enclosed closed air circuit air cooled (CACA) mounted heat exchanger conforming to IC 0161 as per IS: 6362. However, motors below 1000 kW will be subject to purchaser's approval. For BFP motor rating less than 2000 kW, CACW motor can also be accepted subject to purchaser's approval.
- b) Motor of rating 2000 kW and above shall have one of the following enclosure and cooling:

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(i) Totally enclosed, closed air-circuit water cooled (CACW) machine mounted heat exchanger conforming to ICW 37 A 81 as per IS:6362.

(ii) Totally enclosed, closed air-circuit, air cooled (CACA) machine mounted heat exchanger conforming to IC 0161 as per IS:6362 subject to purchaser's approval.

(iii) Totally enclosed tube ventilated (TETV), integral heat exchanger conforming to IC 0151 as per IS:6362.

4.2.2 In case of motors with enclosure of closed air circuit water cooled type (CACW), the following provisions shall be made:

- a) Suitable visual indication for detecting the tube failures.
- b) Visual indication for observing flow of water.
- c) Flow switch for initiating alarm under no flow conditions. The switch shall be provided with two contacts.
- d) Cooling materials of the cooler tube and tube plates shall be suitable for the cooling water specified in Data Sheet-A.

4.2.3 In case of motors with enclosure of closed air circuit water cooled type (CACW), the following shall be provided in connecting pipe line external to the cooler:

- a) Temperature gauge for inlet and outlet water temperature and air temperature.
- b) Cooling water pressure switch with two contacts.

The above are not in the scope of motor supplier.

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

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

4.2.6 For motor having CACA or CACW enclosure, a dial type capillary thermometer shall be provided to measure the temperature of motor internal air circuit at its maximum hot point. Separate temperature switch shall be provided for alarm indication. The temperature switch shall be single pole double throw type and the contacts rating shall be 2 Amp at 240 V AC and 0.5 Amp at 220 V DC.

4.2.7 Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point, with two number drain holes with plugs one on either end of the motor.



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4.3 Class of Insulation

Tropicalised insulation material of class 'F' shall be used for the motors. Motor windings shall be given special treatment to render them non-hygroscopic and oil resistant. For class 'F' insulation the temperature rise shall be limited to that of class 'B'.

4.4 Bearings

Bearing shall be of roller type, except where motor and shaft loading indicate otherwise. Vertical motors shall have combined thrust and guide bearings in upper bracket and guide bearing in lower bracket. The thrust bearing designed to carry all axial thrust conditions imposed by the driven equipment as given in Data sheet-A. Anti-friction bearing shall also be acceptable in case motors have to take thrust due to its own rotor weight only.

4.4.1 Anti Friction Bearings

4.4.1.1 Anti-friction type bearings shall be of ball/roller type. These shall be pressure grease gun lubricated and fitted with grease nipple and grease relief devices. Bearings shall be so constructed that the loss of grease and its creeping along the shaft into the motor housing is prevented. Dirt and water getting into the motors shall also be prevented.

4.4.1.2 The minimum life of ball/roller bearings shall not be less than 30,000 working hours.

4.4.1.3 For the motors equipped with ball/roller bearings adequate means shall be provided during stand-still period to prevent the brinelling effect. During transport and shipping such motors shall receive a special bearing insert or a suitable arrangement to block the movement of rotor.

4.4.2 Sleeve Bearings

4.4.2.1 Sleeve bearings shall be of the split type, readily accessible and replaceable. These shall be either ring-oil lubricated type or forced-oil lubricated type. If forced-oil lubrication is used, the lubricating oil system shall be common to both motor and the driven equipment. The forced-oil lubricating system comprising oil pump, oil tank, piping, oil coolers, valves, etc. shall not be supplied along with motors. These shall be arranged separately by the purchaser.

4.4.2.2 Motors with sleeve bearings shall be fitted with a sight gauge marked with the proper oil level and shall be supplied with the oil fill and oil drain plugs. Proper means shall also be provided for observing oil-ring rotation when the motors are running.

4.4.2.3 When the forced-oil lubrication is provided for the bearings, ring-oil lubrication shall also be provided for starting and emergency shut down which shall be adequate for starting the motors and allowing continuous operation for at least 10 minutes without the forced-oil lubrication system in operation and without damage to the bearing.



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4.4.3 Combined Thrust and Guide Bearings

- 4.4.3.1** For vertical motor combined thrust and guide bearings shall be provided to withstand the normal downward thrust due to operating loads and rotor weight as well as the maximum anticipated upward thrust. The guide bearings shall be of sleeve type. Both thrust and guide bearings shall be housed in a common upper bracket and a guide bearing in lower bracket. In upper bracket, the oil for thrust and guide bearings shall be common.

4.4.4 General requirements for Bearing

- 4.4.4.1** Except in the case of totally enclosed motors, means of access shall be provided to the rotor air gap, without disturbing the bearing housings, to permit the use of air gap gauges to check bearing wear.

- 4.4.4.2** In case of independently supported bearings, motor and bearing pedestals shall be fitted on a common base plate.

- 4.4.4.3** Flow of shaft currents through bearings shall be positively blocked in all motors rated above 1000 kW as also in smaller motors where considered necessary by the manufacturer. In the case of pedestal mounted bearings, both bearing shall be insulated, and an earth bonding link shall be provided at the driving end, the link shall be removable for insulation testing. Where the bearings are mounted directly in the motor end frames, the non-driving end shall be permanently insulated. It shall be possible to carry out maintenance without damaging the insulation. All oil and water pipes, direct-driven oil pumps etc., shall be insulated where necessary to prevent flow of any shaft current. The insulation provided to avoid shaft currents, shall be meggered at 500 volts at manufacturer's work.

In case of water cooled oil bearings, proper insulation shall be provided at the connecting point of water pipe to bearing bodies to prevent the bearings leakage current through the water pipes.

- 4.4.4.4** Sleeve and thrust bearings shall be provided with temperature gauges of mercury in-steel type with micro-switch with a minimum of one meter flexible capillary and having alarm and trip contacts. The contacts rating shall be 2 Amps at 240 V AC or 0.5 Amp at 220 V DC.

- 4.4.4.5** Sleeve and thrust bearings shall be provided with duplex platinum resistance temperature detectors (RTD) for remote indication of bearing temperature. The DC resistance of the RTDs shall be 100 Ohms at 0°C. The RTDs shall be of three wire type. The terminals of the RTDs shall be brought out to the winding RTDs terminal box or in a separate terminal box. The bearing RTDs terminals shall be marked as B1, B2, etc.

4.5 Winding Resistance Temperature Detectors(RTDs)

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Motors shall be provided with a minimum of six Nos. RTDs of platinum resistance duplex type or 12 Nos. simplex type having a DC resistance of 100 Ohms at 0 deg C. The RTDs shall be embedded in the stator windings at locations where highest temperature are expected. The RTDs shall be of three wire type. The terminal box, shall be complete with removable front and cable gland plate. RTD leads shall be marked as 1,2,3 etc.

4.6 Terminals and Terminal Boxes

4.6.1 Terminal, terminal leads, terminal boxes, windings details and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet - A for a duration of atleast 0.25 second.

The test reports for terminal boxes shall be furnished for approval.

4.6.2 Unless otherwise specified or approved, main phase terminal boxes shall be positioned on the left hand side of the motor when viewed from the non-driving end. The main terminal box location shall be subject to purchaser's approval.

4.6.3 Motors with rating of 2000 kW and above shall be star connected and six leads shall be brought out. Line and neutral terminals of these motors shall be located in separate terminal boxes having provision for mounting differential protection current transformers.

4.6.4 Power terminal boxes shall have a phase separated (not phase segregated) construction. However, for motors which would have single core cables, three separate terminals boxes, one for each phase would also be acceptable. A minimum clearance of 100 mm between the lugs/bare live parts of different phases and 90 mm between lugs/bare live parts and earth shall be provided in the terminal boxes for 6.6 kV motors. For high voltages the clearances shall be subject to purchaser's approval.

The distance between gland plate and the terminal studs shall not be less than 500 mm. The terminal boxes shall be capable of withstanding a system fault level specified in Data Sheet-A for at least 0.25 seconds. A suitable provision of releasing the pressure developed during faults shall be made. Terminal boxes shall be suitable for top and bottom entry of cables.

4.6.5 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, motors shall rotate in desired direction when viewed from the non-driving end as specified in data sheet-A.

4.6.6 Motor, terminals and terminal leads shall be fully insulated with no bare 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.

4.6.7 Degree of protection for terminal boxes shall be same as that of motors as specified in Clause 4.1.



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4.6.8 Dessicator shall be fitted inside the terminal box and shall have an indicating head visible from outside the box.

4.6.9 Detachable cable box shall be fitted on the main phase terminal box and the design of cable box shall be suitable for terminating the cables specified in Data Sheet - A.

Details of cable boxes shall be submitted for approval. Cable boxes shall be mounted in such a way that the incoming cable does not foul with the foundation block. Double compression nickel plated brass cable glands for all terminal boxes and copper cable lugs for main terminals shall be included in bidder's scope.

4.6.10 Separate terminal boxes shall be provided for RTDs, CTs and space heaters. Detachable gland plates with double compression glands shall be provided in terminal boxes.

4.6.11 Main phase terminal boxes shall be suitable for 180 deg. rotation.

4.7 Earth Terminals

Two separate earth terminals suitable for connecting copper or MS strip grounding conductor of size given in Data Sheet - A shall be provided on the motor frame.

4.8 General

4.8.1 Motor provided for similar drives shall be inter-changeable.

4.8.2 Motors and their enclosures shall be constructed to permit easy dismantling and reassembly at site. All heavy parts should have means for attaching the lift tackle.

4.8.3 Rotors shall be dynamically balanced.

4.8.4 An arrow block shall be screwed on the body of the motors on the non-driving end to indicate the normal direction of rotation of the motors.

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

4.8.6 Motors shall be provided with eye bolts, lugs or other means to facilitate safe lifting.

4.8.7 The CTs for differential protection for motors shall be arranged by purchaser but the mounting and connections are to be done by the motor supplier.

5.0 SPACE HEATERS

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

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The leads from space heaters of each motor shall be brought out to a separate terminal box. Space heaters shall be mounted inside the motor in accessible place so that their removal and replacement is simple.

6.0 NAME PLATE

Motors shall have anodized brass/stainless steel name plate with all particulars as per IS: 325. The rating plate shall also indicate the following additional information :

- a) Maximum continuous rating in kW and corresponding temperature rise, as applicable for cooling medium temperature specified in Data Sheet -A.
- b) Bearing identification numbers (In case of ball/roller bearing and recommended lubricant)

7.0 PAINTING

- a) Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 as per IS:5. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions. Motors frame shall also be painted to withstand corrosion.
- b) All fasteners used in the construction of the equipment shall be either of corrosion resistant material or heavy cadmium plated. Current carrying fasteners shall be either of stainless steel or high tensile brass or copper.

8.0 SHOP INSPECTION AND TESTS8.1 Stage Inspection and Tests

All materials, components and equipment covered in this specification shall be procured, manufactured as per approved standard quality plan and shall be complied with.

8.2 Type tests

First motor of each type and rating shall be subjected to tests as per IS:325. In addition to this, the following tests shall also be done on first motor of each type and

- a) Over speed test at 20% overspeed for 2 minutes.
- b) Polarization index test. The test value shall be more than 2 when determined as per IS:7816
- c) Degree of protection as per IS 4691. Type test as per IS:4691 for D.O.P. of similar enclosure design can also be subject to purchaser's approval.

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- d) Measurement of noise level as per BS:4999 Part 51.
- e) Tan delta and dielectric loss measurement on each phase of motor stator winding.

8.3 Routine Tests

All motors shall be subjected to routine tests as per IS:325. All motors except the one which has been subjected to type test shall be subjected to the following tests in addition to the routine tests:

- a) Measurement of stator resistance.
- b) Verification for direction of rotation relative to phase sequence of the supply.
- c) Measurement of vibration as per IS: 12075.
- d) Axial play for the rotor having sleeve bearing.

8.4 The following additional Special Tests shall also be conducted:

- a) Surge withstand test on the sample coils at $(4u+5)$ kV and with at least five impulses of 1.2/50 micro sec. wave where u is the line to line voltage in kV.
- b) Surge withstand test at 25.5 kV (PEAK) with 0.3/3 micro sec wave on 6.6 kV motor sample coils with at least five such impulses. For 11 kV motor sample coils, the test voltage value shall be mutually agreed between purchaser & manufacturer.

9.0 SITE TESTS

9.1 Site checks/tests shall be done at site by the equipment supplier (by purchaser in case of supply contract) to ascertain the compliance of the motor with specification and the test specification and the test certificates as per relevant standards and other tests as agreed with BHEL site.

- a) Measurements of insulation resistance.
- b) Measurements for starting current.
- c) Check on motor vibration.
- d) Polarization index.
- e) Correctness for phase sequence.

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10.0 PERFORMANCE GUARANTEES

Bidders shall guarantee that motors offered shall meet the rating and performance requirements as stipulated in this specification and as confirmed by them in technical data sheets and motor characteristics curves. In case the performance of motors at site is not as per the performance guarantee, the bidders have to replace the motors at site free of cost. Regarding performance guarantee refer section 'C' of specification also.

11.0 DRAWINGS

11.1 Drawings to be submitted with offer:

- a) Data Sheet B
- b) Dimensional outline drawing.
- c) Standard Quality Plan (Enclosed in Vol. III) after putting signature and seal of acceptance.
- d) Field Quality Plan for quality checks to be observed at site during erection, testing and commissioning, as per standard BHEL format.
- e) Test certificates for equipment of similar rating and design.
- f) Clause wise deviations, if any.

11.2 Drawings/Data to be submitted after award of contract

- a) Data Sheet C
- b) Final Quality Plan & Field Quality Plan
- c) OGA drawing showing the position of terminal boxes, earthing connections, temperature sensing devices, etc.
- d) Arrangement drawing of terminal boxes.
- e) Characteristic Curves
 - (i) Current versus time at rated voltage and minimum starting voltage.
 - (ii) Speed versus time at rated voltage and minimum starting voltage.
 - (iii) Torque versus speed at rated voltage and minimum voltage. For the motors with solid coupling the above curve i), ii), & iii) to be furnished for the motors coupled with driven equipment. In case motors with flexible coupling, above curves to be furnished with and without coupling. The torque speed curve of driven equipment to be shown with torque speed curve of motor.



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(iv) Thermal withstand curve at hot and cold conditions.

(v) Power factor, efficiency, current, slip versus load curves.

f) O & M manual

12.0 INSTALLATION AND MAINTENANCE MANUAL

12.1 The installation and maintenance manual of motor shall contain the following:

- a) Application of motor
- b) Technical Data
- c) Salient constructional features
- d) Instruction to be followed on receipt of motors at site
- e) Handling and slinging
- f) Storage and reconservation
- g) Instructions for foundation
- h) Erection procedure and check
- i) Earthing
- j) Drying out
- k) Commissioning procedures and site tests
- l) Routine, periodic and preventive inspection and maintenance procedures
- m) Assembly and disassembly of terminal box, rotor, stator, coolers, bearings, RTD etc.
- n) Safety rules
- o) Possible faults, their causes and remedies
- p) Routine and type test reports
- q) Catalogs, literatures and drawings

13.0 SPARES

13.1 Recommended list of spares for commissioning and for operation and maintenance of the motors for a period of three (3) years shall be furnished.

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13.2

A minimum of the following commissioning and O & M spares are to be included in the offer:

a) Commissioning Spares:

- (1) One set of driving end (DE) and nondriving end (NDE) bearings for each type of frame size of motor.

b) Operation and maintenance (O & M) spares.

- (1) One set of driving end (DE) and nondriving end (NDE) bearings for each type of frame size of motor.
- (11) One number bearing oil temperature indicator.
- (111) One number cooling air temp. indicator.

13.3

Bidder shall also quote for any other spares not listed above but necessary for commissioning or for operation and maintenance.



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ANNEXURE-I

LIST OF APPLICABLE CODES & STANDARDS

1.	INDUCTION MOTOR - THREE PHASE	[] IS325 [] BS4999 [] IEC34-1
2.	DESIGNATION FOR TYPE OF CONSTRUCTION & MOUNTING ARRANGEMENT OF ROTATING ELECTRICAL MACHINES	[] IS2253 [] BS4999-107 [] IEC34-7
3.	TERMINAL MARKING FOR ROTATING ELECTRICAL MACHINERY	[] IS4728 [] BS4999-108 [] IEC34-8
4.	DESIGNATION OF METHODS OF COOLING FOR ROTATING ELECTRICAL MACHINES	[] IS6362 [] BS4999-106 [] IEC34-6
5.	DIMENSIONS OF SLIDE RAIL FOR ELECTRIC MOTORS	[] IS2968 [] []
6.	GUIDE FOR TESTING THREE PHASE INDUCTION MOTORS	[] IS4029 [] BS4999-143 []
7.	DEGREES OF PROTECTION PROVIDED BY ENCLOSURES FOR ROTATING ELECTRICAL MACHINES	[] IS4691 [] BS4999-105 [] IEC34-5
8.	CODE OF PRACTICE FOR CLIMATE PROOFING	[] IS3202 [] BSCP1014 []
9.	MEASUREMENT AND EVALUATION OF VIBRATION OF ROTATING ELECTRICAL MACHINES	[] IS12075 [] BS4999-142 [] IEC34-14
10.	CLASSIFICATION OF HAZARDOUS AREAS FOR ELECTRICAL INSTALLATION	[] IS5572 [] [] IEC79
11.	NOISE MEASUREMENT	[] IS6098 [] BS4999-51 [] IEC34-9
12.	STANDARDISATION OF MOTOR FOR AUXILIARIES	[] CBIP-40 [] BS5000-40 []
13.	PREFERRED NUMBERS	[] IS1076 [] []

NOTES:

- EQUIPMENT, ASSOCIATED ACCESSORIES, COMPONENTS/PARTS, RAW MATERIAL AND TESTS SHALL IN GENERAL CONFORM TO
[] IS [] BS [] IEC
- OFFERS CONFORMING TO OTHER AUTHORITATIVE STANDARDS
[] MAY ALSO BE CONSIDERED
[] MAY NOT BE CONSIDERED

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DATA SHEET - A

MV MOTORS

SPECIFIC TECHNICAL REQUIREMENTS

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SECTION D 2

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- 1.0 Design ambient temperature : 50 °C
- 2.0 Driven equipment :
(as specified in specification)
- 3.0 Minimum kW rating of MV motors : > 160 kW
- 4.0 Details of Supply system
- a) Rated voltage : 6600 V, ± 10 %
 - b) Rated frequency : 50 Hz, ± 5 %
 - c) Combined Voltage and frequency variation (sum of absolutes) : 10 %
 - d) System fault level at rated voltage : 40 kA
 - e) Short time rating of MV switchgear : 40 kA for 3 sec.
 - f) Short time rating for terminal boxes : 40 kA for 0.25 sec.
 - g) MV system grounding : ~~Isolated / high resistance / low resistance~~
- 5.0 Applicable standard : As per annexure-I enclosed
- 6.0 Minimum voltage for starting
- a) Mill Motor : _____ % of rated voltage
 - b) Other Motors : 80 % of rated voltage
- 7.0 Locked Rotor current
- a) Excluding tolerance
 - i. BFP motor : 4.5 times rated current
 - ii. Other motors : 6.0 times rated current
 - b) Including tolerance : ± 20 % on all motors
- 8.0 Type of power cables
- a) Insulation : ~~PVC~~ / XLPE
 - b) Sheathing : ~~PVC~~ / FRLS PVC
 - c) Voltage grade : 6.6 kV ~~Earthed~~ / Unearthed
 - d) Armouring : Armoured / ~~unarmoured~~

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DATA SHEET - A

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SPECIFIC TECHNICAL REQUIREMENTS

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- e) Conductor : Copper / ~~aluminum-stranded~~
- f) Screening : ☒ Conductor screened /
☒ Insulation screened
- 9.0 Cable sizes :
- a) power cable for motor : Later sq. mm
- b) power cable for space heater : minimum 2.5 sq. mm PVC armoured Cu
- c) Control cable for RTD : 2 pair 0.5 sq. mm Cu
- d) Control cable for BTD : 2 pair 0.5 sq. mm Cu
- 10.0 Grounding
- a) Conductor size : 50X6 mm
- b) Material : G5 FLAT
- 11.0 Space heater supply : 240 V, single phase
- 12.0 Painting : As per clause No. 7.0
- 13.0 Location of main phase terminal boxes :
- 14.0 Cooling water specification :
- 15.0 Additional tests :
- 16.0 Axial thrust in case of vertical motors (as specified by driven equipment vendor) :
- 17.0 Direction of rotation when viewed from non-driving end : Anti-clockwise / Clockwise
- 18.0 Insulation : CLASS F (ALL INSULATED WINDING) SHALL BE OF COPPER

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INSTRUCTIONS
TO VENDOR

1. This data sheet shall be filled up on the basis of finally agreed points of Data Sheet B, Bld Clarifications and MOM with the bidder.
2. This data sheet shall be submitted by successful bidder after award of contract.

- 1.0 Manufacturer :
- 2.0 Type and frame size & design :
code no.
- 3.0 Nos. required :
- 4.0 Application :
- 5.0 Specification & codes :
- 6.0 Capacity
- a) for specified climatic :
conditions
- b) at 40 °C ambient temp. :
- 7.0 Location of installation : Indoor / Outdoor
- 8.0 Type of enclosure & ventilation:
- 9.0 Degree of protection :
- 10.0 Type of duty :
- 11.0 a) Rated voltage : V
- b) No. of phases :
- c) Frequency : Hz
- 12.0 Permissible variations in
- a) Voltage : x
- b) Frequency : x
- c) Combined voltage & frequency : x
(sum of absolute values)
- 13.0 At rated voltage & frequency
- a) Full load current : A
- b) Full load speed : rpm

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- c) No load current : A
- 14.0 Minimum permissible voltage : _____ % of rated
during starting to bring the voltage
driven equipment up to rated
speed
- 15.0 Maximum permissible time at : _____ minutes
minimum permissible voltage
during running at full load running at _____ % of
rated voltage
- 16.0 Maximum permissible time at 75% : min.
of rated voltage during running
at full load
- 17.0 Whether motor stalls at 70% of :
rated voltage (refer clause
3.5.2)
- 18.0 Efficiency & power factor at : Efficiency P.F.
a) Full load :
b) 50% of full load :
c) 25% of full load :
d) No load :
e) At start :
- 19.0 Stator winding
a) Connection :
b) Type & nos. of terminals :
brought out
c) Resistance between : ohms
terminals at 20 °C
d) Resistance per phase at : ohms
20 °C
- 20.0 Starting current as percentage
of full load current
a) with IS tolerance : %
b) without IS tolerance : %

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- | | | | |
|------|--|---|------|
| 21.0 | Torque at full load | : | kg.m |
| 22.0 | Break away torque as percentage:
of full load torque | : | % |
| 23.0 | Pull up torque as percentage
of full load torque | : | % |
| 24.0 | Pull out torque as percentage
of full load torque | : | % |
| 25.0 | Starting time in sec. without
mechanism coupled or mechanism
coupled through hydraulic
coupling when it may be presumed
that load is transferred to
motor shaft only after attaining
almost full speed | | |
| a) | with rated voltage | : | sec. |
| b) | with 80% of rated voltage: | : | sec. |
| c) | with 110% of rated voltage: | : | sec. |
| 26.0 | Starting time in sec. with
mechanism coupled through
flexible coupling | | |
| a) | with rated voltage | : | sec. |
| b) | with 80% rated voltage | : | sec. |
| c) | with 110% rated voltage | : | sec. |
| 27.0 | Safe stall time (Hot motor) | | |
| a) | at rated voltage | : | sec. |
| b) | at 80% rated voltage | : | sec. |
| c) | at 110% rated voltage | : | sec. |
| 28.0 | Safe stall time (Cold motor) | | |
| a) | at rated voltage | : | sec. |
| b) | at 80% rated voltage | : | sec. |
| c) | at 110% rated voltage | : | sec. |

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29.0	Whether speed switch is provided, if required :	YES / NO	
30.0	Limiting rotor temp. to determine safe stall time :		
31.0	Permissible maximum accelerating time (hot motor) at full load		
a)	at rated voltage :	sec.	
b)	at 80% rated voltage :	sec.	
c)	at 110% rated voltage :	sec.	
32.0	Permissible maximum accelerating time (cold motor) at full load		
a)	at rated voltage :	sec.	
b)	at 80% rated voltage :	sec.	
c)	at 110% rated voltage :	sec.	
33.0	Insulation		
a)	Class of insulation :		
b)	Tropical and fungicidal treatment (mention treatment) given :		
34.0	Whether insulation is suitable for 6.6 kV earthed system		
35.0	Temp. rise under normal and abnormal conditions over 50 °C ambient temperature		
a)	By resistance method :	____ °C over cooling water temp. of ____ °C : ____ °C over cooling air temp. of ____ °C	
b)	By thermometer method :	____ °C over cooling water temp. of ____ °C : ____ °C over cooling air temp. of ____ °C	
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- 36.0 Method of starting :
- 37.0 Permissible starting duty cycles :
- 38.0 Stator thermal time constant :
- 39.0 Maximum permissible voltage during high speed bus transfer & its duration (describe special design feature) : _____ % of rated voltage for _____ duration
- 40.0 Time required for voltage to decay down to following values when driving voltage is removed
- a) 50% : sec.
- b) 40% : sec.
- c) 25% : sec.
- d) 0% : sec.
- 41.0 Method of cooling :
- 42.0 Details of water cooling system
- a) No. of coolers :
- b) Water requirement per cooler : LPM
- c) Losses removed by cooler :
- d) Max. permissible temp. of cooling water at inlet : °C
- e) Maximum permissible temp. of cooling water at outlet : °C
- f) Maximum permissible pressure at water outlet : kg/sq.cm
- g) Water pressure drop through the cooler :

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h) Temp. of cold air coming:
out & entering the machine
for permissible cooling
water temperature

°C

i) Temp. rise of air passing:
through machine at full
load

°C

j) Air pressure drop through:
the cooler

k) Temp. rise of water :
through cooler

°C

l) Protection against :
leakage of water

m) Arrangement to ensure the:
water flow

43.0 Bearings

a) Number :

b) Type :

c) Lubrication System :

d) Quantity of lubricant :
required for both the
bearings

e) Life at rated speed :

hrs.

f) Recommended lubricant :

g) Bearing end play :

h) Inlet oil pressure :

i) Temp. rise of oil through:
bearing

°C

j) Max. permissible temp :
of oil

°C

k) Max. permissible temp. :
of bearing

°C

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- 1) Permissible running time :
without forced oil at full
load & full speed
- m) Whether bearings are : YES / NO
provided with 3 wire,
platinum RTD having 100
ohm resistance at 0°C
for remote temp.
indication
- n) Whether bearings are :
provided with local
temp. indicator having
two adjustable contacts
rated for 2A at 240V
AC or 0.2A at 220V DC
- o) If forced lube oil system
provided
- i. Qty. of lubricant :
required for
initial filling
- ii. Recommended period :
after which
lubricant should
be replaced
- iii. Bearing cooling :
water requirement
- iv. Max. permissible : °C
bearing cooling
water inlet temp.
- v. Max. permissible : °C
bearing cooling
water outlet temp.
- 44.0 Terminal designation corres- :
ponding to direction of
rotation (facing driving end)
- 45.0 Whether separate terminal
boxes provided for
- a) Main terminals : YES / NO

Name of vendor

Project

Revision number

0

1

2

3

Vendor's signature

DATA SHEET - C				SPECIFICATION No.	
MV MOTORS				VOLUME IIB	SECTION D2
				SHEET 8	OF 11
	b) Space heaters	:		YES / NO	
	c) Winding temp. detectors	:		YES / NO	
	d) Bearing temp. detectors	:		YES / NO	
	e) Moisture detectors	:		YES / NO	
	f) Neutral terminals	:		YES / NO	
46.0	Main terminal box details				
	a) Type & Nos.	:			
	b) Fault level permissible for 0.25 sec.	:		MVA	
	c) Rating of each	:			
	d) Total power requirement	:			
	e) Voltage	:		V	
47.0	Details of 3 wire, platinum RTD having 100 ohm resistance at 0°C for winding temp. & bearing temp. detectors				
	a) Type	:			
	b) Nos. provided	:			
	c) Location	:			
48.0	Whether differential protection provided. If yes,				
	a) no. of CTs supplied along with motors	:			
	b) CT details	:			
	i. CT ratio	:			
	ii. Knee point voltage	:			
	iii. Short ckt. with-stand capacity	:			
49.0	Type of mounting				
Name of vendor			Project		
Revision number	0	1	2	3	Page 184 of 202
Vendor's signature					

DATA SHEET - C

SPECIFICATION No.

HV MOTORS

VOLUME 11B

SECTION D2

SHEET 9

OF 11

- 50.0 Shaft orientation :
- 51.0 Shaft extension :
- 52.0 Grounding pads, sizes, nos. & location :
- 53.0 Method of coupling to driven mechanism :
- 54.0 GD sq. value
- a) of the motor :
- b) of the mechanism referred to the motor shaft :
- 55.0 Thermal inertia of the motor :
- 56.0 Whether the speed switch provided : YES / NO
- 57.0 Details of speed switch, if provided :
- 58.0 Compliance with testing requirements : YES / NO
- 59.0 Lifting Device :
- 60.0 Weight
- a) Weight of stator (wound) :
- b) Weight of rotor (wound) :
- c) Weight of base plate :
- d) Weight of Copper :
- e) Net weight of motor :
- 61.0 Shipping details
- a) Shipping dimensions :
- b) Shipping weight :

Name of vendor

Project

Revision number

0

1

2

3

Vendor's signature

DATA SHEET - C

SPECIFICATION No.

MV MOTORS

VOLUME IIB

SECTION D 2

SHEET 10

OF 11

62.0 Whether dial type capillary :
thermometers with temperature
switch provided

- a) In cold air / water path :
b) In hot air / water path :
c) For measurement of oil :
temp. for bearings

63.0 Characteristic curves attached

- a) Speed vs current at : YES / NO
rated voltage
b) Speed vs torque at 110%, : YES / NO
100%, 90% and 80% of
rated voltage
c) Thermal withstand curve : YES / NO
for hot & cold conditions
d) Efficiency vs load : YES / NO
e) p.f. vs load : YES / NO
f) Current vs time : YES / NO
g) Negative phase sequence : YES / NO
curve

64.0 Drawings attached

- a) General arrangement of : YES / NO
motor
b) Main terminal box showing : YES / NO
Boards's incoming cables
c) Instruction manuals : YES / NO

65.0 Other Documents Attached

- a) Final Quality Plan : YES / NO
b) Final Field Quality Plan : YES / NO

Name of vendor		Project		
Revision number	0	1	2	3
Vendor's signature				

DATA SHEET - C

SPECIFICATION No.

HV MOTORS

VOLUME #B

SECTION D 2

SHEET 11

OF 11

65.0 List of Spares

Commissioning Spares

O&M Spares

Name of vendor

Project

Revision number

0

1

2

3

Vendor's signature



TITLE:

**TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT SYSTEM**

2X800 MW YERMARUS STPP

BHEL DOCUMENTS NO.: PE-TS-362-156-A001

VOLUME II-B

SECTION -D3

REV. NO. 01

DATE: 10/03/2013

SECTION – D3

D3: GENERAL TECHNICAL REQUIREMENTS FOR C&I

BHEL – PS - PPEI: NOIDA, SECTOR-16A, U.P. – 201301



TITLE:
**TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT SYSTEM
2X800 MW YERMARUS STPP**

BHEL DOCUMENTS NO.: PE-TS-362-156-A001

VOLUME **II-B**


SECTION –D3

REV. NO. 01

DATE: 10/03/2013


GENERAL TECHNICAL REQUIREMENTS FOR LOCAL CONTROL PANEL

BHEL – PS - PPEI: NOIDA, SECTOR-16A, U.P. – 201301


	DATA SHEET FOR LOCAL PANELS			SPECIFICATION NO.:	
				VOLUME	
				SECTION	
				REV. NO.	DATE:
				SHEET	1 OF 2
TAG No. Qty.....			Data Sheet No.: PES-145A-DS1-0		
Data Sheet A & B					
DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)				DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL	MANUFACTURER				
	CONSTRUCTION	<input checked="" type="checkbox"/> FOLDED <input type="checkbox"/> WELDED (As per requirement)			
TECHNICAL	INPUT POWER SUPPLY	<input type="checkbox"/> 240V 50 Hz AC <input type="checkbox"/> 220V DC <input checked="" type="checkbox"/> 415V 3 PHASE (4 wires)			
	NO. OF FEEDERS	<input type="checkbox"/> ONE <input type="checkbox"/> TWO			
	CONTROL SUPPLY	<input type="checkbox"/> 110V AC <input type="checkbox"/> 220V AC <input type="checkbox"/> 220V DC <input type="checkbox"/> (As per requirement)			
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)	_____ NOS. (AS REQUIRED)			
	PAINT TYPE	<input checked="" type="checkbox"/> EPOXY <input type="checkbox"/> SYNTHETIC ENAMEL <input type="checkbox"/> POWER COATED			
	PANEL COLOUR (EXTERNAL)	<input checked="" type="checkbox"/> LIGHT GREY (Shade 631 IS-5) <input type="checkbox"/> OPALINE GREEN (Shade 275) <input type="checkbox"/>			
	FINISH	<input type="checkbox"/> SEMI MAT <input type="checkbox"/> MATT <input type="checkbox"/> GLOSSY <input checked="" type="checkbox"/> SEMI GLOSSY			
	PANEL COLOUR (INTERNAL)	<input checked="" type="checkbox"/> WHITE <input type="checkbox"/> CREAM <input type="checkbox"/> OFF WHITE			
	FINISH	<input type="checkbox"/> SEMI MAT <input type="checkbox"/> MATT <input type="checkbox"/> GLOSSY <input checked="" type="checkbox"/> SEMI GLOSSY			
	CLASS OF PROTECTION	<input checked="" type="checkbox"/> IP-54 <input type="checkbox"/> _____			
	CONTROL HARDWARE	<input type="checkbox"/> RELAY BASED <input checked="" type="checkbox"/> PLC As per Requirement			
	FOUNDATION ARRANGEMENT	<input checked="" type="checkbox"/> FOUNDATION BOLTS <input type="checkbox"/> ANCHOR FASTENERS			
	WEIGHT OF PANEL (Kg.)				
	PANEL TYPE	<input checked="" type="checkbox"/> PRESSURISED <input type="checkbox"/> UNPRESSURISED As per Requirement			
	CABLE GLAND	<input type="checkbox"/> SINGLE COMPRESSION <input checked="" type="checkbox"/> DOUBLE COMPRESSION			
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL NAME SIGNATURE DATE	

THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

FORM NO. PEM-6666-0

	DATA SHEET FOR LOCAL PANELS			SPECIFICATION NO.:	
				VOLUME	
				SECTION	
				REV. NO.	DATE:
				SHEET 1	OF 2
TAG No. Qty.....			Data Sheet No.: PES-145A-DS1-0		
Data Sheet C					
DATA SHEET-C FOR LOCAL PANEL (TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)					
GENERAL	MANUFACTURER				
	CONSTRUCTION				
TECHNICAL	INPUT POWER SUPPLY				
	NO. OF FEEDERS				
	CONTROL SUPPLY				
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)				
	PAINT TYPE				
	PANEL COLOUR (EXTERNAL)				
	FINISH				
	PANEL COLOUR (INTERNAL)				
	FINISH				
	CLASS OF PROTECTION				
	CONTROL HARDWARE				
	FOUNDATION ARRANGEMENT				
	WEIGHT OF PANEL (Kg.)				
	PANEL TYPE				
	CABLE GLAND				
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL NAME SIGNATURE DATE	

THIS IS A PART OF SPECIFICATION NO. PE-TS-362-156-A001

	DOCUMENT TITLE		DOCUMENT	PE-GL-999-145-1003A	
	GUIDELINE FOR SELECTION OF INSTRUMENTATION CABLE FOR MAUX PACKAGES		NUMBER		
	PROJECT : STANDARD		REVISION NUMBER	00	DATE 29-05-2008
			SHEET	1	OF 1


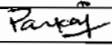
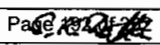
1. The sizes of cable (in term of no. of pairs) has been rationalized in order to achieve greater standardization and better management of quantities, therefore selection shall be generally done in accordance with the following table , based on the requirement for a given application.
2. For PLC based LCP, 0.5mm² screened cables (Type-F, G) to be used. The cable type shall be selected as 0.5mm² type-F (Individual and overall screened) for analog signals and 0.5mm² type-G (Overall screened) for Binary signals.
3. However analog signals like, current and position feedback, 2P type-G cable shall be used, wherein one pair shall remain spare.
4. For selection of cable between instrument to JB/LCP, refer the enclosed interconnection diagram.
5. For drive's cable between PLC and MCC/ actuator , refer project specific drive control philosophy
6. The cables related to Relay based local control panels (Between field, LCP and MCC) to be selected as 1.5mm² control cable from the sizes rationalized by Pem-Elect (3C,5C,7C,12C,19C,24C), after confirming the availability for the given project
7. 3C, 2.5mm² cable shall be used between interposing relays and sol valve.

Type-F (0.5mm², Individual and overall screened)

Size	Purpose	Remark
4P	Control valve's demand and feedback, Field I/O	
8P	Field I/O	
12P	HT motor brg, winding, Field I/O	(when 3 pt. Of motor winding are monitored)
20P	HT motor brg, winding, Field I/O	(when 6 pt. Of motor winding are monitored)

Type-G (0.5mm², Overall screened)

Size	Purpose	Remark
2P	Motor Current , Position feedback signals, Field sensors	
4P	BID, LT drives, sol vlv fb, field I/O	Depending upon drive control philosophy
8P	BID, LT, HT drives, field I/O	
12P	HT drives, field I/O	
16P	LCPs , field I/O	

PARTICULARS	PREPARED BY	REVIEWED BY	APPROVED BY
NAME	MA MANSOORI	PANKAJ JAIN	S.K. DATTA
DESIGNATION	Manager	DGM	Sr. DGM
SIGNATURE			
DATE	29-05-2008	29-05-2008	29-05-2008

[illegible]



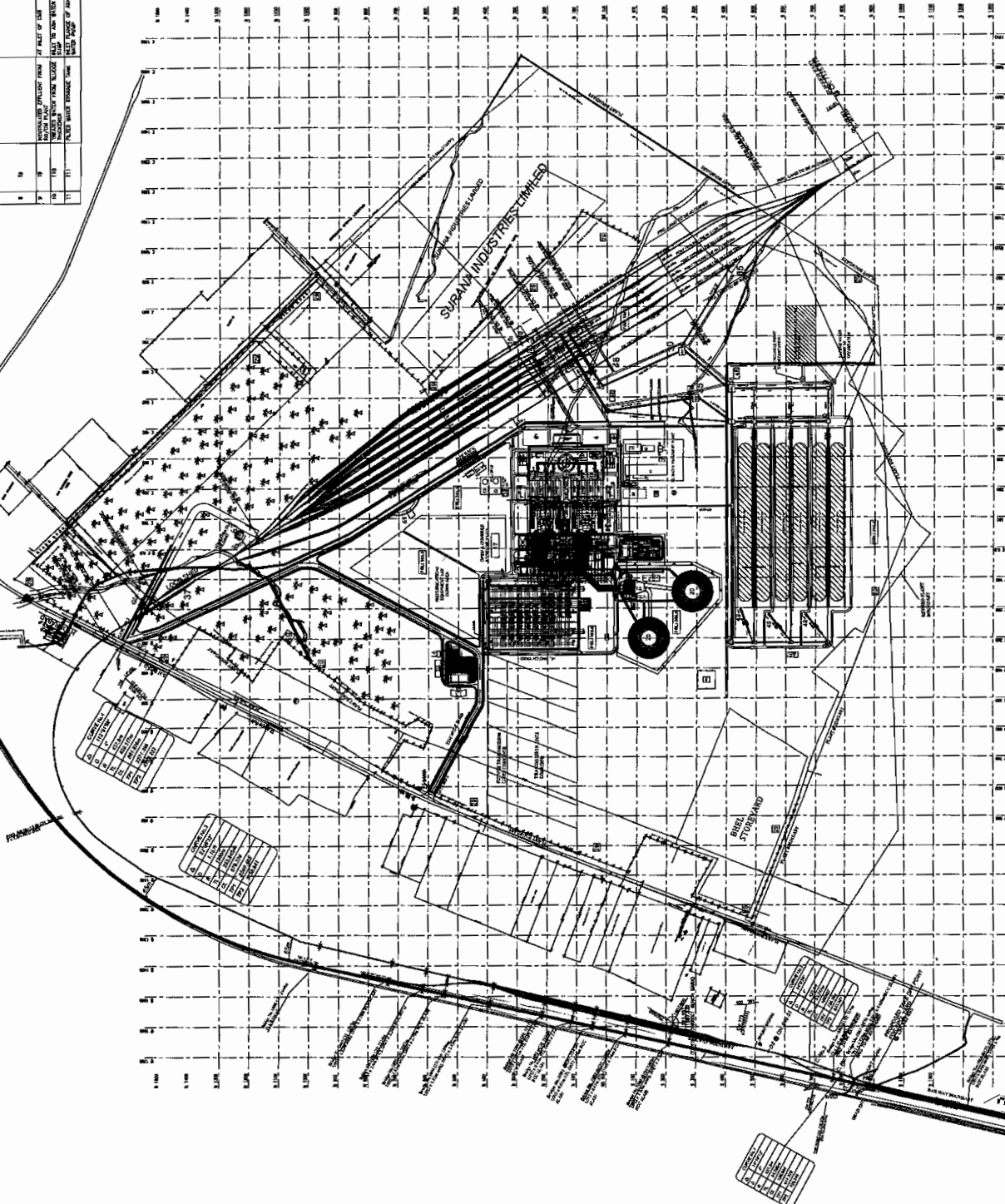
PROJECT: 2X800 MW YERMARUS STPP		DEPT	NAME	SIGN	DATE
CUSTOMER: RAICHUR POWER CORPORATION LIMITED		CODE	PRN	GAU	10-02-11
CONSULTANT: STEAG		NAME	GAU	PRN	10-02-11
BHARAT HEAVY ELECTRICALS LTD		NAME	PRN	GAU	10-02-11
POWER SECTOR		NAME	GAU	PRN	10-02-11
PROJECT ENGINEERING MANAGEMENT		NAME	GAU	PRN	10-02-11
NEW DELHI		NAME	GAU	PRN	10-02-11

TYPICAL LAYOUT FOR CW TREATMENT PLANT

MPL	C	MSE	I	MAX	E	DEPT.	SCALE	NTS	DRAWING No

SHEET	01	OF	01	REV	01		SIGN				
							DATE				

SIZE-A2



SL	DESCRIPTION	SCORE
1	1.	SCORE
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7	7.	
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98	98.	
99	99.	
100	100.	

NO.	ARTICLE DESCRIPTION	NO. OF	REMARKS
1	PAINTS	100	
2	PAINTS	100	
3	PAINTS	100	
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6	PAINTS	100	
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96	PAINTS	100	
97	PAINTS	100	
98	PAINTS	100	
99	PAINTS	100	
100	PAINTS	100	

NOTES:-

1. EXISTING M&A INDICATED INSIDE PLANT TO BE MODIFIED TO SUIT PLANT DRAINAGE SYSTEM.
2. CURTAIN LAYOUT IS INDICATIVE AND SHALL BE FINALISED BY CURTAIN VENDOR.

HOLD-UP=

1. REPL. TO CONFIRM WEATHER REVERSED PLANT BOUNDARY INDICATED (IN BLACK COLOR) IS FINAL. AS REFLECT ROAD POINTING A GREEN BELT ALONG IT IS UNDER HOLD.

APPENDIX

RAICHER POWER CORPORATION LTD.

INVESTIGANDO IL CLIENTE CONSULTANT

CLIENT'S CONSULTANT:

STEAG ENERGY SERVICES (INDIA) PVT. LTD.

Corporate Office
A-29 Sector-18, Noida-201301, India

PROJECT VERMADIS THERMAL POWER STATION

2 X 808 MF

37111

REV.	DATE	ALTD	CHG	APPD	REV.	DATE	ALTD
1	28.07.2011	Y007	0.7A	0.7A	02	11.07.2011	Y003

Figure 1. The effect of the number of trials on the mean number of correct responses. The number of correct responses increased with the number of trials, and the increase was more pronounced for the high condition than for the low condition.

NOTE:
1. PLOT PLAN REC'D, 03 AUGUST 2011 FROM M/S STEAG AND UPDATED BY BHIL - PEM ON 03 DECEMBER 2011.

ROOM, CPU RACK, WINE WATER & OIL TRANSFER PUMP HOUSE MODIFIED AND RELOCATED. THE MODIFICATION ARE AS PER MOM DATED 24-28 NOV 2011.

4. AN- & CUP AREA OUT OF INDICATIVE AND SHALL BE PROVIDED LATER BY CONCERNED AGENCY.

[illegible]

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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TITLE: **TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT SYSTEM
2X800 MW YERMARUS STPP**

BHEL DOCUMENTS NO.: PE-TS-362-156-A001

VOLUME **III**

SECTION -

REV. NO. 01

DATE: 10/03/2013

LIST OF SCHEDULES



TITLE:
**TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT SYSTEM
2X800 MW YERMARUS STPP**

BHEL DOCUMENTS NO.: PE-TS-362-156-A001

VOLUME **III**

SECTION -

REV. NO. 01

DATE: 10/03/2013

SUGGESTIVE PRICE FORMAT FOR CW TREATMENT PLANT: 2X800 MW YERMARUS STPP

Sl. No.	DESCRIPTION OF EQUIPMENT / ITEM	TOTAL PRICE FOR "FOR" SITE
(1)	(2)	(3)
1.0	Total lump sum firm price on FOR site basis for design, engineering, manufacture, fabrication, inspection, testing at manufacturer's works, supply/delivery duly packed at site including freight, unloading, storage and handling at site, in site transportation, erection and commissioning, trial run at site, PG test, plant handing over to customer etc. inclusive of all prevailing taxes, duties and other levies of CW Treatment Plant (along with the chemicals and supervision as indicated in technical specification) complete with all accessories, start up and commissioning spares as required for the total scope defined as per BHEL Technical specification - PE-TS-362-156-A001 for 2X800 MW YERMARUS STPP.	
NOTES:		
a	Bidder to note that total price indicated above at 1.0 shall be considered for evaluation and hence, should be complete in all respect for the full scope defined and considering all terms and conditions agreed.	
b	In case, price indicated above does not match with item wise break-up given at 2.0, the highest price so calculated shall be considered for evaluation but in case of order, the same shall be placed at the lowest price.	
2.0	BREAK-UP OF PRICES GIVEN IN 1.0 ABOVE	
2.1	Total lump sum firm price for EQUIPMENT (SUPPLY) i.e. design, engineering, manufacture, fabrication, inspection, testing at vendor / sub vendor works, supply/delivery duly packed at site etc. but exclusive of all taxes & duties for the complete scope of supply of CW TREATMENT PLANT defined in the BHEL tender specification for delivery up to site basis (freight included).	
2.2	Erection & Commissioning	
2.3	PG test and handing over the plant to customer.	



TITLE :
TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT SYSTEM
2X800 MW YERMARUS STPP

BHEL DOCUMENTS NO.: PE-TS-362-156-A001

VOLUME III

REV. NO. 01 **DATE : 10/03/2013**

SHEET 1 OF 1

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

- a.) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.
- b.) QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.
QP will be subject to BHEL/Customer approval in the event of order & 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.
The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder
- c.) All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.
- d.) There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'
- e.) The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.
- f.) The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).
- g.) All sub vendors shall be subject to BHEL/CUSTOMER approval
- h.) Bidder confirms that all drawings/documents in soft as well as hard copy shall be submitted within 2 weeks from placement of LOI's in the event of order.
Within one (1) week of receipt of BHEL comments a technical representative of bidder shall come for meeting with BHEL alongwith revised documents to resolve all issues and incorporate all comments in the soft copy here for further submission to customer.
Further on receipt of customer comments on the documents a technical representative from bidder shall come for meeting to resolve all issues and incorporate all comments in the soft copy at BHEL and resubmit the drgs/documents for cat I approval and shall visit customer/customer's consultant if required for across the table approval of documents.
- i.) Any special tools & tackles, if required, shall be in bidder's scope.
- j.) Performance Guarantees shall stand valid till the satisfactory completion of performance testing and its acceptance by purchaser/customer
- k.) Prices for recommended spares (if any) for three year operation shall be furnished separately and not to be included in the base price.

BHEL – PS - PPEI: NOIDA, SECTOR-16A, U.P. – 201301.



TITLE:
SCHEDULE OF DEVIATIONS:
 () From Conditions of Contract (Volume-I)
 () From General Technical Conditions (Volume-IIA)
 () From Technical Specification (Volume-IIB)

SPECIFICATION NO. PE-TS-362-156-A001
 VOLUME III
 SECTION
 REV. NO. 01 | DATE: 10/03/2013
 SHEET of

SCHEDULE OF CLARIFICATIONS/DEVIATIONS

All clarification/deviations from the Technical Specification shall be filled in by the BIDDER clause by clause in this format only.

VOLUME	SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION REQUIREMENT	CLARIFICATION	REASONS FOR CLARIFICATION

NOTE: Bidder to furnish the specification clause no. against which the deviation is sought. No general deviation (without mention of the specification clause no.) shall be entertained and the same shall be treated as null and void.

We the undersigned hereby certify that the above mentioned are the only deviations.

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE.				<div style="border: 1px solid black; height: 100px; margin: 0 auto; width: 80%;"></div>
NAME	DESIGNATION	SIGNATURE	DATE	
				COMPANY SEAL



TITLE:
TECHNICAL SPECIFICATION FOR
CW CHEMICAL TREATMENT SYSTEM
2X800 MW YERMARUS STPP

BHEL DOCUMENTS NO.: PE-TS-362-156-A001

VOLUME **III**

SECTION -

REV. NO. 01

DATE: 10/03/2013

LIST OF DRAWING / DOCUMENTS TO BE SUBMITTED AFTER AWARD OF CONTRACT

SL. NO.	BHEL DRG NO	DRG TITLE	CATEGORY	No. of weeks for document submission after placing LOI/PO
1.	PE-V3-362-156-A001	P&I DIAGRAM OF CW TREATMENT PLANT	A	4
2.	PE-V3-362-156-A002	EQUIPMENT LAYOUT OF CW TREATMENT PLANT	A	4
3.	PE-V3-362-156-A003	CIVIL ASSIGNMENT DRAWING OF CW TREATMENT PLANT	A	8
4.	PE-V3-362-156-A004	PIPING LAYOUT OF CW TREATMENT PLANT	A	10
5.	PE-V3-362-156-A005	OPERATION & CONTROL PHILOSOPHY OF CW TREATMENT PLANT ALONG WITH CONTROL SYSTEM CONFIGURATION DIAGRAM (IF APPLICABLE)	A	4
6.	PE-V3-362-156-A006	LCP DOCUMENTS FOR CW TREATMENT PLANT—GA & WIRING DETAILS OF RELAY BASED CONTROL PANEL, BOM, MIMIC DIAGRAM	A	10
7.	PE-V3-362-156-A007	GA DRAWING OF ALL TANKS/VESSEL OF CW TREATMENT PLANT/SKID MOUNTED SYSTEM	A	8
8.	PE-V3-362-156-A008	DATA SHEET OF MOTORS	A	10
9.	PE-V3-362-156-A009	DATA SHEET OF PUMPS	A	10
10.	PE-V3-362-156-A010	DATA SHEET OF INSTRUMENTS	A	10
11.	PE-V3-362-156-A011	DATA SHEET OF VALVES	A	10
12.	PE-V3-362-156-A012	CABLE TRAY/TRENCH & CONDUIT ROUTING DIAGRAM ALONG WITH EARTHING LAYOUT OF CW TREATMENT PLANT	I	12
13.	PE-V3-362-156-A013	CABLE SCHEDULE OF CW TREATMENT PLANT	A	12
14.	PE-V3-362-156-A014	PG TEST PROCEDURE FOR CW TREATMENT PLANT	A	12
15.	PE-V3-362-156-A015	QAP FOR CW TREATMENT PLANT	A	8
16.	PE-V3-362-156-A016	O&M MANUAL FOR CW TREATMENT PLANT	I	20
17.	PE-V3-362-156-A017	ELECTRICAL LOAD DATA	I	8
18.	PE-V3-362-156-A018	VALVE SCHEDULE	A	12
19.	PE-V3-362-156-A019	SUB VENDOR LIST	A	4
20.	PE-V3-362-156-A020	PAINTING SCHEDULE	A	4
21.	PE-V3-362-156-A021	INSTRUMENT SCHEDULE	A	12
22.	PE-V3-362-156-A022	ENGINEERING BOQ	A	20

Note: The above mentioned documents are bare minimum. Any other document as required by BHEL shall be submitted by the bidder without and commercial and delivery implication to BHEL.



TITLE
*** SCHEDULE OF DECLARATIONS**

SPECIFICATION NO. PE-TS-362-156-A001.

VOL III

SHEET..... OF.....

* Bidder shall include this schedule both in technical and Price offers

DECLARATION

Icertify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated and there is no deviation to the specification.

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Bidders Company Name

Authorised representative's
Signature

Name

Bider's Name

The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated

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