1X700 MW BELLARY-3 STPP

VOLUME: II B & III

TECHNICAL SPECIFICATION
FOR
CW TREATMENT SYSTEM

SPECIFICATION NO.: PE-TS-367-156-A001

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA

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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.

SECTION - A

(SCOPE OF ENQUIRY)

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, site testing, pre commissioning, commissioning, trial run, performance and guarantee tests and handing over to customer the **CW CHEMICAL TREATMENT SYSTEM** for **1X700 MW BELLARY -3 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 (this 3 months period includes one initial star up/commissioning and PG test also).

- Scale Inhibitor
- Corrosion Inhibitor
- H_2SO_4

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 and scale deposition 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.

SECTION - B
(PROJECT INFORMATION)

1.0	Owner	:	Karnataka Power Corporation Ltd Shakthi Bhavan No.82, Race Course Road Bangalore–560 001 Karnataka, India
2.0	Project Title		1x700 MW Bellary Thermal Power Station Unit No3, Stage-3
3.0	**Location**	:	**Kudatini Village** **Bellary Dist** **Karnataka state INDIA**
4.0	Latitude and Longitude	:	15° 11' 58" N Latitude 76° 43' 23" E Longitude
5.0	Elevation above mean sea level	:	478 meters
6.0	Climatic Conditions		
	(a) Temperature		
	i. Monthly basis		
	Mean of daily maximum temperature	:	42.5° C (in the month of April)
	Mean of daily minimum temperature	:	19.5° C (in the month of Dec)
	ii. Monthly basis		
	Mean of daily maximum	:	37.5° C
	Mean of daily minimum	:	19.5° C
	iii Highest temperature recorded	:	42.5°C
	iv Lowest temperature recorded	:	14.6°C
	(b) Relative Humidity	:	Varies between 11% and 70%
	(c) Rainfall		
	Annual average rain	:	492 to 846 mm most of which occurs during August to October
	(d) Wind Speed		
	1 Annual mean wind speed	:	8.4 km / hr
	2 Maximum mean wind speed	:	19 km / hr in the month of July.

8.0 Wind Load
- (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

9.0 Wind Loading for Stack
- (a) For wind pressure as per clause 8.0 above
- (b) For RC stacks as per IS: 4998

10.0	Seismic data (as per IS:1893 latest issue)		
	(a) Zone	:	Zone III
	(b) Importance factor (I)	:	2.5 for electrical equipment 1.5 for others.
11.0	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 175 kW	:	11000V, 3 phase, 3 wire, 50Hz medium earthed AC 3300V, 3 phase, 3 wire, 50Hz medium earthed AC
	(b) For motor control centre	:	415V, 3 phase, 3 wire solidly earthed AC
	(c) For motor rated 175 kW and below	:	415, 3 phase, 3 wire solidly earthed AC
	(d) DC. motor starters, DC solenoids, DC alarm, control and protections	:	220 V DC, 2 wire, unearthed DC

(e)	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.
(f)	Uninterrupted power supply	:	110 V, 1 phase, 50Hz, 2 wire AC supply from UPS system for I&C (including indicator recorders) and UCMS only
(g)	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.
(h)	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.
(i)	Solid state controls (including solenoid valves)	:	24 V DC, 2 wire, supply from Battery chargers for instrumentation system only.
(j)	Lighting fixtures	:	240 V, 1 phase, 2 wire, 50Hz system.
(k)	Lighting fixtures and space heaters in panels	:	240 V, 1 phase, 2 wire, 50Hz system.
(l)	Construction supply	:	415 V, 3 phase, 4 wire, 50 Hz AC supply with neutral lead solidly earthed. .
(m)	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 ±10% Frequency variation ± 5% Combined voltage & frequency variation ± 10%
ii.	DC supply	:	Voltage variation +10% -20%

SECTION – C

SPECIFIC TECHNICAL REQUIREMENTS

C1: SPECIFIC TECHNICAL REQUIREMENTS FOR MECHANICAL

C2: SPECIFIC TECHNICAL REQUIREMENTS FOR ELECTRICAL

C3: SPECIFIC TECHNICAL REQUIREMENTS FOR C&I

SECTION – C1

SPECIFIC TECHNICAL REQUIREMENTS-MECHANICAL

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-367-156-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 star up/commissioning and PG test also) for normal run.

2.2.1 Scale Inhibitor.

2.2.2 Corrosion Inhibitor.

2.2.3 H_2SO_4

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 (shall be located under industrial shed of cooling water treatment plant).

2.5 Following minimum number of instruments:

2.5.1 pH transmitter one number (as per P & ID).

2.5.2 On line digital corrosion monitor one number (as per P & ID).

2.5.3 On line digital scale monitor one number (as per P & ID).

2.5.4 On line bio fouling monitor one number (as per P & ID).

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-367-156-A001).

2.10 Safety requirement as per Data Sheet-A.

2.11 Start-up and commissioning spares as required.

2.12 Recommended spares for 3 years normal operation (optional item).

2.13 All special tools necessary for proper maintenance or adjustment of the equipment packed in permanent box.

2.14 Finish paints for touch up painting of equipments after erection at site in sealed container.

2.15 Initial charge of all lubricants and grease.

2.16 Monitoring gadgets, instruments, and equipments required for maintenance (till PG test and plant handover).

2.17 Test racks (corrosion, sealing, and bio-fouling) with coupons.

2.18 All blank flanges/counter flanges, isolations valves, tees etc. to interconnect the pipes and all terminal points.

2.19 Auxiliary Structure /hanger, support components for piping.

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.
2) Supervision of the treatment program for a period of 3 months at site.
3) Arrangement of all instruments and lab facilities to carry out trial run/commissioning and PG test.
4) Complete grouting for equipment, fixing and any concreting inside the vessels and lining.
5) All personnel required during commissioning and PG Test.
6) Performance testing.
7) Determination of corrosion rates and scale deposition at regular intervals and review on regular basis and submit fortnightly reports to the BHEL.
8) 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.

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 (316) < 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

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 (150 meter piping distance).

6.3 All drains: Common drain 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 Air-conditioning, ventilation and fire fighting facilities.

7.2 Drinking water and service water.

7.3 All Civil works at site.

7.4 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).

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 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 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-V. 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 drags, 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.

11.0 DRAWING/DOCUEMNTS 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-Annexure VI.**
- **P&ID for CW Chemical Treatment- PE-DG-367-156-A001-Annexure-V.**
- **Plot Plan –PE-DG-367-100-M001-Annexure- IX.**

NOTE-1: - Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the woks 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.

CLARIFIED WATER ANALYSIS
ANNEXURE -1

Sl.No	Description	Unit	Water Quality Considered for design
	Physical Parameters		
1	pH		7.5-8.5
2	Temperature	Deg. C	30
3	Conductivity	mic.mhos/cm	1980
4	Total Suspended Solids	mg/l	100.0
5	Total Dissolved Solids	mg/l	1500 (max)
6	Turbidity	NTU	51.0
7	Oil & grease	mg/l	Nil
	Chemical Parameters		
8	Calcium as Ca	mg/l	50.0
9	Magnesium as Mg	mg/l	40.0
10	Sodium as Na	mg/l	347
11	Potassium	mg/l	5.1
12	Iron - Total (Fe)	mg/l	1.0
13	Alkalinity-m as CaCO3	mg/l	550.0
14	Alkalinity-p as CaCO3	mg/l	50.0
15	Bicarbonate as HCO3	mg/l	671
16	Carbonate as CO3	mg/l	10
17	Sulphate as SO4	mg/l	24.0
18	Chloride as Cl	mg/l	307
19	Silica reactive as SiO2	mg/l	32.0
20	C.O.D	mg/l	60.0
21	Colloidal silica	mg/l	3 to 18
22	Dissolved oxygen	mg/l	5.2
	Additional Parameters		
23	BOD	mg/l	8.2
24	TOC	mg/l	12.4
25	Nitrate	mg/l	19.0
26	Ammonia	mg/l	Nil
27	Total Silica	mg/l	22 to 46
28	Zinc	mg/l	0.37
29	Nickel	mg/l	< 0.005
30	Chromium Total	mg/l	0.009
31	Barium	mg/l	Nil

Sl.No	Description	Unit	Water Quality Considered for design
32	Bromide	mg/l	Nil
33	Fluoride	mg/l	0.9
34	Hydrogen Sulphide	mg/l	Nil
35	Manganese	mg/l	0.16
36	Strontium	mg/l	Nil
37	Ammonical Nitrogen	mg/l	<0.1
38	Phosphate	mg/l	1 to 2
	Bacteriological Parameters		
39	Coliforms (e coli)	Cfu/ml	present
40	Feaccal Colifrms	Cfu/100ml	86.0
41	Total Viable Count at 48 hrs	Cfu/100ml	67×10^{-2}

NOTE:

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

B. DATA FOR COOLING TOWER:

i. Recirculation Volume of Cooling Tower is 80000 Cum/hr.
ii. Storage/Holdup volume of cooling tower basin=8100 CuM.
iii. Temperature difference across cooling tower is 9.8 Deg C.
iv. MOC of Condenser tube is- Ti (ASTM A249 TP304).
v. Cooling Water System metallurgy shall be as per P&ID CW/ACW System (enclosed in Technical Specification).

LIST OF APPROVED SUB VENDORS
ANNEXURE - II

S NO.	ITEM	APPROVED SUPPLIERS	PLACE
1	TANK	BELCO POLLUTION CONTROL PVT LTD.	GRATER NOIDA
		FABTECH	PUNI
		TECHNOGAB	NEW DELHI
3	METERING PUMPA/PRV	METACHEM	MUMBAI
		SWELORE	AHMEDABAD
		V K PUMPS	NASIK
4	AGITATOR/STIRRER	REMI	MUMBAI
5	STRAINER	OTOKLIN	MUMBAI
		GRAND PRIX	NEW DELHI
		AYPEE	NEW DELHI
		GREAVES COTTON	MUMBAI
		MULTITEX	NEW DELHI
6	HORIZANTAL CENRIFUGAL PUMP	KIRLOSKAR BROS. LTD	PUNE
		M&P	PUNE
		KSB PUMPS LTD	PUNE
		SAM PUMPS	COINBATORE
		BEACON WEAR	CHENNAI
		MATHER & PLATT	PUNE
		SULZER PUMPS LTD	MUMBAI
7	ORIFICE PLATE	MICRO PRECISION	FARIDABAD
		INSTRUMENTAION LTD	PALGHAT
		CARLO DYNAMICS	HYDRABAD
7	GAT E VALVES	TECHNO VALVE	MUMBAI
		BDK	HUBLI
		LEADER	JALANDHAR
10	GLOBE VALVE	TECHNO VALVE	MUMBAI
		LEADER	JALANDHAR
11	BALL VALVE	FLOW CHEM	AHMEDABAD
12	NRV CHECK VALVE	TECHNO VALVE	MUMBAI
13	SAFETY VALVES/RELIEF VALVES	METACHEM	MUMBAI
		KEYSTONE	BARODA
		V K PUMPS	NASIK
14	3 WAY VALVE	TECHNO VALVE	MUMBAI
		HI TECH	AHMEDABAD
15	PIPING	CHOKSHI TUBES	AHMEDABAD
		REMI	MUMBAI
		RATNAMANI	AHMEDABAD
16	FITTINGS	BHARAT FORGE	PUNE
		RELIANCE FORGE	
		PRADEEP METALS LTD	MUMBAI
17	FLANGES	PRADEEP METALS LTD	MUMBAI
		BHARAT FORGE	PUNE
		RELIANCE FORGE	
18	LT MOTORS	KEC	BANGALORE
		SIEMENS	MUMBAI
		ABB	FARIDABAD

		CROMPTON GREAVES LTD	MUMBAI
		BHARAT BIJLEE	MUMBAI
		NGEF	BANGALORE
		ASEA BROWN BOVERI	
		MARATHON	
		GE-POWER	
		RAJINDRA ELECT INDUSTRIES	
		LAXMI HYDRAULICS PVT. LTD	
19	PRESSURE GAUGE/DPG	AUXIROL	UK
		SWITZER (FOR DP GAUGES)	CHENNAI
		BUDENBURG	UK
		A N INSTRUMENTS	KOLKATA
		BELLS CONTROL	KOLKATA
		MANOMETER INDIA	MUMBAI
		GENERAL INST	MUMBAI/GOA
		GLUCK INDIA	MUMBAI
20	LEVEL GAUGES	SIGMA INSTRUMENTS	MUMBAI
		LEVCON	KOLKATA
		SB ELECTROMECHANICAL	PUNE
21	LEVEL SWITCHES	LEVCON	KOLKATA
		EIP INSTRUMENTS	NOIDA
		EIP BULK CONTROL	DELHI
		SIGMA INSTRUMENTS	MUMBAI
		EIP ENCIRO LEVEL CONTROL	NOIDA
		NIVO CONTROL	INDORE
		E&H	GERMANY
		DEXEL BROOK	USA
22	DIFF. PRESURE SWITCH	INDFOS IND	GHAZIABAD
		BARTON INST. SYSTEM	USA
		SWITZER	CHENNAI
		VASUTECH (VARMA TRAFAG , EXCEPT FOR DIAPH VACCUM TYPE)	REWARI
		SOR	USA
		DRESSER	USA
		KDG	UK
		DELTA CONTROLS	USA
		HERION	GERMANY
23	LOCAL CONTROL PANEL	INDSUSTRIAL SWITCHGEAR & CONTROL	MUMBAI
		POSITRONICS	BARODA
		ECS	NOIDA
		SWITCHING CIRCUIT	KOLKATA
		CONTROL & SCHEMATICS	HYDRABAD
		GE POWER	BANGLORE
		SIEMENS	KOLKATA
		C&S	NOIDA
		PYROTECH	UDAIPUR
		DELTA CONTROL	MUMBAI
		L&T	MUMBAI
24	STROKE CONTROLLER	V K PUMPS	NASIK
		METACHEM	MUMBAI
		SWELORE	AHMEDABAD

		DELTA CONTROL	MUMBAI
25	INST CABLES (SCREENED CABLES)	RELIANCE	BANGLORE
		DELTON	FARIDABAD/NEW DELHI
		NICCO	KOLKATA
		CCI	MUMBAI
		UNIVERSAL	SATNA
26	CONTORL CABLES	DELTON	FARIDABAD/NEW DELHI
		FINOLEX	PUNE
27	POWER CABLES (LT CABLES)	CCI	MUMBAI
		NICCO	KOLKATA
		UNIVERSAL	SATNA
		IACL (HVPL)	NEW DELHI
		FGI	KOLKATA
		FINOLEX	PUNE
		INDUSTRIAL CABLE	RAJPURA
28	PH	HACH	USA

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

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 piplines
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

2.0 PREPARTION 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 were 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 BHEL/Customer.

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 red oxide primer shall be applied. Primer shall be applied by brushing to ensure a continuous film without 'holidays'. The dry film thickness of each coat shall be minimum 30 microns.

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 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 Admirality 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
	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.

DRAWING / DOCUMENT DISTRIBUTION SCHEDULE
ANNEXURE - IV

S. NO.	DESCRIPTION	CONSULTANT	KPCL HEAD OFFICE	KPCL 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/APPROVAL 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 SEVEN (07) HARD COPIES.

KPCL- KARNATAKA POWER CORPORATION LIMITED
CONSULTANT -TRACTAEBEL
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 Seven (07) 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 copes 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 (KPCL) 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 of the service vessel are and regeneration area.
  - Cable tray lay out.
  - Civil scope drawings.
  - Piping lay out drawing.

P & ID
ANNEXURE - V

DATASHEET -A
ANNEXURE - VI

DATA SHEET-A

SL NO.	DESCRIPTION	PARAMETERS
1.0	**SULPHURIC ACID STORAGE TANK**	
1.1	Numbers	Three (3) Nos.
1.2	Type	Horizontal cylindrical with dished ends.
1.3	Type of fluid to be handled	Sulphuric Acid.
1.4	Effective capacity	52 M^3 each
1.5	**Material of Construction**	
1.5.1	Shell	Mid steel as per IS 2062 or ASTM A 515 Gr.70.
1.5.2	Dished Ends	Mid steel as per IS 2062 or ASTM A 515 Gr.70.
1.6	Thickness	10 mm (minimum)
1.7	Instruments	As per P& ID.
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	CI
2.10.3	Shaft	EN8
2.10.4	Strainer	Carbon Steel (2X100 %, 50 BS).
2.11	Type of drive	Electrical Motor
3.0	**SULPHURIC ACID DAY TANKS**	
3.1	Numbers	Two(2)
3.2	Type	Vertical cylindrical with dished bottom.
3.3	Type of fluid to be handled	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	
4.0	**SULPHURIC ACID INJECTION PUMPS**	
4.1	Number	Two (2) [1W+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	450 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	Electrical Motor

5.0 SCALE	**INHIBITOR/CORROSION INHIBITOR TANKS**	
5.1	Numbers To be provided	Two (2)
5.2	Type	Vertical cylindrical with dished bottom.
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
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 CW forebay.
6.5	Duty	As vendor's recommendations.
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	Electrical Motor
7.0	**PIPING , VALVES, FITTINGS AND FLANGES**	
7.1	For H_2SO_4 Dosing system	Carbon steel to ASTM A 106 Gr. B sch 40 (Dimension standard ANSI B 36.19)
7.2	For Scale Inhibitor /Corrosion Inhibitor Dosing system	ASTM A 312 TP 304 sch 40 (Dimension standard ANSI B 36.10)
8.0 PIPE	**DIFFUSERS**	
8.1	For Scale Inhibitor / Corrosion Inhibitor Dosing system	8 Nos (MOC: SS 316)
8.2	For H2SO4 dosing system, perforated pipe will be provided near dosing point	

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

Note: -2:

a) The dosing point shall be suitable for proper mixing in the forebay.
b) All gasket used in the chemical site shall be from chemical proof material to relevant chemical.
c) Silica gel shall be provided in vent line of the acid storage tanks.
d) Bulk H_2SO_4 tank shall be kept such a height to ensure gravity flow to day tanks.

QUALITY ASSURANCE PLAN
ANNEXURE- VII

MANUFACTURER'S NAME & ADDRESS :	STANDARD QUALITY PLAN			PROJECT : 1x700 MW BELLARY -3 STPP
	ITEM : CW CHEMICAL TREATMENT SYSTEM	QP.NO : PE-QP-367-156-A001 REV. : 0 DATE : 14-06-2012 PAGE : 1 OF 10		PACKAGE : CONTRACT NO. : CONTRACTOR : BHEL

S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY** M	C	N	REMARKS
1	2	3	4	5	6	7	8	9	D*	10			11
1.0	WELDER'S QUALIFICATION												
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	TANKS, BOTTOM ENDS, FLANGES												
2.1	RAW MATERIAL :												
2.1.1	PLATE	CHEMICAL & PHY. PROPERTIES	MA	CHEMICAL &. PHY. TEST	1/PLATE	APPD. DWG/DATA SHEET	APPD. DWG/DATA SHEET	MFG.TC/LAB REPORT		P	V	V	IDENTIFICATION BY BHEL
		INTERGRANULAR CORROSION TEST	MI	CORROSION TEST	1/PLATE	APPD. DWG/DATA SHEET	APPD. DWG/DATA SHEET						
2.1.2	PIPE FOR NOZZLE	CHEMICAL & PHY. PROPERTIES	MA	CHEMICAL & PHY. TEST	1/HEAT/SIZE	ASTM A 312 GR.TP 316	ASTM A 312 GR.TP 316	MFG.TC/LAB REPORT		P	V	V	
		MICRO STRUCTURE	MI	GRAIN STRUCTURE	1/HEAT/SIZE	FOR HEAT TREATMENT	FOR HEAT TREATMENT	DO		P	V	V	$ REFER NOTE-6
		CORROSION TEST	MI	CORROSION TEST	1/HEAT/SIZE	ASTM A 262 PR.'E'	ASTM A 262 PR.'E'	DO		P	V	V	
		HYDRO TEST	NA	LEAKAGE	100%	NO LEAKAGE	NO LEAKAGE	MFG. TC/IR		P	V	V	

	FOR BHEL	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	
MANUFACTURER/ SUB CONTRACTOR	CONTRACTOR	INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION AS APPROPRIATE, "CHP" CUSTOMER SHALL IDENTIFIED IN COLUMN "N".	
SIGNATURE			REVIEWED BY

DOC NO.

NAME & SIGN OF APPROVING AUTHORITY

MANUFACTURER'S NAME & ADDRESS :	STANDARD QUALITY PLAN		PROJECT : 1x700 MW BELLARY -3 STPP
	ITEM : CW CHEMICAL TREATMENT SYSTEM	QP.NO : PE-QP-367-156-A001 REV. : 0 DATE : 14-06-2012 PAGE : 2 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	D*	AGENCY** M	C	N	REMARKS
1	2	3	4	5	6	7	8	9		10			11
2.2	IN PROCESS												
2.2.1	BOTTOM ENDS	DIMENSIONS	MA	MEASUREMENT WITH TEMPLATE	100%	APPD.DWG.	APPD.DWG.	MFG.TC./LAB REPORT		P	V	V	
		SURFACE DEFECTS ON WELDMENTS		DP TEST	100%	ASTM E 165	NO SURFACE DEFECTS	MFG.TC		P	V	V	
2.3	FINAL ASSEMBLY :	DIMENSIONS & ORIENTATION	MA	MEASUREMENT	100%	APPD.DWG.	APPD.DWG.	MFG.TC		P	V	V	
2.3.1		LEAKAGE	MA	WATER FILL FOR 2 HOURS	100%	APPD.DWG.(BY OWNER)	NO LEAKAGE	MFG.TC		P	V	V	
3.0	STIRRER :												
3.1	RAW MATERIAL FOR SHAFT	CHEMICAL.& PHY. PROPERTIES	MA	CHEMICAL.& PHY. TEST	1/BAR/ HEAT	ASTM A 479 GR.TP 316	ASTM A 479 GR.TP 316	MFG.TC/LAB REPORT		P	V	V	
		INTERGRANULAR CORROSION TEST	MA	CORROSION TEST	DO	ASTM A 262 PR.'E'	ASTM A 262 PR.'E'	DO					
3.2	IMPELLER	CHEMICAL PROP.	MA	CHEMICAL MECHANICAL TEST	1/PLATE	ASTM A 240 GR.TP 316	ASTM A 240 GR.TP 316	MFG.TC/LAB REPORT		P	V	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 SIGNATURE	CONTRACTOR	** 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	NAME & SIGN OF APPROVING AUTHORITY

MANUFACTURER'S NAME & ADDRESS :	STANDARD QUALITY PLAN ITEM : CW CHEMICAL TREATMENT SYSTEM	QP.NO : PE-QP-367-156-A001 REV. : 0 DATE : 14-06-2012 PAGE : 3 OF 10	PROJECT : 1x700 MW BELLARY -3 STPP PACKAGE : CONTRACT NO. : CONTRACTOR : BHEL

S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY** M	C	N	REMARKS
1	2	3	4	5	6	7	8	9	D*	10			11
3.3	COMPLETE UNIT WITH MOTOR	PERFORMANCE IN WATER FILL TANK	MA										
		- VIBRATION		MEASUREMENT	100%	APPD.DWG/DATA SHEET	APPD.DWG/DATA SHEET	MFG.TC		P	V	V	
		- WOBBLING		VISUAL	100%								
		- POWER CONSUMPTION OR CURRENT DRAWN		MEASUREMENT	100%	APPD.DWG/DATA SHEET	APPD.DWG/DATA SHEET	MFG.TC					
4.0	MOTORS :												
		ROUTINE & TYPE TEST, DEGREE OF PROTECTION	MA	VERIFICATION OF TEST CERTIFICATES	100% FOR ROUTINE TEST & 1/SIZE FOR TYPE TEST & DEGREE OF PROTECTION	APPD.DATA SHEET	APPD.DATA SHEET	MFG.TC/LAB REPORT		P	V	V	MAKE OF MOTOR SHALL BE AS PER APPD.LIST
5.0	METERING PUMP & PRESSURE RELIEF VALVE :(PUMPS SHALL BE PROCURED FROM BHEL APPD.SOURCE)												
5.1	RAW MATERIAL :												
5.1.1	WETTED PARTS	CHEMICAL & PHY. PROPERTIES	MA	CHEMICAL. & MECH. TEST	1/BAR	APPD.DWG./DATA SHEET (BY OWNER)	APPD.DWG./DATA SHEET (BY OWNER)	MFG.TC/LAB REPORT		P	V	V	
		SURFACE TEST		UT ON BAR>25 MM DIA	100%	ASTM A 388	REF. NOTE # 1	MFG.TC/LAB REPORT					
				DP ON M/C SURFACE	100%	ASME - E - 165	NO SURFACE DEFECTS	MFG.TC/LAB REPORT					
5.2	FINAL INSPECTION												
5.2.1	PUMP WITH MOTOR	CAP/STROKE	MA	PERFORMANCE	100%	APPD DRG/. DATA SHEET (BY OWNER), API-675	APPD DRG/. DATA SHEET (BY OWNER), API-675	INSPECTION REPORT		P	W	V	
		ACCURACY		SHOP TEST									
		REPEATABILITY		SHOP TEST									

	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 N: OWNER		
MANUFACTURER/ SUB CONTRACTOR	CONTRACTOR	INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION AS APPROPRIATE, "CHP" CUSTOMER SHALL IDENTIFIED IN COLUMN "N".		
SIGNATURE			REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY

MANUFACTURER'S NAME & ADDRESS :	STANDARD QUALITY PLAN	PROJECT : 1x700 MW BELLARY -3 STPP
	ITEM : CW CHEMICAL TREATMENT SYSTEM QP.NO : PE-QP-367-156-A001 REV. : 0 DATE : 14-06-2012 PAGE : 4 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** M	C	N	REMARKS
1	2	3	4	5	6	7	8	9	D*	10			11
		POWER DRAWN @ 100% STROKE		MEASURED AT WORK									
		LEAKAGE &		HYDRO TEST			1.5X DES. PRSS.			P	W	V	
		DIMENSIONS,		MEASUREMENT									
		NOISE,		MEASUREMENT			NOISE < 85 dbA						
		VIBRATION		MEASUREMENT			≤45 MICRONS (PEAK TO PEAK)						
5.2.2	RELIEF VALVE	PERFORMANCE	MA	SET & RESET PR.	100%	APPD DRG/. DATA SHEET (BY OWNER)	APPD DRG/. DATA SHEET (BY OWNER)	INSPECTION REPORT		P	V	V	
		DIMENSIONS		MEASUREMENT		APPD DRG/. DATA SHEET (BY OWNER)	APPD DRG/. DATA SHEET (BY OWNER)	INSPECTION REPORT					
		LEAKAGE DURING PERFORMANCE TEST		VISUAL		NO LEAKAGE	NO LEAKAGE	INSPECTION REPORT					
		HYDRO TEST				APPD DRG/. DATA SHEET	APPD DRG/. DATA SHEET						
6.0	CENTRIFUGAL PUMPS WITH MOTORS												
6.1	RAW MATERIAL												
6.1.1	CASING AND COVER	CHEM. & PHY PROP.	MA	CHEM. & PHY TEST	1/HEAT	APPD DRG/. DATA SHEET (BY OWNER)	APPD DRG/. DATA SHEET (BY OWNER)	FOUNDRY CERTIFICATE		P	V	V	
6.1.2	IMPELLER	CHEM. PROP.	MA	CHEM. TEST	1/HEAT	APPD DRG/. DATA SHEET (BY OWNER)	APPD DRG/. DATA SHEET (BY OWNER)	MFG TC/LAB REPORT		P	V	V	
6.1.3	WEAR RING	CHEM. PROP.	MA	CHEM. TEST	1/HEAT	APPD DRG/. DATA SHEET (BY OWNER)	APPD DRG/. DATA SHEET (BY OWNER)	MFG TC/LAB REPORT		P	V	V	
6.1.4	SHAFT/SHAFT SLEEVE	CHEM. PROP.	MA	CHEM. TEST	1/HEAT	APPD DRG/. DATA SHEET	APPD DRG/. DATA SHEET	MFG TC/LAB REPORT		P	V	V	
6.2	FINAL ASSEMBLY	DYNAMIC BALANCING	MA		100%	ISO 1940 GR 6.3, APPD	ISO 1940 GR 6.3, APPD	MFG TC/LAB REPORT		P	V	V	
	PERFORMANCE	DIMENSION	MA	MEASUREMENT, HYDRO	100%	DATA SHEET/DRAWING	DATA SHEET/DRAWING	MFG TC/LAB REPORT		P	W	W	
		QVSH, POWER DRAWN.		TEST & PERFORMANCE		(BY OWNER)	(BY OWNER)						
		EFFICIENCY, LEAKAGE		TEST		NOISE <=85 dbA	IS - 5120						
		NOISE, VIBRATION				VIBRATION @							

@:AS PER VDI 2056, GROUP M. RMS VELOCITY OF 2.8 MM/SEC. EQUIVALENT DISPLACEMENT AMPLITUDE OF 25 M

MANUFACTURER/ SUB CONTRACTOR SIGNATURE	CONTRACTOR	** 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	NAME & SIGN OF APPROVING AUTHORITY

MANUFACTURER'S NAME & ADDRESS :	STANDARD QUALITY PLAN		PROJECT : 1x700 MW BELLARY -3 STPP
	ITEM : CW CHEMICAL TREATMENT SYSTEM	QP.NO : PE-QP-367-156-A001 REV. : 0 DATE : 14-06-2012 PAGE : 5 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	D*	AGENCY** M	C	N	REMARKS
1	2	3	4	5	6	7	8	9		10			11
7	VALVES												
7.1	RAW MATERIAL :												
7.1.1	BODY, BONNET COVER	CHEMICAL & MECH PROPERTIES	MA	CHEMICAL & MECH TEST	1/HEAT	APPD.DWG./DATA SHEET (BY OWNER)	APPD.DWG./DATA SHEET (BY OWNER)	MFG. TC/LAB REPORT		P	V	V	
		HEAT TREATMENT	MA	HEAT TREATMENT	1/HEAT	DO	DO						
7.1.2	TRIM MATERIAL	CHEMICAL PROPERTIES	MA	CHEMICAL TEST	1/BAR/SIZE	APPD. DATA SHEET BY OWNER	APPD. DATA SHEET BY BHEL	LAB REPORT/MGF TC					
7.2	ASSEMBLY												
		HYDRO TEST		LEAKAGE (BODY SEAT,	100%	APPD.DWG./DATA	NO LEAKAGE	MFG TC		P	V	V	
		AIR TEST		AIR SEAT)		SHEET (BY OWNER)	NO LEAKAGE	MFG TC					
		DIMENSIONS		MEASUREMENT			APPD.DWG./DATA SHEET (BY OW	MFG TC					
8.0	FITTING :												
8.1	RAW MATERIAL	CHEMICAL & MECH PROPERTIES	MA	CHEMICAL & MECH TEST	1/HEAT	ASTM A 182 GR.TP 316	ASTM A 182 GR.TP 316	MFG.TC/LAB REPORT		P	V	V	
		HEAT TREATMENT	MA	HEAT TREATMENT	100%	ASTM A 182 GR.TP 316	ASTM A 182 GR.TP 316	MFG.TC/LAB REPORT					
		INTERGRANULAR CORROSION TEST	MI	CORROSION TEST	1/HEAT	ASTM A 262 PR. 'E'		MFG.TC/LAB REPORT MFG.TC/INSP REPORT					
8.2	FINAL INSPECTION	DIMENSIONS	NA	MEASUREMENT	100%	APPD.DWG./DATA SHEETS/ANSI B 16.11/16.5	APPD.DWG./DATA SHEETS/ANSI B 16.11/16.5	MFG.TC/INSP.REPORT					

	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	** 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	NAME & SIGN OF APPROVING AUTHORITY

MANUFACTURER'S NAME & ADDRESS :	STANDARD QUALITY PLAN	PROJECT : 1x700 MW BELLARY -3 STPP
	ITEM : CW CHEMICAL TREATMENT SYSTEM QP.NO : PE-QP-367-156-A001 REV. : 0 DATE : 14-06-2012 PAGE : 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** M	AGENCY** C	AGENCY** N	REMARKS
1	2	3	4	5	6	7	8	9	D*	10			11
9.0	STRAINERS :												
9.1	RAW MATERIAL FOR BODY	PHY.& CHEM. PROPERTIES	MA	PHY. & CHEM.TEST	1/BAR/SIZE	APPD.DWG./DATA SHEETS (BY OWNER)	APPD.DWG./DATA SHEETS (BY OWNER)	LAB REPORT		P	V	V	
9.2	SCREEN	CHEMICAL	MA	CHEMICAL	1/SIZE	APPD.DWG./DATA SHEETS (BY OWNER)/SS 316	APPD.DWG./DATA SHEETS (BY OWNER)/SS 316	MFG.TC/LAB REPORT		P	V	V	
		MESH SIZE	MA	MEASUREMENT	1/SIZE	APPD.DWG./DATA SHEETS (BY OWNER)	APPD.DWG./DATA SHEETS (BY OWNER)	MFG.TC/LAB REPORT					
9.3	FINAL INSPECTION	DIMENSIONS	MA	MEASUREMENT	100%	APPD.DWG./DATA SHEETS (BY OWNER)	APPD.DWG./DATA SHEETS (BY OWNER)	MFG.TC		P	V	V	
		LEAKAGE		HYDRO TEST	100%	APPD.DWG./DATA SHEETS (BY OWNER)	NO LEAKAGE	MFG.TC					
10.0	PIPE (SEAMLESS)												
	MATERIAL (REF. NOTE -2)	CHEMICAL	MA	CHEMICAL	1/HEAT/SIZE	ASTM 312 Gr. TP 316	ASTM 312 Gr. TP 316	MFG.TC/LAB REPORT		P	V	V	IDENTIFICATION BY BHEL
		MECHANICAL TEST		MECHANICAL TEST	1/HEAT/SIZE	ASTM 312 Gr. TP 316	ASTM 312 Gr. TP 316	MFG.TC/LAB REPORT		P	V	V	$ REFER NOTE-6
		MICRO STRUCTURE		GRAINS STRUCTURE	1/HEAT/SIZE	FOR HEAT TREATMENT	FOR HEAT TREATMENT	MFG.TC/LAB REPORT		P	V	V	
		INTERGRANULAR CORROSION TEST		CORROSION TEST	1/HEAT/SIZE	ASTM A 262 PR 'E'	ASTM A 262 PR 'E'	MFG.TC/LAB REPORT		P	V	V	
		HYDRO TEST		LEAKAGE	100%	NO LEAKAGE	NO LEAKAGE	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 N: OWNER		
MANUFACTURER/ SUB CONTRACTOR SIGNATURE CONTRACTOR	INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION AS APPROPRIATE, "CHP" CUSTOMER SHALL IDENTIFIED IN COLUMN "N".	REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY

MANUFACTURER'S NAME & ADDRESS :	STANDARD QUALITY PLAN	PROJECT : 1x700 MW BELLARY -3 STPP
	ITEM : CW CHEMICAL TREATMENT SYSTEM QP.NO : PE-QP-367-156-A001 REV. : 0 DATE : 14-06-2012 PAGE : 7 OF 10	PACKAGE : CONTRACT NO. : CONTRACTOR : BHEL

S.NO.	COMPONENTS/ OPERATION	CHARACTERISTICS CHECKED	CATEGORY	TYPE/ METHOD CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY** M	C	N	REMARKS
1	2	3	4	5	6	7	8	9	D*	10			11
11.0	LEVEL GAUGE :												
11.1	RAW MATERIAL	CHEM.PROPERTIES	MA	CHEM.TEST	1/BAR	APPD.DWG./DATA SHEETS (BY OWNER)	APPD.DWG./DATA SHEETS (BY OWNER)	LAB REPORT		P	V	V	
11.2	FINAL INSPECTION	DIMENSION	MA	MEASUREMENT	100%	APPD.DWG./DATA SHEETS (BY OWNER)	APPD.DWG./DATA SHEETS (BY OWNER)	MFG.TC					
		LEAKAGE		HYDRO TEST	1/SIZE	APPD.DWG./DATA SHEETS (BY OWNER)	APPD.DWG./DATA SHEETS (BY OWNER)						
12.0	PRESSURE GAUGE & DIFF PRESSURE GAUGE												
12.1	MAT. FOR WETTED PARTS& BOURDEN	CHEM.PROPERTIES	MA	CHEM.TEST	1/HEAT	APPD.DWG./DATA SHEETS (BY OWNER)	APPD.DWG./DATA SHEETS (BY OWNER)	MFG.TC/LAB REPORT/ COC		P	V	V	
		DIMENSIONS	MA	MEASUREMENT	SIZE	APPD.DWG./DATA SHEETS (BY OWNER)	APPD.DWG./DATA SHEETS (BY OWNER)	MFG.TC/LAB REPORT					
12.2	CALIBRATION	ACCURACY, OVER PRESSURE	MA		100%	APPD.DATA SHEET (BY OWNER)	APPD.DATA SHEET (BY OWNER)	MFG. TC		P	V	V	
		OVERLOAD PROT. TYPE TEST CERT. FOR DEGREE OF PROTECTION	MA	VERIFICATION	TYPE TEST			MFG.TC/LAB REPORT					

	FOR BHEL	LEGEND : * RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.	FOR CUSTOMER USE	DOC NO.
		** M : MANUFACTURER/SUB-CONTRACTOR C : CONTRACTOR/NOMINATED INSPECTION AGENCY N: OWNER		
MANUFACTURER/ SUB CONTRACTOR	CONTRACTOR	INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION AS APPROPRIATE, "CHP" CUSTOMER SHALL IDENTIFIED IN COLUMN "N".		
SIGNATURE			REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY

MANUFACTURER'S NAME & ADDRESS :	STANDARD QUALITY PLAN			PROJECT : 1x700 MW BELLARY -3 STPP
	ITEM : CW CHEMICAL TREATMENT SYSTEM	QP.NO : PE-QP-367-156-A001 REV. : 0 DATE : 14-06-2012 PAGE : 8 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** M	C	N	REMARKS
1	2	3	4	5	6	7	8	9	D*	10			11
13.0	LEVEL TRANSMITTER :												
13.1	MAT. FOR WETTED PARTS INCLUDING FLOAT	CHEM.PROPERTIES	MA	CHEM.TEST	1/HEATR	APPD.DATA SHEET/DWG. (BY OWNER)	APPD.DATA SHEET/DWG. (BY OWNER)	MFG.TC/LAB REPORT		P	V	V	
13.2	PERFORMANCE	FUNCTIONAL	MA	VISUAL	100%	APPD.DATA SHEET/DWG. (BY OWNER)	APPD.DATA SHEET/DWG. (BY OWNER)	MFG.TC		P	V	V	
		IR-HV-IR		ELECTRICAL		DO	DO	MFG.TC					
		DIMENSIONS		MEASUREMENT		DO	DO	MFG.TC					
		DEGREE OF PROTEC.		TYPE TEST		DO	DO	MFG.TC/LAB REPORT					
14.0	PRESSURE SWITCH, DIFF PRESSURE SWITCH & DIFF PRESSURE TRANSMITTER												
	MATERIAL FOR WETTED		MA	VERIFICATION		APPD.DATA SHEET/DWG. (BY OWNER)	APPD.DATA SHEET/DWG. (BY OWNER)	MFG COMPLIANCE CERTIFICATE		P	V	V	
	PARTS PERFORMANCE	CALIBRATION	MA	PERFORMANCE	100%	APPD.DATA SHEET/DWG. (BY OWNER)	APPD.DATA SHEET/DWG. (BY OWNER)	MFG TC		P	V	V	
15.0	CONTROL PANEL :	DIMENSIONS, CONTINUITY, IR-HV-IR FUNCTIONAL, DEGREE. OF PROT, VERIFICATION OF MAKE, RATING OF COMPONENTS SIMULATION TEST $$ PAINT SHADES, THICK ADHESION	MA	MEASUREMENT, ELECTRICAL	100%	APPD.DWG./DATA SHEETS (BY OWNER)	APPD.DWG./DATA SHEETS (BY OWNER)	LAB REPORT		P	W	V	$$ REFER TEST PROCEDURE NOTE-4
16.0	COMPLETE SKID ASSEMBLY :	DIMENSIONS & ORIENTATION	CR	MEASUREMENT	-100%	APPD.DWG./ DATA SHEET	APPD.DWG./ DATA SHEET	INSPECTION REPORT		P	W	W	$$ REFER TEST PROCEDURE NOTE-5
		LEAKAGE, CHECK ON WELDMENTS FUNCTIONAL TEST$$		VISUAL & HYDRO TEST		DISCH.PIPING - 1.5 x DISCH.PR. OF PUMP SUCTION PIPING -3 KG/CM2	NO LEAKAGE NO LEAKAGE						

FOR TECHNO CONSULTANTS	LEGEND : * RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.	FOR CUSTOMER USE	DOC NO.
	** M : MANUFACTURER/SUB-CONTRACTOR C : CONTRACTOR/NOMINATED INSPECTION AGENCY N: OWNER		
MANUFACTURER/ SUB CONTRACTOR / CONTRACTOR	INDICATE "P" PERFORM, "W" WITNESS, AND "V" VERIFICATION AS APPROPRIATE, "CHP" CUSTOMER SHALL IDENTIFIED IN COLUMN "N".		
SIGNATURE		REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY

MANUFACTURER'S NAME & ADDRESS :	STANDARD QUALITY PLAN		PROJECT : 1x700 MW BELLARY -3 STPP
	ITEM : CW CHEMICAL TREATMENT SYSTEM SUB - SYSTEM : LP CHEMICAL DOSING SYSTEM	QP.NO : PE-QP-367-156-A001 REV. : 0 DATE : 14-06-2012 PAGE : 9 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
										M	C	N	
1	2	3	4	5	6	7	8	9	D*	10			11
		PAINTING	MA	VISUAL & MEASUREMENT	-100%	APPD DWN/PAINTING SCHEME	APPD DWN/PAINTING SCHEME	INSPECTION REPORT		P	V	V	
		PACKING	MA	VISUAL	-100%	BHEL SPEC	BHEL SPEC	INSPECTION REPORT		P	V		
				DFT	-100%	BHEL SPEC	BHEL SPEC						

FOR TECHNO CONSULTANTS		LEGEND :	FOR CUSTOMER USE	DOC NO.
		* RECORDS IDENTIFIED WITH "TICK" SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.		
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" SHALL IDENTIFIED IN COLUMN "N".	REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY

MANUFACTURER'S NAME & ADDRESS :	STANDARD QUALITY PLAN		PROJECT : 1x700 MW BELLARY -3 STPP
	ITEM : CW CHEMICAL TREATMENT SYSTEM	QP.NO : PE-QP-367-156-A001 REV. : 0 DATE : 14-06-2012 PAGE : 10 OF 10	PACKAGE : CONTRACT NO. : CONTRACTOR :

P - PERFORMANCE W - WITNESS

V - VERIFICATION MA - MAJOR MI - MINOR

CR - CRITICAL CHP--D :CUSTOMER(BHEL/OWNER) HOLD POINT

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.

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.

NOTE-3) LEVEL GAUGE, PRESSURE GAUGE , LEVEL TRANSMITTER, CONTROL PANEL & ALL INSTRUMENTS SHALL BE PROCURED FROM OWNER/BHEL APPROVED MAKE.

NOTE 4) SIMULATION TEST WILL BE CARRIED OUT WITH 24 VDC SUPPLY TO CONTROL PANEL AT THE CONTROL PANEL MANUFACTURER'S PLACE.

NOTE- 5) FUNCTIONAL TEST WILL BE CARRIED OUT WITHOUT 24 VDC i.e., ONLY CONTINUITY TEST WILL BE SHOWN AT VENDOR'S WORK.

NOTE 6) FOR PIPES PURCHASED DIRECTLY FROM MANUFACTURER'S OR AUTHORIZED DEALERS, APART FROM TC REVIEW, CHECK WILL BE AS PER CLAUSE 2.1.2 AND 10.0; HOWEVER FOR HYDRAULIC TEST MANUFACTURER TC SHALL BE REVIEWED . IN CASE ON IMPORTED PIPES PURCHASED FROM OPEN MARKET CHECK TESTION AS PER CLAUSE 2.1.2 AND 10.0 (INCLUDING HYDRAULIC TEST) SHALL BE CARRIED OUT ON EACH LENGTH ;HYDRAULIC TEST SHALL BE WITNESS BY BHEL.

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 REVIEWED (EXCEPT TIME TEMPERATURE CHART)

	FOR BHEL	LEGEND :	FOR CUSTOMER USE	DOC NO.
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SIGNATURE			REVIEWED BY	NAME & SIGN OF APPROVING AUTHORITY

SECTION C2

SPECIFIC TECHNICAL REQUIREMENTS FOR ELECTRICAL

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

a) Services and equipment as per "Electrical Scope between BHEL and Vendor".

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

c) Supply of mandatory spares as specified in the specifications of mechanical equipment's.

d) Erection and commissioning spares.

e) Erection & Maintenance tools & tackles.

f) Electrical load requirement for CRANES & HOIST.

g) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.

h) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer /BHEL approval without any commercial and delivery implications to BHEL.

i) Various drawings, data sheet as per required format, quality plans, calculations, Type test & Routine test reports & certificates, operation and maintenance manuals, Complete technical literature with catalogues etc shall be furnished as specified at contract stage. All documents shall be subject to customer /BHEL approval without any commercial implications to BHEL.

j) Motor shall meet minimum requirement of motor specification.

k) The sub-vendor list for various electrical items is subject to BHEL/Customer approval without any commercial implications.

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

Refer "Electrical Scope between BHEL and Vendor".

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/ quality assurance requirements stipulated. In line with this, the bidder as technical offer shall furnish two signed and stamped copies of the following:

a) A copy of this sheet "Electrical Equipment Specification for CW TREATMENT PLANT and sheet "Electrical Scope between BHEL and Vendor" with bidder's signature and company stamp.

b) List of Erection and Commissioning spares.

c) List of Erection & Maintenance tools & tackles.

d) Electrical load requirement.

e) If there is any conflict, customer motor specification will prevail over BHEL motor specification.

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

4.0 LIST OF ENCLOSURES

4.1 Electrical scope between BHEL & vendor.

4.2 Technical specification for 6.6kV and 415V Electric Motors.

4.3 Motor data sheet-C

4.4 Quality Plan for motors.

4.5 Load data format.

ELECTRICAL LOAD FORMAT

LOAD TITLE	R IN KV A)		UNIT (U)/STN (S)	os.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	BL.		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LO AD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs				
1 2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

भेल BHEL	LOAD DATA (ELECTRICAL)	JOB NO.		ORIGINATING AGENCY		PEM (ELECTRICAL)
		PROJECT TITLE	1X700 MW BELLARY-3 TPS	NAME		DATA FILLED UP ON
		SYSTEM / S	CW TREATMENT PLANT	SIGN.		DATA ENTERED ON
		DEPTT. / SECTION	ELECTRICAL	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

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

PACKAGE : CW TREATMENT PLANT

PROJECT : **1 X 700 MW : BELLARY-3 TPS, UNIT-3**

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

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

PACKAGE : CW TREATMENT PLANT

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
8	Lighting	BHEL	BHEL	
9	Equipment grounding & lightning protection	BHEL	BHEL	
10	Below grade grounding	BHEL	BHEL	
11	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
12	Mandatory spares	Vendor	-	Vendor to quote as per specification.
13	Recommended O & M spares, E & C spares, erection & maintenance tools & tackle.	Vendor	-	As per specification
14	Any other equipment/material/service required for completeness of system but not specified above (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
15	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for C & I systems for vendor supplied equipment shall be furnished during detail engineering by vendor in soft copies in the BHEL cable schedule format.
16	Equipment layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipments requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Electrical equipment layout drawing shall be to BHEL approval.
17	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.

SECTION C3: SPECIFIC TECHNICAL REQUIREMENTS FOR C&I

BHEL	**MEASURING REQUIREMENTS (C&I) FOR CW TREATMENT PLANT (RELAY BASED)**	DRAWING NO:
		REV. NO. / DATE:
		SHEET 1 OF 2

GENERAL REQUIREMENTS FOR MEASURING INSTRUMENTS

1.0 Measuring instruments/equipment and subsystems offered by the Bidder shall be from reputed experience manufacturers (from BHEL/customer approved vendor list) of specified type and range of equipment. Further, all instruments shall be of proven reliability, accuracy, repeatability requiring a minimum of maintenance. All instrumentation equipment and accessories under this specification shall be furnished as per technical specifications, ranges, makes/ numbers as approved by BHEL during detailed engineering.

2.0 Every panel-mounted instrument, requiring power supply, shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a ground terminal and shall be suitably connected to panel grounding bus.

3.0 All local gauges as well as transmitters, sensors and switches for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance under the scope of specification shall be provided. The necessary root valves, impulse pipings and all the other accessories required for mounting/erection of local instruments shall be furnished even if not specifically asked for.

4.0 Instruments shall be terminated up to LCP with control cable (1.5sqmm). The LCP shall be fully wired. All the necessary cables, flexible conduits, junction boxes and accessories for the above purpose shall be included. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg / Cm2.

5.0 Pressure gauge to be provided at the discharge of each pump.

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

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	MEASURING REQUIREMENTS (C&I) FOR CW TREATMENT PLANT (RELAY BASED)	DRAWING NO:	
		REV. NO.	DATE:
		SHEET 2 OF 2	

SPECIFIC TECHNICAL REQUIREMENTS

Operator's command execution time : 1 sec
DAS data update time : 1 sec
Closed loop control update time of 200 m sec for critical loops & 500 m sec for other loops (from change of output of the sensor of the transmitter/ temperature element to the corresponding control command output).
Open loop control update time of 50-100 m sec.
However, for SG/TG protections higher speed shall be considered as per manufacturer's requirement.
Controller loading : Max. 60%
Data bus loading : Max 50%
Overall system availability : 99.7%

5.6.02 **Worst Loading Conditions :**
For distributed control system the worst loading condition shall include the following tasks :
(a) All process inputs scanning and processing is in progress and all the data is transmitted over the main data bus every one second.
(b) All closed loop controls in operation
(c) All open loop controls in operation
(d) All output devices are in operation with rated performance/speed.
(e) Control/information request is initiated on control VDU.
(f) In burst mode operation, 100 digital alarms are generated per second for a period of 10 seconds.

6.0.00 General Guidelines for Provision of Instruments/Instruments to be provided for Systems/Equipment:

6.1.00 Bidder shall provide the various field instruments, in- line instruments directly mounted on pipe and panel mounted instruments including the accessories as required for different systems/equipment of the plant as per the guide lines given in clause of this section below.

6.1.01 Bidder shall include the field sensors/transmitters/ initiating devices for the following :

1. Sensors/transmitters required for all closed loop controls shall be provided considering the sensor level redundancy for controlled parameters and parameters required for compensation.
2. Sensors/initiating devices required for all open loop controls shall be provided considering the sensor level redundancy as required and as called for.
3. Sensors/transmitters required for measurement system.
4. Sensors/Initiating Devices shall be provided for status indication on CRT of various drives required for the plant.
5. Initiating Devices/contacts shall be provided for fault/abnormal conditions of the process equipment/ systems for Sequence of events recording and Annunciation System.
6. Necessary field sensors, smart converters, smart transmitters, temperature elements, probes, transducers, process switches viz, pressure, temperature,

level, flow & limit switches etc, required for functional completeness and/or otherwise felt necessary by Bidder, with all necessary stubs, bosses, first isolation (Root) valves, cocks, manifolds, instrument isolation & drain valves, impulse pipes & tubes, mounting stands & brackets, protection covers, racks & canopies, mounting accessories etc, terminated to local junction boxes / proximeter housings with suitable type of cables, glands, lugs and sleeves, conductor marker /ferrule. Technical specifications provided elsewhere, as part of this specification shall apply as the technical guideline.

7. Pressure instrument shall have the unit suffixed with 'a' or 'g' to indicate absolute or gauge pressure, respectively. Scales and charts of all instruments shall have linear graduations. Deviation indicators shall have the null position at mid scale. The normal operating parameter shall be identified with a clear green mark.

6.2.00 Selection of Ranges for Instruments:

6.2.01 The ranges of the instruments shall be selected based on the philosophy indicated below:

1. For pressure and draft measurements, the maximum operating pressure will be within 70 to 80% of the maximum scale range. All pump suction measurement and steam pressure measurements in extraction steam and in heaters will cover the negative pressure range also and all draft gauges will cover the negative pressure as well as the positive pressure as the case may be.
2. For temperature measurement, the maximum operating temperature will be within 80 to 90% of the maximum scale range.
3. For pressure switches and temperature switches, the set points shall fall within 40% to 70% of the scale range selected.
4. All displays shall be in engineering units. Instrument scales displayed on screen will have graduations with scale divisions based on multiples of 10. The smallest division shall preferably be a whole number approximately 1% of the scale range if not otherwise impracticable.
5. For level measurement, the maximum of the range will cover the overflow point or six inches from the top of the vessel and the minimum of the range will be six inches above the bottom of the vessel. Also, the gauge glasses will be stacked with overlap to cover permissive, alarm and trip levels.
6. For flow measurement, the maximum range shall be fixed at about 10 to 15% above the maximum operating flow.
7. For electro-chemical measurements (conductivity, pH, dissolved O2, Silica etc.), the maximum range will be around 10 to 15% higher than the recommended alarm settings.

6.2.02 Engineering units:

The following system of units shall be followed for various displays and scales Unless otherwise mentioned shall be

1. Pressure: Kg/cm2

2. Differential Pressure: mm of H2O column / Kg/cm2
3. Draught: mm of H2O column
4. Vacuum : mm of H2O column
5. Temperature : Degree Celsius (O C)
6. Flow (Steam, Water): Tonnes / hr.
7. Flow (Oil) : Tonnes/hr
8. Flow Air : Tonnes / hr
9. Density : gms/c.c
10. Level : mm
11. Conductivity : Micro-mho / cm
12. Gas Analyzer: Percentage by weight or as specified in respective case.
13. Dissolved Oxygen / Silica / : ppm or ppb Sodium / Hydrogen
14. Coal flow : Tones / hr
15. Speed : RPM

6.3.00 **The general guidelines for various instruments, which have to be provided on Plant equipments/systems are elaborated below.**

6.3.01 **Pressure indicators** shall be provided for

1. Suction and discharge lines of pumps/fans, including on suction/discharge header if two or more pumps are employed for the same service.
2. All input and output lines of process equipment.
3. Inlets and outlets of heaters, heat exchangers and desuperheaters.

6.3.02 **Pressure Switches** shall be provided

1. On all process lines/Equipment where parameter abnormality/status including pre trips alarms to be communicated to the operator in control room.
2. For all permissive conditions governed by safety operation of the equipment. eg. pr. adequate, conditions.
3. For all protection conditions. Eg. pr. very high/very low conditions
4. For all interlock conditions which governs starting of standby equipment or subsequent equipment for safety operation of the system.
5. 3 switches shall be employed for protection in case of critical applications
6. Inlet and outlet of filters/strainers.

6.3.03 **Differential Pressure Switches** shall be provided

1. Across filters/strainers for remote monitoring
2. Across condenser CW line for remote monitoring and interlocks

6.3.04 **Differential Pressure Indicators** shall be provided

(a) Across filters/strainers for local monitoring
(b) Across condenser CW line for local monitoring

6.3.05 **Pressure Transmitters** shall be provided

1. At suction and discharge of all major pumps/fans.
2. For all control and monitoring applications as demanded by the process. It shall be noted that for all critical analog/binary controls applications 3

transmitters shall be provided.

3. Pressure conditions of all major vessels/tanks like Deaerator, Hotwell, Boiler Drum etc.
4. All inputs for equipment/unit performance calculation.

6.3.06 **Differential Pressure Transmitters** shall be provided,

1. For all the requirements of differential pressure, flow and level measurements. For critical control applications 3 transmitters shall be provided.
2. All inputs for equipment/unit performance calculation.
3. Auxiliary cooling water services flow measurement instead of variable area flow meters.

6.3.07 **Temperature indicators (Thermometers)** shall be provided

1. On all process lines where local indication is warranted by the system either for monitoring or testing.
2. On the inlet/outlet equipments such as heaters, desuperheaters, Heat Exchangers & Coolers for both the fluid media.
3. Capillary type temperature indicators shall be used in vibration prone areas.
4. Thermowell shall be provided for all temperature indicators.

6.3.08 **Temperature Switches** shall be provided

1. For all process lines where parameter abnormality to be communicated to the operator in control room where redundant transmitters are not provided
2. For all permissive & interlock conditions governed by the safety operation of the equipment where redundant transmitters are not provided and for protection of the equipment.
3. For all critical services 3 nos. shall be provided for protection application.

6.3.09 **Resistance temperature detectors(RTD's)** shall be provided for all services where maximum temperature does not exceed 150 degrees centigrade.

1. The element shall be 3 wire type/4 wire, duplex with all thermowell.
2. The RTD is employed for remote display for providing necessary information to the operator about the performance of the related equipment such as pumps, fans, Motors..etc Eg : Suction/Discharge of pumps and fans inlet/outlet of heat exchangers, fans / pumps bearings, motor windings, motor bearings etc.

6.3.10 **Thermocouples** shall be provided for all services where normal operating temperature exceeds 150 deg C.

1. The element shall be duplexed integral with thermowell. K-type for temperature upto 600 degC and R- type for temperature above 600 degC.
2. The thermocouple is employed for remote display, for control applications, density correction for flow measurements.
3. All thermocouple shall be directly connected to the respective input modules in DDCMIS through Extension/Compensating cables. The extension/compensating cables shall be laid from T/C till DDCMIS

cabinets and the cold junction compensation shall be carried out at DDCMIS. Extension cables shall be supplied for K & T type Thermocouples and Compensating cables for all R & S Type Thermocouples.

4. Metal temperature thermocouples shall be provided for the services like pipe metal, separator/Drum, SH/RH tube metal temperature. For metal thermocouples suitable pads with clamps etc., shall be provided. The termination of these thermocouples shall be at low temperature area with adequate extension length of thermocouples.

6.3.11 **Thermo wells** shall be provided along with Temperature elements of RTD & Thermocouples except for metal/bearing/winding temperature measurements.

1. For measurement of flue gas temperature, Inconal 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.

Temperature Transmitters are not envisaged.

6.3.12 **Level gauges** shall be provided

1. On all tanks and the maximum length of one gauge glass shall not exceed 1 metre. The gauge glasses shall be stacked to cover the complete height of the tanks including over flow level. There shall be an overlap of minimum 150 mm, when more than one level gauge is required. Suitable platforms shall be provided for purpose of taking measurements during maintenance..
2. All high pressure vessel shall be provided with level gauges on either end as per Boiler statutory requirement.

6.3.13 **Level switches** shall be provided,

1. On all equipment (storage vessel) where parameter abnormality/status to be communicated to the operator in the control room.
2. All permissive and interlock conditions governed by the safety operation of the equipment and for protection conditions.
3. For all critical services, 3 switches shall be provided for protection application.
4. The instrument shall be external cage type with SW connection with isolation facility for surface mounted tanks and top mounted with still pipe for all sumps.

6.3.14 **Level transmitters** shall be provided on process equipment where continuous remote monitoring and/or control of level is envisaged.

1. The instrument shall be displacement type for all pressure/vacuum applications involving two phase media like Hotwell, LPH services..etc
2. The instrument shall be differential pressure type for other applications with pressure.
3. Other type of level transmitters viz., Ultrasonic, RF Type, Radar Type, capacitance Type ..etc for special applications.

6.3.15 **Flow Glasses** at the outlet of the pipe line shall be employed under the following conditions:

1. Coolant from the equipment (coolers)
2. The instrument shall be rotary type with glass mounted for indication.
3. Upto 4 inch on-line flow glasses shall be supplied and above 4 inch bypass type flow glasses shall be provided.

6.3.16 **Flow Switches** shall be provided at different outlet header of identical equipment to alarm in the event of inadequate coolant requirement (or) lube oil, cooler outlet on cooling water line.

6.3.17 **Speed Measurement** shall be provided, where variable speed drives are to be controlled from remote e.g., BFP, ID fans , Feeders etc.

6.3.18 **Coriolisis type mass flow Meters** shall be provided for the measurement of HFO, LFO and DM Water flow measurement.

6.3.19 **Flow Elements** shall be provided as mentioned below.

1. Orifice plate shall be provided for spray water, condensate, makeup water, DM water, soot blowing system.
2. Flow nozzle shall be provided for BFP suction, Feedwater, HP Bypass, Aux. steam system.
3. Impact head type element (Annubar) type/Orifice shall be provided for condenser cooling water system.
4. Aerofoil for secondary air flow
5. Venturi for primary air flow measurement or as per proven standard and practice of boiler supplier.
6. The flow element connection shall be Butt welded except for applications, where flanged connection have to be used.
7. Flow elements shall be provided with three (3) sets of tap points with independent root valves.

6.3.20 **Control valves** shall be provided

1. For all control application as required and in line with the system requirement.
2. If the process demands any other control, then control valves shall be provided for those applications also.
3. Where a single control valve can not meet the turned down ratio as dictated by the process, control valves with split range application shall be provided.
4. All bypass valves of control valves as detailed in section - D1 shall be suitable for inching operation and provided with position transmitters.
5. Control valves for HP & LP Bypass system shall be hydraulic operated

6. Control valves for modulating shall be pneumatically operated. Control valves in high pressure services shall have welded end connections. Control valves and actuators shall be equipped with standard accessories like air filter regulator with pressure gauge, valve positioners with E/P converter & pressure gauges, position transmitters, handwheel, limit switches, air failure lock etc.

The general specification of the control valves is detailed in Section-D3.4.

6.3.21 **Solenoid valves** shall be provided with pneumatic control valves hooked up with process interlock requirements and where direct tripping is involved. The number of ways for solenoid valve shall be provided as indicated below

1. Two (2) way solenoid valves shall be provided, where process line of less than 2 inch with low pressure & temperature application. Eg : ACW overhead tank make up line.
2. Three (3) way solenoid valve shall be provided commonly, where the pressure is admitted or exhausted from a diaphragm valve or single acting cylinder. Eg: Pneumatic operated spray water block valve.
3. Four (4) way solenoid valve shall be provided for operating double acting cylinders. Eg: Pneumatically operated on-off type dampers
4. Dual coil solenoid valves shall be supplied for protection application and single coil for open/close application.

6.3.22 **Control Dampers (Modulating)** shall be provided for air & flue gas control application. If process demands any other control, the necessary control dampers shall be provided for those applications.

6.3.23 **Valve/Damper Actuators Accessories:**

All pneumatic actuators (valves/dampers) included in the scope of BIDDER for ON/OFF and regulating services shall be complete with all accessories including the following:

Hand wheel with lock, Air filter regulator, Air lock relay, Pneumatic tubing from nearest air header to the actuator complete with all necessary fittings, Positioner for regulating services, End position (open/close) limit switches, Local position indicator and non contact type position transmitter with 2 wire 4-20mA DC output for regulating services, Necessary solenoid valves required for open/close operation & interlock functions, Electro-pneumatic (E/P) converters for the regulating services, suitable for accepting 4- 20mA DC signal, Junction box near the valve for terminating the limit switch/position transmitter/E-P converter signals.

6.3.24 **Position Transmitters** shall be provided for all control valves, control damper and bypass valves/dampers, where modulating/inching operation is required. Position transmitters shall be non-contact type. The general specification is given in Section-D3.4.

6.3.25 **Electro-Pneumatic Converters** shall be provided for all pneumatically

operated control valves, control dampers, power cylinders etc., for converting controller output of 4-20 mA to 3-15 PSI for interfacing with pneumatic actuators. In case of single E/P converter is driving more than one positioner, then its air out put shall have shall sufficient capacity.

6.3.26 Air Filters Regulators shall be provided in the

1. Air supply line to valve positioners/power cylinders
2. Air supply line to electrical to pneumatic converters
3. Air supply line to pneumatic interlocked block valves
4. For each Instrument Rack/Local panel field instruments enclosure for purging.

6.3.27 **Analytical Instruments:**

a. Steam and water quality measurement:

The various analytical instruments complete with their sampling system and sampling racks shall be provided for continuous monitoring of the quality of the process fluid as per Table-3.

These analysers shall be kept in an air conditioned room. The specification details for analysers, sample coolers and sampling racks shall be as per section-D3.4.

b. Gas Analysers:

The following gas analysers shall be provided at the location indicated below:

1. Economiser outlet or Each of Air preheater Inlet : Oxygen
2. Each of Air preheter outlet : Oxygen
3. ID fan outlet : Particulate Emission Analyser.
4. Stack : i) Sample Extractive type SO2, NOX, CO
   ii) Particulate emission.

Bidder shall also provide Oxygen measurement in high temperature zones of boiler for combustion control and performance analysis, if required.

The specification details for gas analyser is given in section-D3.4.

6.3.28 Interposing Relays shall be provided,

1. For all drive commands, (HT,LT,BIDIRECTIONAL, SOLENOID, DC DRIVE etc.,)
2. Potential free contacts required between systems for unit / equipment trip, protection & interlocks applications...etc

The Interposing relays' provided are independently mounted in MCC/Integral starter/DDCMIS cabinets or in separate cabinets.

6.3.29 **Transmitter Racks**

All the pressure, flow and level transmitters shall be grouped depending on the geographical locations and mounted on Transmitter Racks. The general specification of transmitter racks is given in Section-D3.4.

also 2 sets to be mounted on Unit control desk.

3.00.06 The alarm windows and group alarms shall be freely configurable without wiring changes from PC based OWS.

3.00.07 Contact multiplication (Buffer terminal cabinets)cabinets with optical isolation input cards required for UCP & ECP alarm points shall be provided as per requirement.

4.00.00 <u>TECHNICAL SPECIFICATIONS FOR FIELD INSTRUMENTS, PLC, VMS, CCTV AND OTHER EQUIPMENT/SYSTEMS</u>

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.

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.

4.00.01 <u>Smart Electronic Transmitters for Measurement of Pressure, Differential Pressure(DP) & Flow/Level(DP Type):</u>

4.00.02 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. Hystersis: +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.
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.

4.00.03 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.

4.00.04 In Detail Technical Specification:

1)Type of Transmitter: Microprocessor based 2 wire type HART protocol compatible,
2) Accuracy : - +/- 0.1 % of span
3) Output Signal Range: 4-20 mA DC(Analog)*Superimposeddigital on HART protocol*
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 &
+/- 0.25% for range more than 70 KSC(g).
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 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

In addition to the transmitters 3 Nos. of hand held calibrators for configuration shall be provided for maintenance of units.

5.00.00 Coriolis Type Smart Mass Flow Meter :

Bidder shall provide Coriolis type Mass Flow Meter for flow measurement of HFO (Main & Return),LDO and DM water flow to Unit. The technical details are Accuracy - 0.2% of FS,Repeatability - 0.1%,Output - 4-20 mA, Protection - IP-65 and Hazardous Area- Flame proof Classification for LFO/HFO.

6.00.00 Displacement Type Level Transmitters:

6.00.01 Displacement 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 bidder. 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.

6.00.02 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.

7.00.00 <u>Impact Head Type Flow Element:</u>

7.00.01 The impact head type element (annubar) shall be tubular insert type with minimum four impact ports facing upstream direction, located precisely for determination of average flow velocity. The material of the sensor shall be 316 SS. Accuracy shall be +/- 1.0 % of actual value or better. Repeatability shall be +/- 0.01 % of actual value or better.

7.00.02 The elements shall be supplied complete with mounting hardware, end support plugs and CS valve manifold (1/2" NPT connection) for instrument connections. All pertinent data including OWNER's instrument Tag No. for the flow element shall be punched on a stainless steel plate and affixed to the element.

7.00.03 On line retracting facility and flushing arrangement shall be provided.
Anubar Type flow element shall be used for measurement of C W flow.
Bidder shall submit all sizing calculations, precise flow calculations, fabrication and assembly drawings, installation drawings for all the flow elements for OWNER's review and approval.

8.00.00 **Digital Display Unit**

To display the digital value of any analog process parameter with sign and decimal point of any analog input assigned though operator. Accuracy shall be+/-0.25% of reading; shall be of size 2". type of display - LED; Seven segment or dot matrix type; five digits, sign and decimal point; colour of display shall be Green ; enclosure shall be IP32 or equal; all DDUs shall be mounted on the Unit Control Panel. For outdoor applications, the size shall be 6". DDU used outside control room shall be of Dot matrix type.

9.00.00 **THERMOCOUPLE ASSEMBLY WITH THERMOWELL**

Duplex type with accuracy of +/-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.

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.

Thermo wells shall be provided along with Temperature elements of RTD & Thermocouples except for metal/bearing/winding temperature measurements.

1. For measurement of flue gas temperature, Inconal 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

10.00.00 RESISTANCE TEMPERATURE DETECTORS (RTD) WITH THERMOWELL:

Duplex type with accuracy of +/-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.

11.00.00 Test Thermowells:

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

12.00.00 Pressure Indicators:

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 +/-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.

13.00.00 Pressure Switches:

Non indicating type, field mounted Pressure Switches of aluminium casing (epoxy coated), and 316 SS element and accuracy of +/-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.

14.00.00 **Differential Pressure Indicators:**

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 +/-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.

15.00.00 **Differential Pressure Switches:**

Bellows or diaphragm operated non-indicating field mounted type; aluminium casing (epoxy coated); 316 SS pressure element nylon movement; an accuracy of +/-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 + 0.5% FSR.

16.00.00 **Thermometers:**

Indicating type, field mounted, filled system with 5metre capillary and six (6) inch dial housed in aluminium casing (epoxy coated) with an accuracy of +/-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.

17.00.00 **Temperature Switch:**

Non Indicating type, field mounted, filled system with 5 metre capillary housed in Aluminium casing (epoxy coated) with an accuracy of +/-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 meet the ANSI 19.3-1994 (latest)requirements.

18.00.00 **Level gauges:**

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.

19.00.00 **Level Switches:**

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.

Accessories like name plate, drain valve for external case type level switches, mating flange, gaskets (asbestos), fasteners, bolts & nuts, etc. shall be supplied.

20.00.00 **Flow Glasses:**

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.

21.00.00 **Flow Elements:**

SS 316 flow nozzles for all steam and feed water services with D and D/2 pressure tappings; 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 tappings complete with root valves. Orifice plate shall not be less than 3 mm thick for nominal pipe diameter upto 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.
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.

22.00.00 **Flow Switches:**

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.

23.00.00 **Flow integrators(Electronic Type):**

Flush mounted receiver type electronic digital flow integrators with accuracy 0.2%; linearity within 0.2%; six (6) digits, 24 V DC power supply. IP65 or equivalent degree of protection for enclosure; Accessories like square root extractor shall be provided.

24.00.00 **Air Filter Regulator (AFR):**

Constant bleed type AFR with an accuracy of +0.1%, inlet pressure range of 5-8 kg cm2 and suitable spring ranges (AFR) for use with positioners in control valves, control damper, E/P converters and shut off valves, transmitter purging lines etc; Filtering particles above five microns having phosphor bronze filter element. Material of accessories will be SS. Built in blow down valve shall be provided. AFR shall have automatic drain feature. All accessories shall be supplied. Degree of protection shall be IP65

25.00.00 **Electro-Pneumatic Converters (E/P):**

Two wire type E/P convertors with an accuracy of +/-0.25% accepting 4-20 mA DC signals from control system and converting to 0.2 to 1 kg/cm2 air pressure to operate valve positioner of all final control elements; Housed in cast aluminium casing (with polyurethene paint); IP65 degree of protection for enclosure. Material of accessories will be SS. Direct/reversing acting, 4 SCFM and above capacity

26.00.00 **Position Transmitters:**

24 V DC operated Non contact type electronics/LVDT type, 4-20 mA, 2 wire system with an accuracy of +/-1%; range adjustment and zero adjustment to be provided; IP65 or equivalent degree of protection for casing. The output shall be linear. All accessories shall be SS.

27.00.00 **Solenoid Valves:**

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.
The operating voltage shall be for 24VDC/ 220VDC/230VAC/110VAC depending on the service.

28.00.00 **MAGNETIC FLOWMETER :**

Inline type with indicating top mounted transmitter with flange connection. Accuracy: 0.5% of flow rate or volume flow. Repeatability 0.1% of flow rate/volume flow. Transmitter shall be smart with LCD display and superimposed HART on 4-20mA DC output. Data storage shall be in EEPROM. Shall have diagnostic capabilities. Touch control facility on the indicator for checking the rate/volume and diagnostic messages.

Material: Case-Al.alloy with corrosion resistant, flow tube and extension pipe-Stainless steel (SS 304) and Lining-fluro carbon.

The flow rate shall be available in DCS/PLC and flow integration shall be implemented in DCS/PLC to indicate volume flow.

29.00.00 **Local Instrument Enclosure & Racks/CJCB,s:**

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.

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 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.

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.

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.

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.

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.

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.

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.

30.00.00 **Junction Boxes:**

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 JBs 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 mm2 to 2.5 mm2 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 JBs is subject to Purchaser's approval. All the field Junction boxes shall have double doors. All JBs 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.

31.00.00 **Inter Posing Relays (IPR):**

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 though 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 mm2. to2.5 mm2 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.

32.00.00 **System Cabinets:**

These cabinets shall house signal conditioning cards, input/output cards, processor cards & associated power supply units. Indoor located, free standing vertical type system cabinets with 2 mm thick sheet metal of cold rolled steel; double doors with neoprene gaskets; keylocks; antivibration pads of 15 mm thick; Fluorescent lighting; fan in each cabinet with leouers, brass wire mesh, door switches, removable gland plate of 3 mm thick, cable glands, cubicle earthing, lifting bolt.; fire proof compound (50 mm thickness) for sealing cable entry; fire detector for each section; space heater for each section (strip type). Lamp shall be provided in each cabinet to indicate the cabinet having fault condition. The racks in system cabinets shall have provision along with plug in sockets/back plane to house at-least 20% additional cards, to accommodate for engineering flexibility or future expansion. The protection class shall be IP-32. The paint shade and thickness ..etc shall be as decided during engineering. Doors shall have concealed type of hinges and swing of 100 degrees. The doors shall be provided both at the front and rear. Power supply distribution shall be provided on per cabinet basis with all associated MCBs, protections, etc. The system cabinets, racks in system cabinets, slots in the racks & the terminals shall have identification numbers. A stainless steel metal tag (plate) shall be fixed to the inside of the door & the layout of the racks, slots & details of the card type/service shall be inscribed on this metal tag. Each cabinet shall be provided with one each 3pin receptacles for 240 V, 1P 50 C/S. Smoke detector shall be mounted in each system panel and shall be connected to the plant Fire detection and Alarm system.

33.00.00 **Local Panels:**

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 hardwares shall be terminated at site by

vendor. Quantity shall be as required.

34.00.00 **Vibration Monitoring System (VMS) and Analysis System.:**

34.01.01 Vibration pickups and transducers shall be provided on Y-axis for all 3.3/11KV equipments with isolated 4-20 MA DC outputs and 2 Nos. SPDT alarm contacts for high and very high condition & fault for each pickup. The system shall be complete with transducers, monitors, redundant power supply, isolators mounted inside the cabinet. The sensors, mounting pads, brackets, special cables etc. shall be included.

34.01.02 The Vibration Monitoring System shall be furnished on a system basis including vibration transducers with low noise flexible cables in flexible conduit, terminated in local terminal boxes, necessary pre-amplifier/ electronics mounted in local weatherproof boxes(IP-65) vibration monitors & mounting racks/cabinets. The Vibration-monitoring system shall include all power supplies, inter-connecting cabling, calibration equipment, indicators, integrating units, signal conditioning devices and all other accessories required for monitoring of Vibration at each point. However, the finally selected sensor type shall also depend on recommendation of the equipment manufacturer & suitable for application requirement.

34.01.03 Transducers shall be furnished in weatherproof housing suitable for field conditions. Monitor shall provide vibration indication calibrated in velocity units along with provisions of changing to displacement unit (field programmable)for each measurement point in both horizontal & vertical planes. The vibration monitor racks with power supplies shall be mounted in unit control panel. However, for CWP/ACWP the rack cabinet shall be located in CW pump house.

34.01.04 The functional requirement for vibration monitoring system shall include but not be limited to the following:

a. Vibration monitor front face status indications shall be available for indications of healthy conditions of pick-up circuit, monitor circuit and power supply. Also set point indication with set point adjustment facility for setting alarm & trip levels shall be provided.
b. The facility shall be available from front of mounting rack for functional checking of monitors with inhibition of alarm of alarm and trip contact outputs during test.
c. All vibration monitoring equipment shall be functionally tested for circuit continuity and output response. All the components & inter-connection cables shall be tested to ensure compliance with the specification requirements & all other applicable codes and standards.

34.01.05 For turbine and generators vibration pickups and transducers shall be provided on both X & Y axis as part of turbo supervisory system. The monitoring system

GENERAL TECHNICAL REQUIREMENT

D1: GENERAL TECHNICAL REQUIREMENTS FOR MECHANICAL

D2: GENERAL TECHNICAL REQUIREMENTS FOR ELECTRICAL

D3: GENERAL TECHNICAL REQUIREMENTS FOR C&I

SECTION-D1

GENERAL TECHNICAL REQUIREMENT-MECHANICAL

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 shall be taken care of by VENDOR without any commercial & delivery implication.

Service water line shall be provided with isolation valves & flange connection at one point near plant area. All further piping wherever required within the plant shall be taken care of Vendor.

For all pumps while calculating the pump head, 20% margin (minimum) shall be considered on the value of friction losses. However the minimum head as indicated in the datasheet –A has to be provided by the bidder. The static head shall be considered based on the pipe routing, however it shall be minimum 12 m. The detailed pipe routing shall be furnished by the bidder during detail engineering.

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 H_2SO_4 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.

2.0 CAPACITY SELECTION:

ACID DOSING (98% H_2SO_4)		
Acid dosage rate	=	[(Make-up M-Alkalinity X COC)-(Desired M-Alkalinity in Recirculating water)] X Blow-down X 24/1000
	=	[550X5)-550] X 354 X 24 / 1000
	=	18691.20 kg/day
	=	778.80 kg/hr (Approx)
	=	794.694 kg/hr (98% H_2SO_4)
Specific Gravity	=	1.84
Acid dosage rate	=	794.694/1.84 LPH.
	=	431.89 LPH.
Acid Dosing Pumps selected	=	450 LPH Each (1W + 1S).
Capacity of H_2SO_4 Day Tank for 24 Hrs	=	10365.5 Liter.
Capacity of H_2SO_4 Day Tank for 24 Hrs(Selected)	=	5200 Liter., each (2 nos)
Capacity of H_2SO_4 Storage	=	155482.50 Liter.

Tank for 15 days		
Capacity of H_2SO_4 Storage Tank for 15 days(selected)	=	52 M3 each (3 nos)

SCALE INHIBITOR /CORROSION INHIBITOR

Scale inhibitor and corrosion inhibitor are a proprietary chemicals and level of its dosage in CW & ACW depends upon the plant operation.
However, the system will be designed for minimum 10-ppm dosage of either scale inhibitor or corrosion inhibitor and for biocide dosing rate is minimum 3 ppm.

SCALE INHIBITOR /CORROSION INHIBITOR - CONTINUOUS DOSING RATE		
Dosing rate	=	Blowdown (m^3/hr) X dosage (ppm) /1000
	=	354 X 10 / 1000
	=	3.54 kg/hr of 100% solution.
Specific gravity	=	1 (approx).
Chemical dosage rate of 100% Solution.	=	3.54/1 LPH (Approx).
Chemical dosage rate of 10% Solution.	=	35.4 LPH.
Chemical dosage rate Considered.	=	50 LPH (Approx).
Chemical Injection Pump (selected)	=	50 LPH (1W+1S).
Capacity of Day Tank for 24 Hrs considering 10% dilution factor	=	849.60 Litre.
Capacity of Day Tank for 24 Hrs Selected	=	2000 Litre, each (2 nos)

3.0 PLANT OPERATION AND CONTROL

The operation of the Circulating Water Treatment Plant will be manual from Relay Based Local Control Panel (LCP).

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

a) Status of all the equipment of chemical dosing system. The status includes ON, OFF, TRIP indication of respective motor / pump/agitator.
b) Hardwired annunciation for pump trip, level low 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.

The operation of Sulphuric Acid Injection Pumps shall be auto 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 local control panel.

Provision for locking the local stop push buttons after tripping the motor from local push buttons shall be available in LCP.

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

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.
Normally two (2) pumps will be in service, each dedicated for each Unit and one (1) pump will be there as common stand-by pump which will be used separately for both the units by selection through selector switch.

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. No deviation in this regard shall be acceptable.

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/flat 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. The dissolving basket material of construction as per data sheet-A.

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 be same as that of preparation and measuring tanks.

5.2 MET ERING 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, 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.

6.0 INSPEC TION / TEST:

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

7.0 SPECIA L 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.

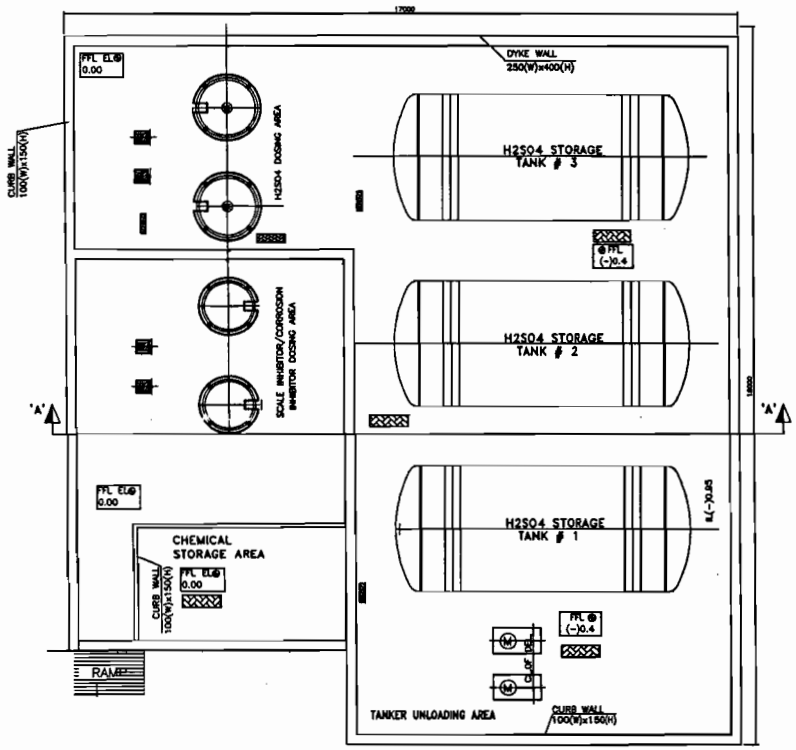
8.0 PAIN TING: -

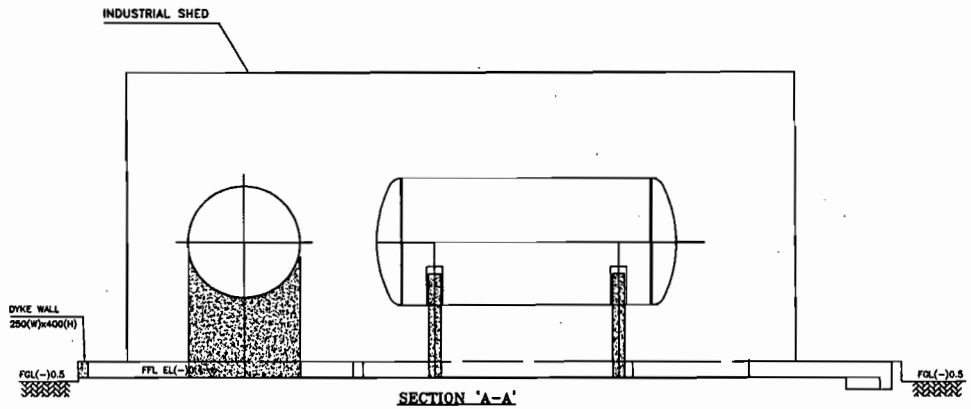
All equipment including pumps, motors piping supports tanks etc. shall be painted to the specification to be prepared by the bidder and approved by the purchaser.

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.

FIRST ANGLE PROJECTION





SECTION 'A-A'

TYPICAL LAY OUT OF COOLING WATER TREATMENT PLANT

JOB NO.	367	PROJECT: 1X700 MW BELLARY-3 STPS			
STATUS	CONTRACT	CUSTOMER: KARNATAKA POWER CORPORATION LIMITED			
DISTRIBUTION		CONSULTANT: TRACTEBEL ENGINEERING PVT. LTD.			
TO		BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA	DEPT CODE	NAME	SIGN
			A	DRN GAJ	
				DESN GAJ	
				CHD FS	
				APPD SB/SBJ	
No. OF REV.	DATE ALTD CHD APPD				
		TITLE: TYPICAL LAY OUT FOR CW TREATMENT PLANT			
		DEPT. SCALE	DRAWING NO. PE-DG-367-156-A002		
		SIGN	SHEET 1 OF 1	REV 00	
		DATE			

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SECTION D2

GENERAL TECHNICAL REQUIREMENTS FOR ELECTRICAL

	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

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

1.0 INTENT OF SPECIFIATION

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

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

2.0 CODES AND STANDARDS

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

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

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

3.0 DESIGN REQUIREMENTS

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

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

3.3 Starting Requirements

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

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

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

3.3.3 The following frequency of starts shall apply

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

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

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

3.4 **Running Requirements**

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

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

3.5 **Stress During bus Transfer**

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

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

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

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

4.0 **CONSTRUCTIONAL FEATURES**

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

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

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

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

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

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

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

4.7 **Terminals and Terminal Boxes**

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

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

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

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

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

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

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

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

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

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

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

4.9 **General**

4.9.1 Motors provided for similar drives shall be interchangeable.

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

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

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

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

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

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

5.0 INSPECTION AND TESTING

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

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

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

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

6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

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

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

	TITLE	SPECIFICATION NO.
BHEL	**LV MOTORS**	VOLUME II B
		SECTION D
	DATA SHEET-A	REV NO. 00 DATE 03/04/2012
		SHEET 1 OF 1

1.0	Design ambient temperature	:	50 °C
2.0	Maximum acceptable kW rating of LV motor	:	<160KW
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Degree Of Protection	:	IP55
5.0	Cooling	:	TEFC/CACA
6.0	Details of supply system		
	a) Rated voltage (with variation)	:	415V ± 10%
	b) Rated frequency (with variation)	:	50 Hz (Variation: +5% TO –5%)
	c) Combined voltage & freq. variation	:	10% (sum of absolute values)
	d) System fault level at rated voltage	:	50 kA for 1 sec
	e) Short time rating for terminal boxes		
	o 110kW & Above (Breaker controlled)	:	50 kA for 1 sec
	o Below 110kW (MCCB+ Contactor controlled)	:	50 KA for 0.20 sec.
	f) LV System grounding	:	Solidly
7.0	Class of insulation	:	Class 'F', with temp rise limited to class B.
8.0	Minimum voltage for starting (As percentage of rated voltage)	:	80% of rated voltage
9.0	Power cables data	:	Shall be given during Detailed engg
10.0	Earth Conductor Size & Material	:	Shall be given during Detailed engg
11.0	Space heater supply	:	240 V, 1Φ , 50 Hz
12.0	Rating up to which Single phase motor	:	Acceptable below 0.20 kW
13.0	Locked rotor current		
	a) Limit as percentage of FLC	:	600%
	b) Permissible tolerance, if any	:	20%
14.0	Additional tests	:	As per QP
15.0	Flame-proof motor		
	a) Enclosure suitable (As per IS:2148)	:	As per requirement
	b) Classification of Hazardous area (As per IS: 5572 part-I)	:	As per requirement
	c) Degree of protection	:	IP65
16.0	Makes	:	AS PER ANNUXURE-I

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

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

NAME OF VENDOR				REV.	
NAME	SIGNATURE	DATE	SEAL		

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

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

NAME OF VENDOR				REV.	
NAME	SIGNATURE	DATE	SEAL		

भेल/BHEL	QUALITY PLAN	CUSTOMER : KPCL			PROJECT TITLE 1X 700 MW : BELLARY-3 TPS, UNI			SPECIFICATION : NUMBER :			
	SHEET 1 OF 2	BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006/0			SPECIFICATION TITLE			
		SYSTEM			ITEM AC ELECT. MOTORS BELOW 75KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	3	-	-	
2.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	3	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	3	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	3	-	-	
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	3	2,1	2,1	NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	

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

BHEL	QUALITY PLAN		CUSTOMER : BSEB			PROJECT TITLE	2 X 500 MW : BARAUNI TPS UNIT#		SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006/0			SPECIFICATION : TITLE :			
	SHEET 2 OF 2		SYSTEM			ITEM AC ELECT. MOTORS BELOW 75KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	3	1	-	

NOTES:

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

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

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

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

BHEL	QUALITY PLAN	CUSTOMER : KPCL			PROJECT TITLE: 1 X 700 MW : BELLARY-3 TPS, UNIT-3			SPECIFICATION NUMBER :				
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION TITLE :				
	SHEET 1 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)			SECTION			VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	RAW MATERIAL & BROUGHT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	-	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVENT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	-	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVENT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	-	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	-	

BHEL	PARTICULARS	BIDDER/VENDOR
	NAME	
	SIGNATURE	
	DATE	

BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN	CUSTOMER : KPCL			PROJECT TITLE 1 X 700 MW : BELLARY-3 TPS, UNIT-3			SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION : TITLE			
	SHEET 2 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	-	
		4.INTERNAL FLOWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	-	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO BREAKAGE ON OTHER PHY. DESIGN	-DO-	3	-	-	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	-	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	-	

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

भेल BHEL	QUALITY PLAN		CUSTOMER : KPCL			PROJECT TITLE: 1 X 700 MW : BELLARY-3 TPS, UNIT-3			SPECIFICATION : NUMBER :			
	SHEET 3 OF 9		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION : TITLE			
			SYSTEM			ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	-	
		2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG. .	MANUFR'S DRG.	-DO-	3	-	2	FOR MV MOTOR INSULA-TION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IS	RELEVANT IS	SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3	-	-	
		2.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	-	2	

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

	QUALITY PLAN	CUSTOMER : KPCL			PROJECT TITLE 1 X 700 MW : BELLARY-3 TPS, UNIT-3			SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION : TITLE			
	SHEET 4 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)			SECTION			VOLUME III

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

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

	QUALITY PLAN		CUSTOMER : KPCL			PROJECT TITLE 1 X 700 MW : BELLARY-3 TPS, UNIT-3			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION : TITLE			
	SHEET 5 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
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.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVENT SPEC./ ASTM-E165	MANUFR'S SPEC./ BHEL SPEC./	-DO-	3	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	3	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	3	-	2	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	3	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	3	-	-	

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

BHEL	QUALITY PLAN		CUSTOMER : KPCL			PROJECT TITLE: 1 X 700 MW : BELLARY-3 TPS, UNIT-3			SPECIFICATION NUMBER :			
	SHEET 6 OF 9		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION TITLE			
			SYSTEM			ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	3	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	3	-	-	
		3.CORE LOSS & HOTOPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	3	-	2	(FOR MOTORS OF 2MW AND ABOVE)
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	3	-	-	
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	3	-	-	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	2	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	2	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	2	1	FOR MV MOTOR
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	3	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	3	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	2	THREE DIPS TO BE GIVEN
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

भा.ह.उ.लि. BHEL	QUALITY PLAN	CUSTOMER : KPCL			PROJECT TITLE: 1 X 700 MW : BELLARY-3 TPS, UNIT-3			SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION : TITLE			
	SHEET 7 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	2	
2.7	COMPLETE STATOR ASSEMBLY	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	3	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	3	-	-	
		2.SOUNDNESS	CR	MALLET TEST & MV TEST	-DO-	-DO-	-DO-	Log Book	3	-	-	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	3	-	-	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	3	2	1	VERIFICATION FOR MV MOTOR ONLY
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	3	2	-	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	3	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	3	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	3	-	2	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	3	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	3	-	-	

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

	QUALITY PLAN		CUSTOMER : KPCL			PROJECT TITLE 1 X 700 MW : BELLARY-3 TPS, UNIT-3			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION : TITLE			
	SHEET 8 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	3	1	1,2	NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	3	1,2	1,2	NOTE - 2
		3.VIBRATION	MA	-DO-	100%	IS-12075	IS-12075	-DO-	3	1,2	-	
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	3	2,1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	3	-	2,1	TC FROM AN INDEPENDENT LABORATORY NOTE-3
		6.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	3	2,1	-	
		7.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	3	-	2,1	NOTE-3
		8.PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	3	2,1	-	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY

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

	QUALITY PLAN		CUSTOMER : KPCL			PROJECT TITLE	1 X 700 MW : BELLARY-3 TPS, UNIT-3		SPECIFICATION : NUMBER :		
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007/2			SPECIFICATION : TITLE		
	SHEET 9 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 75KW & ABOVE (LV & MV)			SECTION		VOLUME III

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

NOTES:

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

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

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

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

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

SECTION D3
GENERAL TECHNICAL REQUIREMENTS FOR C&I

	SPECIFICATION FOR LOCAL CONTROL PANEL	DRAWING NO:
		REV. NO. / DATE:
		SHEET 1 OF 6

1.0 SCOPE

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

2.0 CODES AND STANDARDS

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

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

a)	IS-6005 : 1970	:	Code of practice for phosphating of iron and steel.
b)	IS-5 : 1978	:	Colours for ready mixed paints and enamels.
c)	IS-1248:1983	:	Direct Acting Indicating Instruments.
d)	IS-13947 (Part-III):1993	:	Rotary Cam Switches.
e)	IS-6875:1973	:	Auxiliary relays.
f)	IS-8828:1993	:	Circuit breaker for household and similar installations.
g)	IS-13947 (Part-I):1993 Rules)	:	Low Voltage switchgear & control gear : Part-I (General
h)	NFPA-496:1974	:	Purged & Pressurised Enclosure for Electrical Equipment in Hazardous Locations.

3.0 TE CHNICAL REQUIREMENTS

3.1 Panel Construction

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

3.1.2 The panels shall be of free standing vertical type folded construction by sheet metal formation depending upon the equipments to be mounted on it. The panels shall be suitable for outdoor location, IP-65 enclosure; made of cold rolled steel with sheet material with thickness of 3mm; anti-vibration pads of 15 mm thick; fluorescent lighting; fire proof compound (50 mm thick) for sealing cable entry (bottom); fire detector for each section. The panels shall be robustly built and stiffness as necessary shall be provided. CFL of 40 W shall be provided from one end to other end at continuous length and shall be operated by door switches as well as by manual switches. Name plates for all instruments/inserts with Tag. No. & short description of service engraved shall be provided. These shall be phenolic overlays (1.6 mm thick), black background with white lettering & shall be fixed to the panel by stainless steel screws (counter sunk). Each section of panel shall be provided with one each 3 pin receptacles for 240V, IP 50 c/s & 110 V, IP 50 c/s. Panel shall be delivered fully wired.

3.1.3 The panel shall be suitably reinforced to ensure adequate support for all instruments mounted thereon. All welds on exposed panel surfaces shall be ground smooth. All the instruments, inserts and annunciation windows shall be mounted & wiring connections at these hardware shall be terminated at site by vendor. Quantity shall be as per required.

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel
Frame thickness: Not less than 3.0mm
Enclosure thickness: Not less than 2.5 mm for load bearing sections (Mounted with instruments), 1.6 mm for doors and Not less than 2.0 mm for others
Panel Height: Not less than 2365 mm
Gland plate thickness: 3.0mm

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

3.1.5 The panel shall be provided with rear doors with integral lockable handle. The door when locked shall be held at minimum three places. The door width shall not be more than 550mm.The doors shall be provided with suitable stiffness to prevent buckling. The handle shall be on the right side of the door. The door shall be removable type along the bottom of the front desk continuously with concealed hinges to facilitate maintenance work. The length of each cover plate shall not exceed 1 m. Suitable pocket inside the door shall be provided for keeping the drawings / documents.

3.1.6 Double doors with neoprene gasket at every 1.5 m shall be and removable covers. Suitable ventilation louvers & blowers shall be provided at bottom and top of the doors covered with removable brass mesh.

3.1.7 The class of protection shall be in accordance with IP-65 unless otherwise specified in the Data sheet – A.

3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as given in Data sheet-A. Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.

3.1.9 The cable glands of the required size and type as given in Data sheet-A shall be supplied along-with the Panel.

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

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

3.1.11 Single / dual control power supply feeders of voltage class as specified in data sheet-A (No. PES-145-54A-DS1-0) shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.

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

3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm2 to 2.5mm2 external cables. The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm height from finished floor. The panel shall have ten (10) percent spare terminal.

	SPECIFICATION FOR LOCAL CONTROL PANEL	DRAWING NO:	
		REV. NO.	DATE:
		SHEET 3 OF 6	

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

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

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

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

3.2 Hazardous Area Panel Requirement

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

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

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

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

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

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

3.3 Control & Monitoring devices

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

3.3.2 Alarm Annunciator System

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

3.3.3 Relays

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

3.3.4 Timers

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

3.3.5 Control / Selector Switches

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

3.3.6 Push Buttons / Indicating Lights

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

RED	Motor OFF / Valve CLOSE	YELLOW	Alarm acknowledge.
GREEN	Motor ON / Valve OPEN	BLACK	Lamp test

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

GREEN	Motor OFF / Valve CLOSED condition	AMBER	Motor tripped condition.
RED	Motor ON / Valve OPEN condition	WHITE	Normal / healthy condition

3.3.7 Ammeters

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

3.3.8 Miniature Circuit Breaker (MCB)

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

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

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

4.0 TE STING AND INSPECTION

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

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

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

4.3.1 Routine Tests

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

4.3.2 Type Tests

1. Enclosure Class Test

5.0 SP ARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

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

5.2. Mandatory Spares

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

5.3. Recommended Spares

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

6.0 DRAW INGS AND DOCUMENTS

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

1. Data Sheet A & B
2. General Arrangement Drawing.
3. Catalogue and technical information for instruments and devices.
4. Quality Plan.

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

1. Data Sheet C
2. GA Drawing indicating layout of instruments, construction details, foundation details, cable gland plate along-with cable glands and all details mentioned in this specification.
3. Control Schematic Diagram along with grouping of different terminals for various functions.
4. Catalogue and technical information for instruments and devices with selected options clearly marked.
5. O&M Manuals.
6. "As Built" Drawing.
7. CDs.

7.0 MARKING AND PACKING

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

8.0 APPLICABLE DATA SHEET FORMS

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

- Data sheet A&B for Local Panels
- Data sheet C for Local Panels

PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: **PE-QP-999-145-I056**
VOLUME IIB
SECTION D
REV. NO. 01 DATE: 22-02-2008
SHEET 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 $ P	Agency $ W	Agency $ V	Remarks
	INCOMING											
1.0	Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	3	—	2	
		2. Bend Test	CR	Mech. test	Sample	IS:1079 IS:513	IS:1079 IS:513	Log Book	2	—	—	
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	—	—	
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	—	—	
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	—	—	
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	—	1	
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	IS:2062	IS:2062	Log Book	2	—	—	
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	—	—	
		3. Straightness	MA	Measurement	100%	Factory Std.	Factory Std.	Log Book	2	—	—	
		4. Mill marking	MA	Visual	100%	IS:2062	IS:2062	Log Book	2	—	1	
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	—	—	
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	—	—	

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

PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	PE-QP-999-145-I056
VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 22-02-2008
SHEET	2 OF 7

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

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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

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SHEET	3 OF 7

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

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PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: **PE-QP-999-145-I056**
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SHEET 4 OF 7

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

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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: **PE-QP-999-145-I056**
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SHEET 5 OF 7

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

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V - Agency Verifying the Test.

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2 - Vendor
3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	PE-QP-999-145-I056
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	W	V	Remarks
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.
		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

STD QUALITY PLAN NO.:	PE-QP-999-145-I056
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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	Type Test Certificate	3	—	1	
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant IS.	BHEL approved spec., drg., BOM & relevant IS.	Test Report	2	1	1	
15	FUCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		2. Instrument Calibratio	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant IS.	BHEL approved spec/drg & relevant IS.	Inspection Report	2	1	1	

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FORM NO. PEM-6666-0

	DATA SHEET FOR LOCAL CONTROL PANEL	SPECIFICATION NO.:	
		VOLUME	
		SECTION	
		REV. NO.	DATE:
		SHEET 1 OF 1	

TAG No. ..... Qty.....

Data Sheet A & B

			DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL	MANUFACTURER			
	CONSTRUCTION		■ FOLDED ☐ WELDED (As per requirement)	
	ENCLOSURE SHEET THICKNESS	FRONT	■ 3.0 mm .	
		OTHER	■ 3.0 mm	
		DOOR	■ 3.0 mm	
TECHNICAL	INPUT POWER SUPPLY		☐ 240V 50 Hz AC ☐ 220V DC ■ 415V 3 PHASE ☐	
	NO. OF FEEDERS		☐ ONE ■ TWO	
	CONTROL SUPPLY		☐ 110V AC ■ 220V AC ☐ 220V DC ☐ During detailed engg. (As per requirement)	
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		_____NOS: (AS REQUIRED)	
	PAINT TYPE		☐ EPOXY ENAMEL ■ EPOXY POWDER COATED	
	PANEL COLOUR (EXTERNAL)		■ LIGHT GREY (Shade 631 IS-5) (Project specific) ☐ OPALINE GREEN (Shade 275) ☐ During detailed engg.	
	FINISH		■ MATT ☐ GLOSSY ☐ SEMI GLOSSY	
	PANEL COLOUR (INTERNAL)		■ WHITE ☐ CREAM ☐ OFF WHITE	
	FINISH		☐ MATT ☐ GLOSSY ■ SEMI GLOSSY	
	CLASS OF PROTECTION		■ IP-65 ☐ IP-55	
	CONTROL HARDWARE		■ RELAY BASED	
	FOUNDATION ARRANGEMENT		■ FOUNDATION BOLTS ☐ ANCHOR FASTENERS	
	WEIGHT OF PANEL (Kg.)			
	PANEL TYPE		☐ PRESSURISED ■ UNPRESSURISED As per Requirement	
	CABLE GLAND		☐ SINGLE COMPRESSION ■ DOUBLE COMPRESSION	
	AMMETER (TYPE OF INPUT)		☐ 1 Amp CT ☐ 4-20 mA	

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

FORM NO. PEM-6666-0

THIS IS A PART OF TECHNICAL SPECIFICATION NO. - PE-TS-367-156-A001

	DATA SHEET FOR LOCAL PANELS	SPECIFICATION NO.:	
		VOLUME	
		SECTION	
		REV. NO.	DATE:
		SHEET 1 OF 1	

TAG No. ..... Qty.....

Data Sheet C

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

GENERAL	MANUFACTURER		
	CONSTRUCTION		
	ENCLOSURE SHEET THICKNESS	FRONT	
		OTHER	
		DOOR	
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		
	AAMETER (TYPE OF INPUT)		

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

FORM NO. PEM-0666-0

BHEL	SPECIFICATION FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE	SPECIFICATION NO.: PES – 145 – 026A
		VOLUME
		SECTION
		REV. NO. / DATE :
		SHEET 1 OF 2

1.0 TECHNICAL REQUIREMENTS

1.1 General

The gauges shall be suitable for an ambient temperature of 0-55°C and relative humidity of 0-95%.

1.2 Bourdon tube, Movement & Shank

Bourdon Shall be made of stainless steel to AISI 316 and the teeth shall be polished to have frictionless movement without backlash. Movement shall conform to AISI 304.

1.3 Case

Shall be made of die cast aluminium and painted with black stoving enamel paint over a suitable etch primer. The case shall be provided with a blow-out disc, to safeguard the window glass.

1.4 Bezel Ring

Shall be made of anodized aluminium with anti corrosive finish.

1.5 Dial & Scale

The dial shall be made of a suitable material with anti corrosive finish, meeting the requirements of IS-3624. The scale shall be concentric and graduated in kgf/sq.cm. in the pressure gauge. MM of Hg on vacuum side and kgf/sq.cm on pressure side in case of vacuum/compound gauges. The marking shall be black on a non reflecting white background. The pointer deflection angle shall be 270 Deg. The unit of measurement shall also be marked on the dial.

1.6 Pointer

Shall be made of suitable metal with black finish. The pointer shall be provided with suitable mechanism for zero adjustment without opening the case.

1.7 Mounting & connection

Flush mounting, back connection, clamp fixing. Direct mounting bottom connection.

	SPECIFICATION FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE	SPECIFICATION NO.: PES – 145 – 026A	
		VOLUME	
		SECTION	
		REV. NO.	DATE :
		SHEET 2	OF 2

2.0 TESTING

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

2.2 The vendor shall conduct following tests as a minimum requirement and shall furnish test certificate thereof, for BHEL's approval before despatch of the same.

a) Routine Tests

i) Accuracy Test.

ii) Overload test.

iii) Endurance test.

iv) Vibration test.

b) Type tests

i) Thermal stability test.

ii) Weatherproof, water tight and Dust tight tests.

3.0 APPLICABLE DATA SHEET FORMS

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

- Data sheet A&B for Pressure/Differential Pressure Gauge :Data sheet no. PES-145-26A-DS1-0

- Data sheet C for for Pressure/Differential Pressure Gauge :Data sheet no. PES-145-26A-DS2-0

FORM NO. PEM-6666-0

	CHECK LIST FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE (MECHANICAL AUXILIARY PACKAGES)	SPECIFICATION NO.: PE-TS-375-145-I054
		VOLUME
		SECTION
		REV. NO. 00 DATE: 15.02.2012
		SHEET 16 OF 16

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

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

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

FORM NO. PEM-6666-0

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE	SPECIFICATION NO.:
		VOLUME
		SECTION
		REV. NO. / DATE:
		SHEET 1 OF 1

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

Data Sheet A & B

DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL	MANUFACTURER		
	MODEL NUMBER		
TECHNICAL	PRESSURE ELEMENT	▌BOURDON ☐ DIAPHRAGM ☐ BELLOW	
	MATERIAL	SENSING ELEMENT – AISI 316 SS MOVEMENT – AISI 304 SS CASING – ▌DIE CAST AL ☐ SS	
	ENCLOSURE	☐ IP-55 ▌IP-65 ☐ FUEL GAS HAZARDOUS APPL. EXPL. PROOF	
	DIAL	SIZE: ☐ 100MM ▌150MM COLOR: WHITE NUMERALS: BLACK SCALE: ▌LINEAR ☐ SQUARE ROOT	
	CASE	COLOUR : BLACK	
	ADJUSTMENT	▌EXT. MICROMETER SCREW ☐ INT. MICRO SCREW	
	MOUNTING	▌LOCAL ☐ PANEL OR RACK	
	OVER RANGE PROTECTION	▌150% OF MAX. PRESSURE ☐ 125% ABOVE 150 KG/CM2 FSD ☐ AS REQUIRED	
	BLOW OUT DISC	SUITABLE MATERIAL	
	SWITCHING FACILITY NO./TYPE OF CONTACTS COJNTACT RATINGS SETTING RANGE REPEATABLITY POWER SUPPLY	**NOT REQUIRED**	
PERFORMANCE	ACCURACY	± 0.5% OR BETTER OF FULL SCALE DEFLECTION	
CONNECTION	PROCESS	AS APLLICABLE	
	LOCATION	☐ BACK ☐ BOTTOM ▌AS REQUIRED	
ACCESSORIES	NAME PLATE / METAL TAG	SS	
	MOUNTING	☐ WALL ▌PIPE – U CLAMPS & BOLTS ☐ PANEL / RACK ☐ AS REQUIRED	
	OTHER	AS PER ENCLOSED DIAGRAM OR CUSTOMER SPECIFICATION	

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

FORM NO. PEM-6666-0

THIS IS A PART OF TECHNICAL SPECIFICATION NO. - PE-TS-367-156-A001

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE	SPECIFICATION NO.:
		VOLUME
		SECTION
		REV. NO. / DATE:
		SHEET 1 OF 1

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

Data Sheet C

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

GENERAL	MANUFACTURER	
	MODEL NUMBER	
TECHNICAL	PRESSURE ELEMENT	
	MATERIAL	
	ENCLOSURE	
	DIAL	
	CASE	
	ADJUSTMENT	
	MOUNTING	
	OVER RANGE PROTECTION	
	BLOW OUT DISC	
	SETTING RANGE	
PERFORMANCE	ACCURACY	
CONNECTION	PROCESS	
	LOCATION	
ACCESSORIES	NAME PLATE / METAL TAG	
	MOUNTING	
	OTHER	

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

BHEL	**SPECIFICATION FOR LEVEL SWITCH**	SPECIFICATION NO.: PES – 145 – 033
		VOLUME
		SECTION
		REV. NO. / DATE :
		SHEET 1 OF 3

1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site of Level Switch (Float type/displacer type) for use in Utility/Captive Power Station/Combined Cycle Station.

2.0 CODES AND STANDARDS

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

2.2 The Design and Materials used for the components shall also comply with the relevant National and International standards.

3.0 TECH NICAL REQUIREMENTS

3.1 General

The switches shall be magnetically operated, glandless type, suitable for tropical climate for operation at 0-55°C and Relative Humidity 0-95%. The switch shall be suitable for top mounting or side mounting with external chamber.

3.2 Housing

The switch housing shall be of die cast Aluminium/SS-304, weather proof, drain tight, water tight and dust tight as per NEMA 4.

3.3 Float Assembly/Displacer

The float assembly/displacer shall be made of stainless steel to AISI:316. Wire rope, spring housing, sleeve pipe shall also be of AISI:316.

3.4 External Chamber

The material for external chamber for side mounted level switches shall be as per data sheet and shall be of suitable thickness.

A drain plug shall be provided in the external chamber to facilitate testing.

The external chamber and the float assembly shall be arranged from the Level Switch supplier and not fabricated at site.

3.5 Mounting

The switch shall be suitable for direct mounting on the vessel at top or side mounted on an external chamber connected to the vessel.

3.6 Switching Data

The switch shall be single pole double throw (SPDT) or Double Pole Double Throw (DPDT) as specified in the data sheet.

The switch contacts shall be suitable for current rating 5A at 230V AC and 0.25A at 220V DC.

3.7 Differential

The differential between make and break shall be 12 ±2 mm for side mounted and 35 ±3 mm for top mounted. Other adjustable range to suit the specific requirement shall also be acceptable.

3.8 Specific gravity of the fluid

Specific gravity of the fluid shall be 0.7 to 1.2.

4.0 TESTING AND INSPECTION

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

4.2 The bidder shall furnish the Quality Plan in the format enclosed in volume-III. In case the Quality Plan(s) is/are included in volume-IIB, the bidder shall furnish his Quality Plan strictly in line with the same. The Quality Plan shall be discussed and finalised with the technically accepted bidders before opening the price bid. The stages where the purchaser would like to be associated for witnessing or verification would be indicated by the purchaser in the Quality Plan before approval.

4.3 The following test shall be conducted as a minimum requirement.

a) Routine Tests

i) Repeatability Test.

ii) Contact Rating Test.

b) Type Tests

Weatherproof, water tight & dust tight test.

4.4 Inspection will be conducted by BHEL and/or their authorised representatives as per the agreed inspection schedule. The inspection schedule will be submitted by the bidder for BHEL's approval at contract stage. The cost of all tests and inspections will be deemed to have been included in the bid. For all the type tests covered under 4.3 (b), "Type Test Certificates" as per agreed Quality Plan shall be furnished. In the absence of the same, such Type Tests shall be arranged at the Vendor's works in the presence of BHEL and/or their authorised representatives or in independent Test House /Laboratory approved by BHEL.

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares

The bidder shall supply all commissioning spares along with the equipment.

5.2 Recommended Spares

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

	SPECIFICATION FOR LEVEL SWITCH	SPECIFICATION NO.: PES – 145 – 033	
		VOLUME	
		SECTION	
		REV. NO.	DATE :
		SHEET 3	OF 3

6.0 D RAWINGS AND DOCUMENTS

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

6.1.1 Data sheet-B, completely filled-up along with all enclosures.

6.1.2 Quality Plan.

6.1.3 Catalogs with detailed technical information.

6.1.4 Bar-chart to indicate the time schedule for procurement, manufacture, testing and dispatch.

6.2 The successful bidder shall furnish the following documents in required number of copies during the contract stage:

6.2.1 For approval

i) Dimensional/Installation drawings.
ii) Data sheet-C, completely filled-up along with all the enclosures
iii) Quality Plan of vendor/sub-vendor.
iv) Test Certificates.

6.2.2 Final/As-built Drawings

Final/As-built drawings/RTFs in required number of copies shall be submitted.

6.3 Operation & Maintenance Manuals

O&M Manuals in required number of copies shall be submitted. O&M Manuals shall also contain storage & commissioning instructions.

7.0 MARKING AND PACKING

7.1 Marking

A stainless steel name-plate shall be permanently fixed on each equipment giving its Tag Number and technical specifications.

7.2 Packing

All equipment/materials shall be suitably packed and protected for the entire period of dispatch, storage and erection against impact, abrasion, corrosion, incidental damage due to vermin, sunlight, high temperature, rain, moisture, humidity, dust, sea-water spray (where applicable) as well as rough handling and delays in transit and storage in open.

8.0 APPLICABLE DATA SHEET FORMS

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

- Data sheet A&B for Level Switch (Float/Displacer type) : Data sheet no. PES-145-33-DS1-0
- Data sheet C for Level Switch (Float/Displacer type) : Data sheet no. PES-145-33-DS2-0

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STANDARD QUALITY PLAN FOR LEVEL SWITCHES

QUALITY PLAN NO.:	PE-QP-999-145-I033
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE:
SHEET	1 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
									P	W	V	
1.0	**Material / Components**											
1.1	Non wetted parts	Physical, chemical properties	MA	Physical, chemical analysis	1/cast	Approved drg. / data sheet / BHEL Spec.	Relevant raw material std.	Test report	3/2	—	2,1#	# Compliance certificate to be verified.
1.2	**Float Assembly and wetted parts**	Physical for float only and chemical properties for all wetted parts including float assembly	MA	Physical, chemical analysis	1/batch	AISI:3.16/ BHEL spec/drg/approved data sheet	AISI:3.16/ BHEL spec/drg/approved data sheet/relevant material std.	Internal Inspection Report	3/2		2/1	
1.3	**Chamber**	Dimensions and leak tightness	MA	Measurement, visual,hyd test	100%	- do -	- do -	- do -	3/2	2	1	
1.4	Float	Leak Tightness	MA	Hyd Test	100%	- do -	No Leakage	Internal Inspection Report	3/2	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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STANDARD QUALITY PLAN FOR LEVEL SWITCHES

QUALITY PLAN NO.:	PE-QP-999-145-I033
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE:
SHEET	2 OF 4

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
1.5	Switch	1. Make, type and rating	MA	Visual	100 %	BHEL/ Mtr Spec	BHEL/ Mtr Spec	Internal Inspection Report	3/2	—	2/1	
		2. Contact Continuity	CR	Electrical	100 %	- do -	- do -	To have continuity	3/2	—	2/1	
2.0	Final Inspection	1. Marking, Range,Model,Tag No ,Sl No.	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report	2	1	-	
2.1	Assembly	2. Correct assembly, workmanship and finish	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log book	2	1	-	
		3. Connection	MA	Visual & measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report	2	1		
		4. Scale marking	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report	2	1		
		5. Cleanliness	MA	Visual	100%	Manufacturer standard	Free from scratches ,dirt etc	Log book	2	1		
		6. Overall dimensions	MA	Visual	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection Report	2	1		

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

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

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STANDARD QUALITY PLAN FOR LEVEL SWITCHES

QUALITY PLAN NO.:	PE-QP-999-145-I033
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE:
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 $ P	W	V	Remarks
2.2	Routine test	1. Overload	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	TEST REPORT	2	1	1	
		2. Repeatability	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	TEST REPORT	2	1	1	
		3. Set point adjustment	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	TEST REPORT	2	1	1	
		4. Differential	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	TEST REPORT	2	1	1	
		5. Contact rating	CR	Measurement	100%	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Inspection report	2	-	1	
		6. Insulation resistance and HV	CR	Electrical	100%	Manufacturer standard	Approved drg. / data sheet / BHEL Spec.	TEST REPORT	2	1	1	
2.3	Type Test	Weather proofness	CR	Measurement	Sample/ design	Approved drg. / data sheet / BHEL Spec.	IS:2147/NEMA-4	TEST REPORT	3/2		1	

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$ 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 LEVEL SWITCHES

QUALITY PLAN NO.:	PE-QP-999-145-I033
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE:
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
									P	W	V	
2.4	Pack ing	Soundness of packing	MA	Visual	100 %	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Log Book	3/2	2		

LEGEND:
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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

FORM NO. PEM-6666-0

	DATA SHEET FOR LEVEL SWITCHES (FLOAT / DISPLACER TYPE)	SPECIFICATION NO.:	
		VOLUME	
		SECTION	
		REV. NO.	DATE:
		SHEET 1 OF 2	

TAG No. ..... Data Sheet No.: **PES-145-33-DS2-0**

Data Sheet A & B

DESCRIPTION		Data sheet-C (To be filled by the vendor after the award of contact)	
GENERAL	MANUFACTURER		
	MODEL NUMBER		
TECHNICAL	TYPE	▌ TOP MOUNTED ☐ SIDE MOUNTED (with/without external chamber) ☐ DISPLACER TYPE ▌FLOAT OPERATED ☐ EXTERNAL CHAMBER	
	MATERIAL	FLOAT ASSEMBLY SS ANSI 316	
	DISPLACER	AISI 316	
	WIRE ROPE	AISI 316	
	SLEEVE PIPE	AISI 316	
	EXTERNAL CHAMBER	☐ CS WELDED CONST. ▌ SS WELDED CONST. ☐ AS WELDED CONST.	
	SWITCH HOUSING	▌AISI 304 SS ☐ DIE CAST ALUMINIUM	
	GSKET	☐ NEOPRENE ▌TEFLON	
	ENCLOSURE	▌SWITCH HOUSING NEMA-4 ☐ FUEL GAS HAZARDOUS APPL. EXPL. PROOF ☐ OTHER	
	TYPE OF SWITCH	2 SPDT CONTACTS	
	CONTACT RATING	☐ 5A/ 240 AC ▌0.2A / 220 VDC	
	ISOLATION VALVE	▌ YES ☐ NO	
	SP. GR. OF FLUID	0.70 TO 1.2	
	DIFF. BETWEEN MAKE & BREAK OF SWITCH	☐ 12 ±2 mm (SIDE MOUNTED) ☐ 35 ±3 mm (TOP MOUNTED) ▌ ADJUSTABLE	
	MAXIMUM PRESSURE RATING	AS APPLICABLE	
	MAXIMUM TEMPERATURE RATING	AS APPLICABLE	
PERFORMANCE	REPEATABILITY	±1mm	
CONNECTION	EXT. CHAMBER CONNECTION	AS APPLICABLE	
	ELECT.	COMPLETE WITH CABLE GLAND TO SUIT CABLE OF SUITABLE SIZE	
ACCESSORIES	INSTALLATION ACCESSORIES	AS REQUIRED.	

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

FORM NO. PEM-6666-0

THIS IS A PART OF TECHNICAL SPECIFICATION NO. - PE-TS-367-156-A001

	DATA SHEET FOR LEVEL SWITCHES (FLOAT / DISPLACER TYPE)	SPECIFICATION NO.:
		VOLUME
		SECTION
		REV. NO. / DATE:
		SHEET 2 OF 2

TAG No. ..... Data Sheet No.: **PES-145-33-DS2-0**

Data Sheet A & B

DESCRIPTION		Data sheet-C (To be filled by the vendor after the award of contact)
GENERAL	MANUFACTURER	
	MODEL NUMBER	
TECHNICAL	TYPE	
	MATERIAL	
	DISPLACER	
	WIRE ROPE	
	SLEEVE PIPE	
	EXTERNAL CHAMBER	
	SWITCH HOUSING GASKET	
	ENCLOSURE	
	TYPE OF SWITCH	
	CONTACT RATING	
	ISOLATION VALVE	
	SP. GR. OF FLUID	
	DIFF. BETWEEN MAKE & BREAK OF SWITCH	
	MAXIMUM PRESSURE RATING	
	MAXIMUM TEMPERATURE RATING	
PERFORMANCE	REPEATABILITY	
CONNECTION	EXT. CHAMBER CONNECTION	
	ELECT.	
ACCESSORIES	INSTALLATION ACCESSORIES	

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

FORM NO. PEM-0666-0

	SPECIFICATION FOR LEVEL TRANSMITTER (DISPLACEMENT TYPE)	SPECIFICATION NO.: PES – 145 - 08
		VOLUME
		SECTION
		REV. NO. / DATE :
		SHEET 1 OF 4

1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site of Level Transmitter (Displacement Type) for use in Vacuum and low pressure services in Utility/Captive Power Station/Combined Cycle Station.

2.0 CODES AND STANDARDS

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

2.2 The Design and Materials used for the components shall also comply with the relevant National and International standards.

3.0 TECHNICAL REQUIREMENTS

3.1 General

The level transmitter shall be suitable for an ambient temperature 0-55°C & RH 0-95% and shall be equipped with all accessories required for specific service condition. Transmitters shall produce electric current output of 4-20mA proportional to the changes in liquid level.

3.2 Principle of operation

The operation of the Level Transmitter depends upon the movement of displacer due to level variation inside the vessel. The movement is converted into rotary movement by torque element and fed to a Rotary Variable Differential Transformer (RVDT) to obtain 4-20mA DC signal.

3.3 Output Signal

4-20mA DC two wire system.

3.4 Material

Cage (Displacer Chamber)	:	Forged carbon steel/Stainless Steel.
Displacer	:	SS 304/316 SS
Linkage & Torque Tube	:	316 SS

3.5 Rating of Body, Cage & End Connection:

Rating of Body, Cage & End Connection shall be as per Data Sheet.

3.6 Enclosure (Case & Cover)

The transmitter enclosure shall be as per IP-65 unless otherwise specified.

3.7 Zero and Span Adjustment

The transmitter zero and span shall be continuously adjustable through simple devices. The span and zero adjustments shall be independent and non interactive. Each transmitter shall be factory callibrated to the range specified in instrument data sheet.

3.8 Connection

The transmitter shall be supplied with flanged connection. Mating flanges with gasket & nut bolts shall be supplied.

3.9 Mounting

The level transmitter cage shall be mounted on the vessel through suitable flanged connection at top, bottom or side as specified in the Data Sheet.

3.10 Power Supply

The transmitter shall be suitable for 24V DC.

3.11 Signal Grounding

The design of transmitter electronic shall be such that grounding of any of the output wires will not damage the transmitter.

3.12 Cable Entry

Cable gland complete with neoprene gromet suitable for PVC cables with maximum diameter of 11.5mm shall be provided for cable entry. The actual size of the cable shall be indicated during contract stage.

3.13 Terminal Box

A Terminal Box shall be provided for the signal/supply and test terminals.

3.14 Performance Data

3.14.1	Linearity	:	± 1.0% of span or better.
3.14.2	Hysterisis	:	± 1.0% of span or better.
3.14.3	Repeatability	:	<0.5% of span or better.
3.14.4	Accuracy	:	± 1.0% of span or better.
3.14.5	Supply voltage variation effect	:	± 0.05% of span or better per volt.
3.14.6	Sp. gravity range	:	0.2 - 1.4
3.14.7	Action	:	Direct or reverse (As per Data Sheet)
3.14.8	Ambient temp. limits	:	80°C

4.0 TESTING AND INSPECTION

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

4.2 The Quality Plan shall be discussed and finalised with the technically accepted bidders before opening the price bid. The stages where the purchaser would like to be associated for witnessing or verification would be indicated by the purchaser in the Quality Plan before approval.

4.3 The following test shall be conducted as a minimum requirement.

a) Calibration test to confirm compliance with clauses 3.14.1 to 3.14.10 of this specification.

b) IP 65 Enclosure (Type Test).

c) Over range pressure test to confirm compliance with clause 3.5 of this specification.

d) Hydraulic Test for the Cage & Transmitter Body with Displacer as per ANSI B16.34.1988.

4.4 Inspection will be conducted by BHEL and/or their authorised representatives as per the agreed inspection schedule. The inspection schedule will be submitted by the bidder for BHEL's approval at contract stage. The cost of all tests and inspections will be deemed to have been included in the bid. For all the items, "Type Test Certificates" as per agreed Quality Plan shall be furnished. In the absence of the same, such Type Tests shall be arranged at the Vendor's works in the presence of BHEL and/or their authorised representatives or in independent Test House/Laboratory approved by BHEL.

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

As part of the main equipment supply, the bidder shall supply all commissioning spares and consumables required during Start-up, commissioning and Trial-runs of the plant on as required basis.

5.2 Mandatory Spares

The bidder shall offer along with main offer 5% (Maximum 2 Nos.) transmitters of all types, range and model no. (for the measurement of Pressure, Diff. Pressure, Flow level etc.) . The Mandatory Spares offered shall be of the same make and type as the main equipment.

5.3 Recommended Spares

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

6.0 DRAWINGS AND DOCUMENTS

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

6.1.1 Data sheet-B, completely filled-up along with all enclosures.

6.2 The successful bidder shall furnish the following documents in required number of copies during the contract stage :

6.2.1 For approval

i) Dimensional/Installation drawings.

ii) Data sheet-C, completely filled-up alongwith all the enclosures.

iii) Quality Plan of vendor/sub-vendor.

iv) Test Certificates.

6.2.2 Final/As-built Drawings

Final/As-built drawings/RTFs in required number of copies shall be submitted.

6.3 Operation & Maintenance Manuals

O&M Manuals in required number of copies shall be submitted. O&M Manuals shall also contain storage & commissioning instructions.

7.0 MARKING AND PACKING

7.1 Marking

A stainless steel name-plate shall be permanently fixed on each equipment giving its Tag Number and technical specifications.

7.2 Packing

All equipment/materials shall be suitably packed and protected for the entire period of despatch, storage and erection against impact, abrasion, corrosion, incidental damage due to vermin, sunlight, high temperature, rain, moisture, humidity, dust, sea-water spray (where applicable) as well as rough handling and delays in transit and storage in open.

8.0 APPLICABLE DATA SHEET FORMS

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

- Data sheet A&B for Level Transmitter : Data sheet no. PES-145-08-DS1-0
- Data sheet C for Level Transmitter : Data sheet no. PES-145-08-DS2-0

PEM :: C&I

STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER

QUALITY PLAN NO.:	PE-QP-999-145-I001
VOLUME	IIB
SECTION	D
REV. NO.	00 DATE: 12.10.99
SHEET	1 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
1.0	**RAW MATERIAL INSPECTION**											
1.1	Body/Casing, Cable Gland and Mounting Bracket	1. Chemical & Mech. Properties	MA	Analysis	1 / Lot	Tech. Specn. Data Sheet, Mfr. standard	Tech. Specn. Data Sheet, Mfr. standard	Test certificate	3	—	2	Compliance report verification by BHEL.
		2. Dimensions	MA	Measurement	10% Min. 3 Nos.	Manufacturer drg.	Manufacturer drg.	Log Book	2	—	—	
		3. Visual	MA	Visual	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Log Book	2	—	—	
		4. Degree of Protection (If applicable)	CR	IS-2147 IS-2148	1 / Type	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test certificate	3	—	2	
		5. Leak Tightness	MA	Hydro Test	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Log Book	2	—	—	
1.2	Sensor (Diaphragm, Capsule, Bellows, Strain, Gauge, Capacitance etc.)	1. Material Properties (Chemical & Mechanical)	MA	Analysis	1 / Lot	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test certificate	3/2	—	2	
		2. Dimension	MA	Measurement	1 / Lot	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test certificate	2	—	—	
		3. Performance	CR	Function	100%	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test certificate	2	—	—	
		4. Type Test	CR	Mech. & Elect.	1/Type	BHEL Spec. / Approved data sheet	BHEL Spec. / Approved data sheet	Test certificate	3/2	—	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 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-I001
VOLUME IIB
SECTION D
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; 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-I001
VOLUME	IIB
SECTION	D
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 $ P	Agency $ W	Agency $ V	Remarks
2.0	**In-Process Inspection**											
2.1	Electrical Unit											
2.1.1	Etched PCB	1. Dimension – Trade width, Gap etc.	MA	Measurement	Sample	Manufacturer standard	Manufacturer standard	Inspection report	2	—	—	Compliance verification report by BHEL
		2. Defect of undercuts	MA	Visual	Sample	Manufacturer standard	Manufacturer standard	Inspection report	2	—	—	
		3. Quality and plating of plating through holes.	CR	Visual	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	—	—	
		4. Screen printing	CR	Visual	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	—	—	
2.1.2	Component Mounting and soldering	1. Correctness of components	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	—	—	
		2. Mounting and orientation	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	—	—	
		3. Soldering defects and finish	CR	Visual	100%	Manufacturer standard	Manufacturer standard	Inspection report	2	—	—	
2.1.3	Assembled PCBs	Functional check	CR	Electrical checks before & after soaking*	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).

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-I001
VOLUME IIB
SECTION D
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	—	—	Compliance verification report by BHEL
2.2	Mounting, Fitting, Assembly of various mechanical parts	1. Correct Mounting	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	—	—	
		2. Defects	MA	Visual	100%	Manufacturer standard	Manufacturer standard	Log Book	2	—	—	
		3. Dimensions	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	—	—	

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STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER

QUALITY PLAN NO.:	PE-QP-999-145-I001
VOLUME	IIB
SECTION	D
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 $ P	Agency $ W	Agency $ V	Remarks
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-I001**
VOLUME IIB
SECTION D
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. Hysterisis	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	

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PEM :: C&I

STANDARD QUALITY PLAN FOR PRESSURE / DP/LEVEL TRANSMITTER

QUALITY PLAN NO.: PE-QP-999-145-I001
VOLUME IIB
SECTION D
REV. NO. 00 DATE: 12.10.99
SHEET 7 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
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 proofnexx (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. Packeging and Marking	MA	Visual & Measurement	100%	Manufacturer standard	Manufacturer standard	Log Book	2	—	2	

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FORM NO. PEM-6666-0

THIS IS A PART OF TECHNICAL SPECIFICATION NO. - PE-TS-367-156-A001

	DATA SHEET FOR LEVEL TRANSMITTER (DISPLACEMENT TYPE)	SPECIFICATION NO.:
		VOLUME
		SECTION
		REV. NO. / DATE:
		SHEET 1 OF 1

TAG No. ..... Qty..... Data Sheet No.: **PES-145-08-DS1-0**

Data Sheet A & B

	DATA SHEET-A (TO BE FILLED BY PURCHASER)		DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL	MANUFACTURER		
	MODEL NUMBER		
	SERVICE		
	OPERATING PRESSURE & TEMP.		
	LEVEL RANGE		
	B) MAX. OPERATING TEMPERATURE		
	RANGE		
TECHNICAL	TYPE	▌DIRECT ☐ REVERSE	
	POWER SUPPLY	24V DC	
	OUTPUT SIGNAL	4-20mA	
	NO. OF WIRE	TWO	
	ACCURACY	± 0.5 % OF SPAN	
	LINEARITY AND HYSTERISIS	± 1.0 %	
	REPEATABILITY	± 5.0 %	
	GLASS TUBE / GLASS PLATE	BOROSILLICATE TOUGHENED	
	MATERIAL:		
	A) CAGE	☐ FORGED CARBON STEEL ▌316 SS	
	B) DISPLACER	☐ 304 SS ▌316 SS	
	C) LINKAGE & TORQUE TUBE	▌SS-316	
	CONTINUOUS ADJUSTABLE SPAN AND ZERO ADJUSTMENT PROVIDED	YES	
	ZERO & SPAN ADJUSTMENT ARE INDEPENDENT & NON INTERACTIVE	YES	
	MOUNTING	☐ TOP & BOTTOM ☐ SIDE & SIDE ☐ TOP & SIDE ☐ BOTTOM & SIDE	
	END CONNECTION	CENTRE TO CENTRE DISTANCE: CONNECTION FLANCE SIZE: ANSI CLASS: MATERIAL:	
	ENCLOSURE	IP-65	
	OUTPUT INDICATOR	▌YES ☐ NO	
	BODY RATING	ANSI CLASS :	
	ACCESSORIES	MATING FLANGE WITH NUTS & BOLTS AND GASKET	
	CABLE ENTRY DETAILS	SUITABLE GLAND (DOUBLE COMPRESSION) FOR MAXIMUM CABLE DIA OF 17.5mm	

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

FORM NO. PEM-6666-0

THIS IS A PART OF TECHNICAL SPECIFICATION NO. - PE-TS-367-156-A001

	DATA SHEET FOR LEVEL TRANSMITTER (DISPLACEMENT TYPE)	SPECIFICATION NO.:	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE: 19.12.95
		SHEET 1 OF 1	

TAG No. ..... Qty.....

Data Sheet No.: **PES-145-08-DS2-0**

Data Sheet C

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

GENERAL	MANUFACTURER	
	MODEL NUMBER	
	SERVICE	
	OPERATING PRESSURE & TEMP.	
	LEVEL RANGE	
	B) MAX. OPERATING TEMPERATURE	
	RANGE	
TECHNICAL	TYPE	
	POWER SUPPLY	
	OUTPUT SIGNAL	
	NO. OF WIRE	
	ACCURACY	
	LINEARITY AND HYSTERISIS	
	REPEATABILITY	
	GLASS TUBE / GLASS PLATE	
	MATERIAL: A) CAGE B) DISPLACER C) LINKAGE & TORQUE TUBE	
	CONTINUOUS ADJUSTABLE SPAN AND ZERO ADJUSTMENT PROVIDED	
	ZERO & SPAN ADJUSTMENT ARE INDEPENDENT & NON INTERACTIVE	
	MOUNTING	
	END CONNECTION	
	ENCLOSURE	
	OUTPUT INDICATOR	
	BODY RATING	
	ACCESSORIES	
	CABLE ENTRY DETAILS	

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

	SPECIFICATION FOR LEVEL GAUGE	SPECIFICATION NO.: PES – 145 – 028A
		VOLUME
		SECTION
		REV. NO. / DATE :
		SHEET 1 OF 2

1.0 TECH NICAL REQUIREMENTS

1.1 General

The level Gauges shall be suitable for continuous operation under ambient temperature of 0-55 Deg.C and Relative Humidity of 0-95%.

1.2 Type of Level Gauge

The Level Gauge shall be Tubular or Transparent or Reflex or Magnetic type as specified in Data Sheet-A and shall be suitable for the specified service conditions.

1.2.1 **Tubular Type**

Borosillicate transparent glass tube shall be mounted between the top & bottom valve assemblies.

1.2.1.1 Gauge glass body: Body construction and assembly shall be suitable for on line replacement of the Glass tube without interrupting the equipment operation.

1.2.1.2 Protector: A tubular metallic protector with a slit in front for reading the level, shall be provided surrounding the gauge glass. The inside surface of the protector shall be painted yellow or white for clear visibility.

1.2.1.3 Ball Check: Ball check arrangement shall be provided inside the integral gauge glass valve body for automatic shut off and to prevent leakage of liquid during glass tube breakage under pressure or vacuum service.

1.2.1.4 Drain/Vent: The level gauge shall be provided with suitable venting arrangement on the upper arm and a drain valve / cock on the lower arm.

1.2.2 **Transparent Type**

Borosillicate toughened glass bars shall be mounted between the forged metal covers with top & bottom valve assemblies.

1.2.2.1 Ball Check: Ball check arrangement shall be provided inside the integral gauge glass valve body for automatic shut off and to prevent leakage of liquid during glass tube breakage under pressure or vacuum service.

1.2.2.2 Drain/Vent: The level gauge shall be provided with suitable venting arrangement on the upper arm and a drain valve on the lower arm.

1.2.2.3 Illuminator: Proper illuminating arrangement shall be provided for better visibility of the liquid level.

1.2.3 **Reflex Type**

Borosillicate toughened Reflex type glass bars shall be mounted between the forged metal covers with top & bottom valve assemblies.

1.2.3.1 Ball Check: Ball check arrangement shall be provided inside the integral gauge glass valve body for automatic shut off and to prevent leakage of liquid during glass tube breakage under pressure or vacuum service.

1.2.3.2 Drain/Vent: The level gauge shall be provided with suitable venting arrangement on the upper arm and a drain valve on the lower arm.

1.2.4 **Magnetic Type**

Magnetic type level gauge shall be suitable for either direct or indirect mounting as specified in Data Sheet-A. Direct type shall be suitable for mounting externally at the side of the vessel, while Indirect type shall be suitable for mounting at the top of the vessel. The level indication shall be by means of either rolling magnet or Iron ball follower, as specified in Data Sheet-A.

2.0 TESTING AND INSPECTION

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

2.2 The bidder shall furnish the Quality Plan in the format enclosed in volume-III. In case the Quality Plan(s) is/are included in volume-IIB, the bidder shall furnish his Quality Plan strictly in line with the same. The Quality plan shall be discussed and finalized with the technically accepted bidder before opening the price bid. The stages where the purchaser would like to be associated for witnessing or verification would be indicated by the purchaser in the Quality Plan before approval.

2.3 The following shall be conducted as a minimum requirement.

a) Hydraulic pressure test for the complete gauge glass assembly at 1.25 times the maximum operating pressure.

b) Thermal shock test for glass.

2.4 Inspection will be conducted by BHEL and/or their authorized representatives as per the agreed inspection schedule. The inspection schedule will be submitted by the bidder for BHEL's approval at contract stage. The cost of all tests and inspections will be deemed to have been included in the bid. For all the type tests covered under 2.3, "Type Test Certificates" as per agreed Quality Plan shall be furnished. In the absence of the same, such Type Tests shall be arranged at the Vendor's works in the presence of BHEL, and/or their authorized representatives or in independent Test House / Laboratory approved by BHEL.

3.0 APPLICABLE DATA SHEET FORMS

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

- Data sheet A&B for Temperature Gauge : Data sheet no. PES-145-28A-DS1-0

- Data sheet C for Temperature Gauge : Data sheet no. PES-145-28A-DS2-0

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STANDARD QUALITY PLAN FOR LEVEL GAUGES

QUALITY PLAN NO.:	PE-QP-999-145-I028
VOLUME	IIB
SECTION	D
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	MA	Physical, Chemical Test	One Sample from each lot	Approved drg. / data sheet / BHEL Spec.	Approved drg. / data sheet / BHEL Spec.	Test Certificate	3/2	—	2,1#	# Compliance certificate to be verified.
		2. Workmanship, finish and dimensions	MA	Visual, Measurement	100%	Manufacturing standards / drgs.	Manufacturing standards / drgs.	Inspection Report / Log Book	3/2	—	2,1#	
1.2	Glass Tube	Strength, Transparency, dimensions	MA	Toughness & Thermal shock, Visual, Measurement	one sample from each lot	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	MA	Visual	100%	- do -	- do -	Inspection Report	2	1	—	
		2. Workmanship	MA	Visual	100%	- do -	- do -	- do -	2	1	—	
		3. Scale graduation	MA	Visual	100%	- do -	- do -	- do -	2	1	—	
		4. Glass Opaque painting	MA	Visual	100%	- do -	- do -	- do -	2	1	—	For Reflex type
		5. Dimensions and end connections	MA	Measurement	100%	- do -	- do -	- do -	2	1	—	
3.0	**Routine Test**	1. Calibration	CR	Measurement	100%	- do -	- do -	- do -	2	1**	1	**10% quantity with minimum of 1 piece / type & size
		2. Hydro Test	CR	Measurement	100%	- do -	No Leakage	- do -	2	1**	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 LEVEL GAUGES

QUALITY PLAN NO.: **PE-QP-999-145-I028**
VOLUME IIB
SECTION D
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:
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MA - Major characteristics
MI - Minor characteristics

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V - Agency Verifying the Test.

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2 - Vendor
3 - Sub-vendor

	DATA SHEET FOR LEVEL GAUGES	SPECIFICATION NO.
		VOLUME
		SECTION
		REV NO.
		SHEEET 1 OF 1

Date Sheet No. PE-DS-342-145-I028

DATA SHEET – A

S.NO	DESCRIPTION	DATA SHEET-A (TO BE FILLED BY PURCHASER)	TO BE CONFIRMED BY BIDDER
A.	GENERAL		
1.	Manufacturer	Bidder to specify	.....
2.	Model Number	Bidder to specify	.....
3.	Tag Number		.....
4.	Service		.....
	a) Max. Operating Press.		.....
	b) Max. Operating Temp.		.....
5.	Range		.....
B.	TECHNICAL		.....
1.	Type	■ Tubular [ ] Transparent [] Reflex []	.....
		Magnetic: Rolling Magnet [] Iron Bar	.....
2.	Mounting	[■] Direct [] Indirect [] Top [] Side	.....
3.	Material		.....
	Body	[] ASTM: A105 [ ] SS 304 ■ SS 316	.....
	Ball	SS 316	.....
	Spindle/Gland	SS 316	.....
	Gasket	[■] Neoprene [] Teflon [] Other	.....
	Glass Tube/ Glass Plate	Borosilicate Toughened	.....
	Valves	SS 304	.....
	Hand Wheel	Malleable Iron	.....
	Bolt & Nuts	High Tensile Steel	.....
	Chamber	[–] SS 304 ■ SS 316 [] Other	.....
	Float	[L] SS 304 ■ SS 316 [] Other	.....
	Illuminator	[■] Yes [] No	.....
4.	a) Class of Protection	[] IP 55 ■ IP 65 [] Frame Proof (IS:2148)	.....
	b) Power Supply	[■] 240V AC 50 Hz [] 110V AC 50 Hz	.....
5.	Mica Shield	■ Yes [ ] No	.....
6.	Valve Type	[■] Inclined [] Offset	.....
7.	Drain Cock/Valves	[] Cock [■] Valve	.....
C.	Connection		.....
1.	Type, Size & Rating	ANSI class 150 RF	.....
2.	Centre to Centre distance		.....
3.	Nuts, Bolts, Gaskets for connection	[■] Yes [] No	.....
4.	Visible length	1200 mm (max)	.....

LIST OF SCHEDULES

SUGGESTIVE PRICE FORMAT FOR CW TREATMENT PLANT: 1X700 MW BELLARY-3 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-367-156-A001** for 1X700 **MW BELLARY -3 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. manufacture, inspection, testing at vendor / sub vendor works, packing, forwarding etc. but **exclusive of all tax es & du ties** for the complete scope of supply of **CW TRE ATMENT PLANT** defined in the BHEL tender specification for delivery up to site basis (freight included).	
2.2	Taxes & duties etc.	
2.3	Erection & Commissioning	
2.4	PG test and handing over the plant to customer.	
3	Recommended spares for three years of operation of cooling water treatment plant (optional item)	

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.

	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-367-156-A001 VOLUME III SECTION REV. NO. DATE: 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.				
NAME	**DESIGNATION**	**SIGNATURE**	**DATE**	**COMPANY SEAL**

	TITLE * SCHEDULE OF DECLARATIONS	SPECIFICATION NO. PE-TS-367-156-A001. VOL III SHEET..... OF.....

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

DECLARATION

I .....certify 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.

Biders 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

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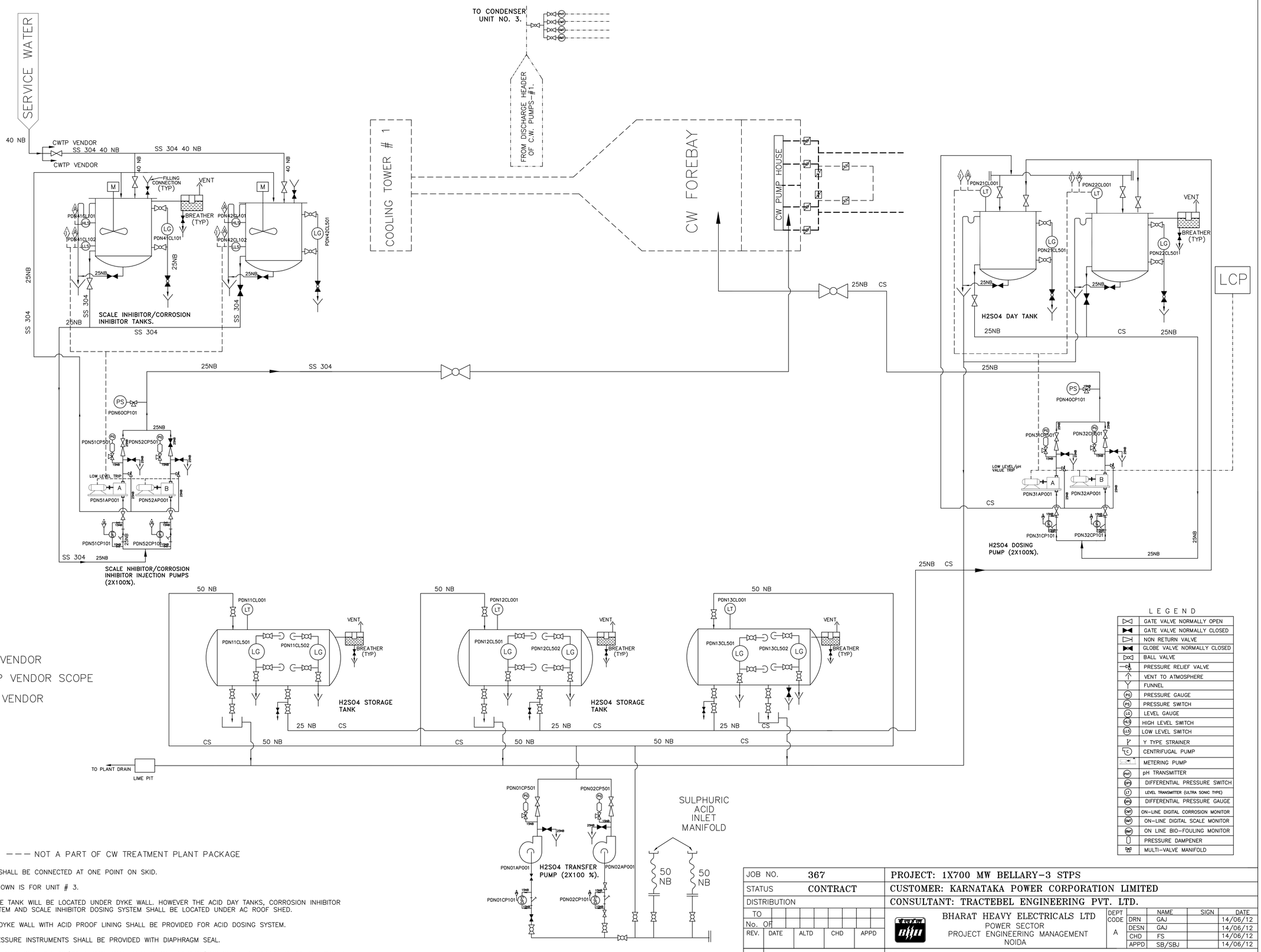
It must not be used directly or indirectly in any way detrimental to the interest of the company.

FIRST ANGLE PROJECTION

First fold



LEGEND	
	GATE VALVE NORMALLY OPEN
	GATE VALVE NORMALLY CLOSED
	NON RETURN VALVE
	GLOBE VALVE NORMALLY CLOSED
	BALL VALVE
	PRESSURE RELIEF VALVE
	VENT TO ATMOSPHERE
	FUNNEL
PG	PRESSURE GAUGE
PS	PRESSURE SWITCH
LG	LEVEL GAUGE
HLS	HIGH LEVEL SWITCH
LLS	LOW LEVEL SWITCH
	Y TYPE STRAINER
C	CENTRIFUGAL PUMP
	METERING PUMP
PHT	pH TRANSMITTER
DPS	DIFFERENTIAL PRESSURE SWITCH
LT	LEVEL TRANSMITTER (ULTRA SONIC TYPE)
DPG	DIFFERENTIAL PRESSURE GAUGE
CMT	ON-LINE DIGITAL CORROSION MONITOR
SMT	ON-LINE DIGITAL SCALE MONITOR
BMT	ON LINE BIO-FOULING MONITOR
	PRESSURE DAMPENER
DMC	MULTI-VALVE MANIFOLD

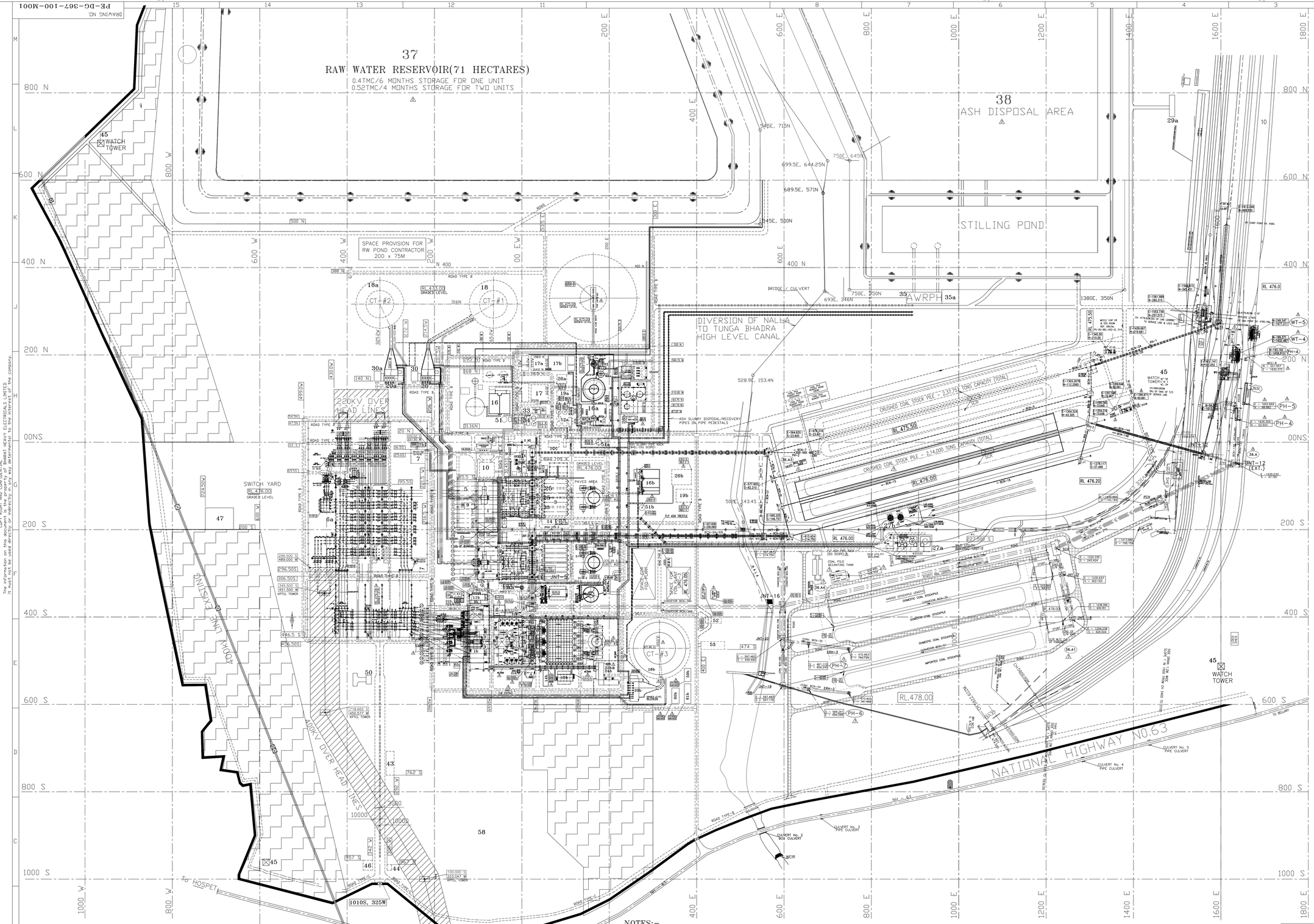
--- NOT A PART OF CW TREATMENT PLANT PACKAGE

NOTES:
1) ALL DRAINS SHALL BE CONNECTED AT ONE POINT ON SKID.
2) THE SKID SHOWN IS FOR UNIT # 3.
3) ACID STORAGE TANK WILL BE LOCATED UNDER DYKE WALL. HOWEVER THE ACID DAY TANKS, CORROSION INHIBITOR DOSING SYSTEM AND SCALE INHIBITOR DOSING SYSTEM SHALL BE LOCATED UNDER AC ROOF SHED.
4) ALL ROUND DYKE WALL WITH ACID PROOF LINING SHALL BE PROVIDED FOR ACID DOSING SYSTEM.
5) ALL THE PRESSURE INSTRUMENTS SHALL BE PROVIDED WITH DIAPHRAGM SEAL.
6) 3 WAY VALVE MANIFOLD FOR PG/PS, 5 WAY VALVE MANIFOLDS FOR DPG/DPS SHALL BE SUPPLIED BY THE BIDDER.
7) BLANK FLANGES, COUNTER FLANGES & ISOLATION VALVES SHALL BE PROVIDED BY THE BIDDER AT THE TERMINAL POINTS WHEREVER APPLICABLE
8) ALL THE EQUIPMENTS , VESSELS, TANKS, VALVES, INSTRUMENTS, PIPING ETC SHOWN IN THIS DRAWING IS VENDOR'S SCOPE UNLESS EXCLUSIVELY MENTIONED.

JOB NO.	367	PROJECT: 1X700 MW BELLARY-3 STPS			
STATUS	CONTRACT	CUSTOMER: KARNATAKA POWER CORPORATION LIMITED			
DISTRIBUTION		CONSULTANT: TRACTEBEL ENGINEERING PVT. LTD.			
TO		BHARAT HEAVY ELECTRICALS LTD	DEPT CODE		NAME / SIGN / DATE
No. OF		POWER SECTOR	A	DRN	GAJ / 14/06/12
REV. / DATE / ALTD / CHD / APPD		PROJECT ENGINEERING MANAGEMENT NOIDA		DESN	GAJ / 14/06/12
				CHD	FS / 14/06/12
				APPD	SB/SBJ / 14/06/12
		TITLE: P & I D FOR CW TREATMENT PLANT			
		DEPT. / SIGN / DATE	SCALE	DRAWING NO. PE-DG-367-156-A001	
				SHEET 1 OF 1	REV. 00

ANNEXURE -IX

DRAWING NO. PE-DG-367-100-M001



1.b. TG BUILDING
2.b. BOILER HOUSE
3.b. ELECTROSTATIC PRECIPITATOR
4.b. CHIMNEY
5.b. TRANSFORMER YARD
6.b. SWITCH YARD (including 220KV extension)
7.b. SWITCH YARD CONTROL BUILDING
8.b. DIESEL GENERATOR HOUSE
9.b. AIR WASHER UNIT(AT 8.5M FLOOR)
10. TECHNICAL OFFICE & WORKSHOP INCLUDING FIRST AID CENTER (COMMON FOR U-1,2&3)
11.b COMPRESSOR HOUSE(FOR UNIT-3)
⚠12.b CONDENSATE STORAGE TANK, CONDENSATE TRANSFER PUMP, BOILER FILL PUMPS & **CPU REGENERATION PUMPS.**
13.b. A/C PLANT ROOM FOR TG BUILDING
14.b VACUUM PUMP HOUSE & TRANSPORT AIR COMPRESSER HOUSE
15.b. ESP/VFD CONTROL ROOM
16.b. CLARIFIED WATER PUMP HOUSE/RESERVOIR
17.b. RO/DM BUILDING
18.b. COOLING TOWER No.-3
19.b. CMB (unit-3)
20.b. COOLING WATER PUMP HOUSE, ACW PUMP HOUSE,
21.b. MRH STORAGE BUNKER.
22.b. ASH HANDLING UNIT
(a) ASH WATER & ASH SLURRY PUMP HOUSE
(b) ASH WATER & ASH SLURRY SUMP
⚠(c) ~~CLARIFLOCCULATOR & CLEAR WELL FOR ASH POND RECOVERY WATER & CHEMICAL HOUSE.~~
⚠(d) ~~TRANSPORT AIR COMPRESSOR HOUSE.~~
23. FUEL OIL TANK AREA (common for U 1,2&3)
24.b (a) ASH SLURRY PUMP HOUSE/ELECTRICAL SWITCHGEAR & CONTROL ROOM
(b) ASH SLURRY SUMP
25.b. BAG FILTER/BUFFER HOPPERS/WETTING HEAD/COLLECTOR TANK-TOWER
⚠ 26b. EFFLUENT TREATMENT PLANT AREA (unit-3)
27.b. FLY ASH SILO/UTILITY BUILDING
28.b. LDO UNLOADING & LDO/HFO PRESSURISING & HEATING FACILITIES
(a) P & H UNIT
(b) MCC/CP ROOM
(c) UNLOADING AREA FOR ROAD TANKERS. (common for U 1&2)
(d) LDO UNLOADING PUMPS. (common for U 1&2)
(e) FOAM HOUSE ETC.
29A. H.F.O. UNLOADING PUMP HOUSE/ FACILITIES (common for U 1&2)
⚠ 30.b. ~~CW-CHLORINATION & ABSORPTION SYSTEM~~ (PL REFER Sl. No.59)
31.b. ACID/ALKALI STORAGE
32.b. NEUTRALIZING PIT
33.b. CPU REGENERATION BUILDING (Unit-3)
34.b. DM STORAGE TANK, DM PUMP HOUSE.
(PUMP HOUSE IS TO ACCOMODATE UNIT-3 DM & CPU/MB REGENERATION PUMPS)
35.A. ASH WATER RECOVERY PUMP HOUSE (Common for U 1&2)
36.A. COAL HANDLING PLANT
36.A1.COAL STOCK YARD WITH GARLAND DRAINS.
36.A2. COAL PILE RUNOFF PIT WITH DECANTATION TANK & PUMPS.
⚠ 36.A3. **BULDOZER SHED FOR UNIT-1**
⚠ 36.A4. **BULDOZER SHED FOR UNIT-3**
50. FIRE STATION (Common for U 1&2)
51.b. SERVICE WATER OVERHEAD TANK
52. ROAD WEIGH BRIDGE/CONTROL ROOM (Common for U 1&2)
54. LOCO SHED(Common for U 1&2)
53. WAPE HOUSE & CHEMICAL HAZARDOUS PLANT (EXISTING).
55.A RAW WATER PUMP HOUSE & PIPING
(RAW WATER PUMP HOUSE Common for U 1&2. ONLY 3 PUMPS, PIPING, MCC & TR. NEED TO BE PROVIDED)
56.b. ~~FIRE WATER BOOSTER PUMP HOUSE~~ (NOT REQUIRED)
⚠ 57.b. FIRE WATER PUMP HOUSE/TANKS – DELETED AS IT IS COVERED IN 16b
⚠ 59b. OZONISATION PLANT
⚠ 60b. CW TREATMENT PLANT
⚠ 61b. SIDE STREAM STEAM FILTRATION.

CUSTOMER SCOPE (EXISTING):

37. RAW WATER RESERVOIR
38. ASH DISPOSAL AREA
39. RAILWAY SIDING/ RAIL TRACK
40. CANTEEN
41. ~~GUEST HOUSE/ DORMETORY~~
42. ~~ADMN. BUILDING WITH CONFERENCE, BANK & POST OFFICE~~
43. PARKING AREA
44. ~~SECURITY~~
45. WATCH TOWER
46. GATE HOUSE
47. 66/11 kV SUBSTATION
48. DEVELOPMENT OF GREEN BELT
58. COLONY

REVISION_3
FINAL

NOTES:–

1. POWER HOUSE FINISHED GROUND FLOOR LEVEL IS EL.(±)0.00M WHICH CORRESPONDS TO RL.476.5M.
2. ALL ROADS ARE FLEXIBLE PAVEMENT TYPE OF CONSTRUCTION UNLESS NOTED OTHERWISE. WIDTH OF ROAD ARE AS FOLLOWS:
   a) TYPE AA —— 23m WIDE WITH TWO CARRIAGEWAYS OF 10m WIDE WITH 3m REFUGE
   b) TYPE B —— 17m WIDE WITH TWO CARRIAGEWAYS OF 7m WIDE WITH 3m REFUGE
   c) TYPE B —— 7m WIDE
   c) TYPE C —— 4m WIDE
   d) TYPE D —— 5m WIDE CONCRETE ROAD WITH RAILS
   e) TYPE E —— 5m WIDE CONCRETE ROAD
   f) TYPE F —— 7m WIDE CONCRETE ROAD
   g) TYPE G —— 7m WIDE CONCRETE ROAD WITH RAIL
3. FINISHED TOP OF ROADS SHALL BE 250mm ABOVE THE SURROUNDING GRADE LEVEL IN MAIN PLANT GRADED AREA.
4. ALL ROADS INDICATED ON THIS DWG ARE SUGGESTIVE ONLY AND ARE IN CUSTOMERS SCOPE
5. PIPE/CABLE RACKS ARE INDICATIVE ONLY & FINAL DETAIL SHALL BE AS PER SEPERATE DETAILED DWG.

LEGEND:–

- RAILWAY TRACK
- FUTURE
- BOUNDARY
- FENCING
- EFFLUENT DRAIN
- STORM WATER DRAIN
- ROAD
- GREEN BELT AREA
- ROADS IN COAL HANDLING AREAGREEN BELT AREA

REV.	DATE	ALTD	CHD	APPD
3	22.06.2012	SUNIL	AMH	AJ

DRG REVISED AS PER TCL LETTER NO. F.367/NCR/1-8/-DATED 11.05.12 DATED 07.05.12 & ALSO MEETING AT KPCL ON 17.05.12.
1. JNT 52E IS CORRECTED AS PER GG DRAWING.
2. PIPE RACK IN THE SOUTH SIDE OF BOILER AREA REVISED
3. MRH STORAGE BUNKER RELOCATED.
4. ESP CONTROL ROOM, CST, ETP & CMP RELOCATED.
5. CW TREATMENT PLANT, SIDE STREAM FILTRATION & CPU REGENERATION PLANT ADDED.
6. DRAWING REVISED ALSO AS MARKED THUS⚠

REV.	DATE	ALTD	CHD	APPD
2	07.03.2012	CS	SBU/AMH	AJ

1. DRG. REVISED AS PER CUST./CONSL. COMMENTS DATED: 30.12.2011.
2. SWITCHYARD LAYOUT & CONTROL ROOM INDICATED.
3. COAL HANDLING & ASH HANDLING SYSTEM UPDATED.
4. CW P/H AND COOLING TOWER IS UPDATED.
5. OZONISATION PLANT & ETP PLANT ADDED.
6. DRAWING REVISED AS MARKED THUS⚠

REV.	DATE	ALTD	CHD	APPD
1	01.07.2011	GS	sd/– SBU/AMH	sd/– AJ

1. DRG. REVISED AS PER CUST. COMMENTS & ALSO REVISED AS MARKED⚠
2. COOLING TOWER AREA REVISED.
3. SWITCH YARD AREA REVISED.
4. CHP AREA FOR UNIT-1&2 UPDATED AS PER LATEST DRG.
5. 31B, 32b&33b RELOCATED.

KARNATAKA POWER CORPORATION LIMITED
BELLARY TPS, UNIT-3 1x700MW

TRACTEBEL Engineering
TRACTEBEL ENGINEERING PVT. LTD
CONSULTANT

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

JOB NO. 367
STATUS CONTRACT
DISTRIBUTION

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DEPT CODE		NAME	SIGN	DATE
M	DRN	SBJ	Sd/–	02.03.2011
	DES	AMH/SBJ	Sd/–	02.03.2011
	CHD	AM HUSSAIN	Sd/–	02.03.2011
	APPD	ANIL JOSHI	Sd/–	02.03.2011

TITLE
PLOT PLAN

DEPT. | SCALE 1:3000 | DRAWING NO. PE-DG-367-100-M001
SIGN
DATE | SHEET 1 OF 1 | REV. 3

ELECTRONIC FILE NAME 367_100_M001_R2.DWG

ANNEXURE - VIII

LEGEND

- MOTOR OPERATED BUTTERFLY VALVE
- MANUAL BUTTERFLY VALVE
- NON RETURN VALVE
- GLOBE VALVE
- AIR RELEASE VALVE
- PG — PRESSURE GAUGE
- PS — PRESSURE SWITCH
- PT — PRESSURE TRANSMITTER
- DPG — DIFFERENTIAL PRESS. GAUGE
- DPS — DIFFERENTIAL PRESS. SWITCH
- DPT — DIFFERENTIAL PRESS. TRANSMITTER
- LT — LEVEL TRANSMITTER
- FI / FE — BYPASS/ ONLINE ROTAMETER
- TE — TEMPERATURE ELEMENT
- TG — TEMPERATURE GAUGE
- DCS
- ALARM
- ORIFICE PLATE
- R.E. JOINT (STD.)
- R.E. JOINT (PRESS BAL. TYPE)
- VERTICAL PUMP
- ANNUBAR
- LVM — LIMIT VALUE MONITOR (R1)
- MVAS — MEAN VALUE AUTO SELECTION (R1)
- INTERLOCK (R1)
- (R1)
- LI — FOREBAY LEVEL INDICATOR

S.NO.	EQUIPMENT	NOS. WORK. + STANDBY	CW REQD. PER COOLER CUB.M/Hr.	CW REQD. PER UNIT CUB.M/Hr	PRESS. DROP MWC	TEMP. RISE °C	REMARKS
1	CONDENSER	1 + 0	77100	77100	3.13	9.79	
2	VACUUM PUMPS OF ONE UNIT	1 + 1	100	100 200	3.5	2.0	*DURING START UP BOTH PUMPS WORK.
3	PHE'S (TG AUX) OF ONE UNIT	2 + 1	1121	2242	7.0	7.2 (R1)	
3	PHE'S (SG AUX) OF ONE UNIT	1 + 1	718	718	7.0	8.7	

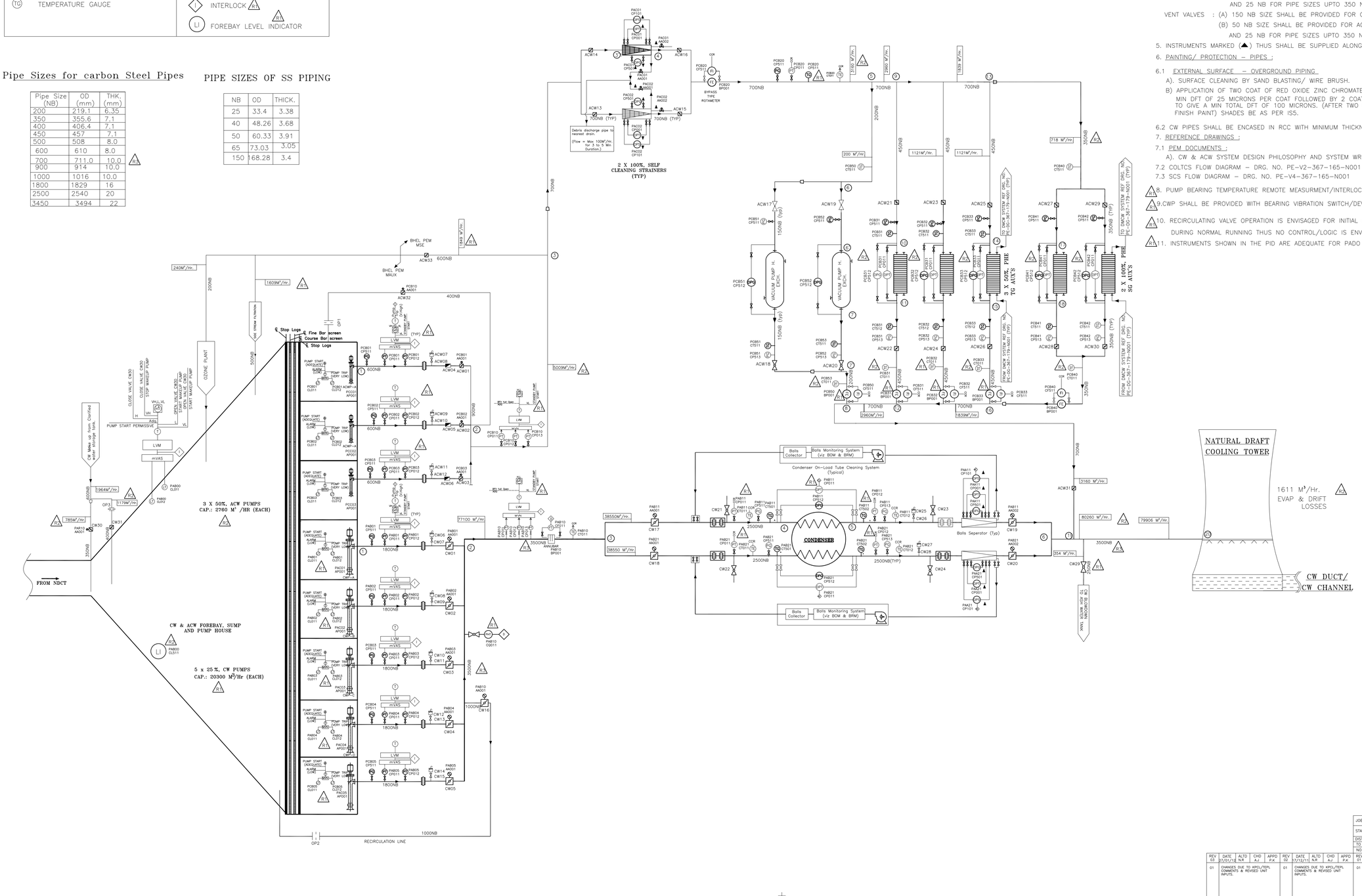
Pipe Sizes for carbon Steel Pipes

Pipe Size (NB)	OD (mm)	THK. (mm)
200	219.1	6.35
350	355.6	7.1
400	406.4	7.1
450	457	7.1
500	508	8.0
600	610	8.0
700	711.0	10.0
900	914	10.0
1000	1016	10.0
1800	1829	16
2500	2540	20
3450	3494	22

(R1)

PIPE SIZES OF SS PIPING

NB	OD	THICK.
25	33.4	3.38
40	48.26	3.68
50	60.33	3.91
65	73.03	3.05
150	168.28	3.4



NOTES:

1. DESIGN PRESSURE : 5.0 Kg/sq.cm (g) FOR C.W.SYSTEM,
   DESIGN PRESSURE : 7.5 Kg/sq.cm (g) FOR A.C.W.SYSTEM,
   DESIGN CW INLET TEMP. TO CONDENSER AND VACUUM PUMPS= 32 °C
   DESIGN ACW INLET TEMP. TO PHE'S = 36 °C
   DESIGN MECHANICAL TEMPERATURE : 50 °C
2. MATERIALS OF CONSTRUCTION (PIPEWORK):
   A) PIPING UPTO & INCLUDING 50NB SHALL BE OF SS CONFORMING TO ASTM-A-312 GR.316 SCH. 40S
   B) PIPING FROM 65 NB TO 150NB(INCLUDING) SHALL BE OF SS CONFORMING TO ASTM-A-312 GR.316 SCH. 10S
   C) PIPING 200 NB AND ABOVE SHALL BE CARBON STEEL ROLLED AND WELDED AS PER IS:3589 FROM CS PLATES AS PER IS:2062 WITH PU (POLYURETHANE) COATING INTERNALLY (POLYURETHANE) COATING INTERNALLY WITH MIN. 2MM DFT AS PER AWWA-C-222.
3. ALL PRESSURE TAPPINGS & ROOT VALVES TO BE OF 15 NB.
4. DRAIN VALVES : (A) 150 NB SIZE SHALL BE PROVIDED FOR CW SYSTEM AS PER LAYOUT REQUIREMENTS.
   (B) 50 NB SIZE SHALL BE PROVIDED FOR ACW SYSTEM FOR PIPE SIZES 400 NB & ABOVE AND 25 NB FOR PIPE SIZES UPTO 350 NB AS PER LAYOUT REQUIREMENTS.
   VENT VALVES : (A) 150 NB SIZE SHALL BE PROVIDED FOR CW SYSTEM AS PER LAYOUT REQUIREMENTS.
   (B) 50 NB SIZE SHALL BE PROVIDED FOR ACW SYSTEM FOR PIPE SIZES 400 NB & ABOVE AND 25 NB FOR PIPE SIZES UPTO 350 NB AS PER LAYOUT REQUIREMENTS.
5. INSTRUMENTS MARKED (▲) THUS SHALL BE SUPPLIED ALONGWITH THE EQUIPMENTS.
6. PAINTING/ PROTECTION – PIPES :
   6.1 EXTERNAL SURFACE – OVERGROUND PIPING
   A). SURFACE CLEANING BY SAND BLASTING/ WIRE BRUSH.
   B) APPLICATION OF TWO COAT OF RED OXIDE ZINC CHROMATE PRIMER (CONFIRMING TO IS 2074) WITH MIN DFT OF 25 MICRONS PER COAT FOLLOWED BY 2 COATS OF FINISH PAINTS USING ENAMEL PAINT TO GIVE A MIN TOTAL DFT OF 100 MICRONS. (AFTER TWO COATS OF PRIMER & TWO COATS OF FINISH PAINT) SHADES BE AS PER IS5.
   6.2 CW PIPES SHALL BE ENCASED IN RCC WITH MINIMUM THICKNESS OF 250 mm WITH REINFORCEMENT. (R1)
7. REFERENCE DRAWINGS :
   7.1 PEM DOCUMENTS :
   A). CW & ACW SYSTEM DESIGN PHILOSOPHY AND SYSTEM WRITEUP – DRG. NO. PE-DC-367-165-N002
   7.2 COLTCS FLOW DIAGRAM – DRG. NO. PE-V2-367-165-N001
   7.3 SCS FLOW DIAGRAM – DRG. NO. PE-V4-367-165-N001

(R1) 8. PUMP BEARING TEMPERATURE REMOTE MEASURMENT/INTERLOCK/PROTECTION SHALL BE PROVIDED FOR CWP AS PER DESIGN PHILOSOPHY.

(R1) 9.CWP SHALL BE PROVIDED WITH BEARING VIBRATION SWITCH/DEVICE FOR INTERLOCK/PROTECTION OF PUMP/MOTOR AS PER DESIGN PHILOSOPHY.

(R1) 10. RECIRCULATING VALVE OPERATION IS ENVISAGED FOR INITIAL COMMISSIONING & DURING MAINTAINENCE SINCE NO OPERATION IS ENVISAGED DURING NORMAL RUNNING THUS NO CONTROL/LOGIC IS ENVISAGED FOR NORMAL RUNNING.

(R1) 11. INSTRUMENTS SHOWN IN THE PID ARE ADEQUATE FOR PADO PACKAGE.

REV	DATE	ALTD	CHD	APPD
03	27/01/12	N.R	A.J	P.K
01	CHANGES DUE TO KPCL/TEPL COMMENTS & REVISED UNIT INPUTS.			

REV	DATE	ALTD	CHD	APPD
02	17/12/11	N.R	A.J	P.K
01	CHANGES DUE TO KPCL/TEPL COMMENTS & REVISED UNIT INPUTS.			

REV	DATE	ALTD	CHD	APPD
01	17/08/11	N.R	A.J	P.K
01	CHANGES DUE TO KPCL/TEPL COMMENTS			

KARNATAKA POWER CORPORATION LIMITED
BELLARY TPS UNIT # 3, 1X 700MW

TRACTEBEL ENGINEERING
TRACTEBEL ENGINEERING Pvt. Ltd.
Consultant

BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

JOB NO.	367
STATUS :	CONTRACT
DISTRIBUTION	
TO	
NO.	

DEPT	NAME	SIGN	DATE
COORD	PRPD N.R		sd/- 14.01.11
	CHD A.J		sd/- 14.01.11
	APPD P.K		sd/- 14.01.11

TITLE: P&ID OF CW & ACW SYSTEM

DEPT. | SCALE | DRAWING NO. PE-DC-367-165-N001
SIGN
DATE | SHEET 01 OF 01 | REV. 03