

KARNATAKA POWER CORPORATION LIMITED

1X370 MW KPCL YELAHANKA CCPP

VOLUME: II B & III

**TECHNICAL SPECIFICATION
FOR
CW TREATMENT PLANT**

SPECIFICATION NO.: PE-TS-409-156-A008



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



TITLE:
KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
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SECTION – A INTENT OF SPECIFICATION



TITLE:

KARNATAKA POWER CORPORATION LIMITED
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1.0 INTENT OF SPECIFICATION

- 1.1** The specification is intended to cover design, engineering, manufacture, fabrication, assembly, inspection and testing at vendor's & sub-vendor's works, painting, forwarding, supply & delivery at site including mandatory spares, startup, erection and commissioning spares as required, chemicals, properly packed for transportation, loading/unloading/handling & storage at site, in site transportation, assembly, Erection & Commissioning, trial run, Supervision of CW Treatment system preparation & submission of drawing/documents including "As Built" drawings, site testing, carrying out performance guarantee tests at site and handover in flawless operating condition to end customer of the entire **CW Treatment Plant** as per the details in different sections / volumes of this specification **for 1x370 MW KPCL Yelahanka CCPP**.
- 1.2** Complete Supply and dosing of following chemicals for a period of 6 months (this 6 months period includes one initial start up/commissioning and PG test also).
- Scale/ Corrosion Inhibitor
 - Biocide
- 1.3** Deputation of his experts (as required by employer) for continuously supervising the CW System for 6 months.
- 1.4** The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the contractor of the responsibility of providing such facilities to complete the supply, erection and commissioning, performance and guarantee of **CW Treatment Plant**.
- 1.5** It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to highest standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgement is not in full accordance herewith.
- 1.6** The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing. Similarly, the extent of supply also includes all terms required for completion of the system and not withstanding that they may have been omitted in drawings / specifications or schedules.
- 1.7** The general term and conditions, instructions to tenderers and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification is subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- 1.8** While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification **within 10 days of receipt of tender documents**. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser / Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.
- 1.9** The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.
- 1.10** Deviations, if any, should be very clearly brought out clause by clause along with cost of withdrawal in the enclosed schedule (in Vol – III); otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/its customer.



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- 1.11** In the event of any conflict between the requirements of two clauses of this specification documents or requirements of different codes and standards specified, Section - C shall prevail over section – D, however more stringent requirement as per the interpretation of the owner shall apply.
- 1.12** In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 1.13** For definition of word like Contractor, bidder, supplier, vendor, Customer/ Purchaser / Employer, consultant, please referred relevant clause(s) of GCC.



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SECTION – B PROJECT INFORMATION

KPCL/Yelahanka 	KARNATAKA POWER CORPORATION LIMITED 370 MW Yelahanka CCPP TITLE PROJECT INFORMATION	SECTION: B VOLUME-II SHEET 1 OF 1
1.0 Owner 2.0 Project Title 3.0 Location 4.0 Latitude and Longitude 5.0 Elevation above mean sea level 6.0 <u>Climatic Conditions</u> (a) <u>Temperature</u> i. <u>Monthly basis</u> Mean of daily maximum temperature Mean of daily minimum temperature ii Highest temperature recorded iii Lowest temperature recorded (b) Relative Humidity (c) <u>Rainfall</u> Annual average rain (d) <u>Wind Speed</u> i. Annual mean wind speed ii. Maximum mean wind speed iii Design Wind Speed 7.0 Seismic data Zone	: Karnataka Power Corporation Ltd Shakthi Bhavan No.82, Race Course Road Bangalore-560 001 Karnataka, India 370 MW Yelahanka CCPP : Yelahanka Bangalore Dist Karnataka state INDIA : 13° 07' N Latitude 77° 35' E Longitude : 900 meters : 37° C : 11.5° C : 39°C : 7.8°C : Varies between 60% and 90% : 970 mm : 2.82 m/s : 3.71 m/s in the month of June. : 33M/sec (As per IS: 875) : Seismic Zone II As per IS 1893	

STATION : BANGALORE CITY

2003														2004					
Month	Temperature in deg.Celsius				Mean RH %		Temperature in deg.Celsius						Mean RH %						
	Mean Max	Highest Max.	Mean Min.	Lowest Min.	0830 hrs.	1730 hrs.	Mean Max	Highest Max.	Mean Min.	Lowest Min.	0830 hrs.	1730 hrs.							
Jan	28.6	31.6	16.0	13.9	80	43	28.8	31.1	16.2	13.7	81	42							
Feb	31.7	33.2	18.9	16.9	75	35	31.1	34.1	16.9	15.1	64	31							
Mar	33.6	35.4	20.4	17.2	67	33	34.3	36.2	20.0	15.7	58	22							
Apr	34.2	36.0	22.3	19.9	74	41	34.2	37.0	22.4	18.7	72	39							
May	35.2	37.6	22.8	21.0	71	34	29.9	34.6	20.8	18.7	84	71							
Jun	31.6	38.1	21.1	19.5	84	62	29.0	31.2	20.0	19.2	86	65							
Jul	29.3	31.3	20.5	19.5	87	68	28.3	31.8	19.8	17.7	89	71							
Aug	28.6	31.6	20.3	19.0	88	68	28.1	30.7	19.7	18.9	86	69							
Sep	29.1	31.8	19.8	18.7	81	58	28.0	31.1	19.9	18.6	88	72							
Oct	28.7	30.6	19.9	17.3	85	72	28.0	31.4	19.4	17.7	86	71							
Nov	27.8	29.4	18.0	15.0	80	60	26.8	29.0	17.6	14.8	79	62							
Dec	27.8	31.1	16.0	13.0	76	48	28.1	29.9	15.4	13.0	76	46							

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13

DIRECTOR
Meteorological Centre
Central Observatory Complex
Palace Road,
BANGALORE 560 001

STATION : BANGALORE CITY

Month	2005							2006				
	Temperature in deg.Celsius				Mean RH %			Temperature in deg.Celsius				
	Mean Max	Highest Max.	Mean Min.	Lowest Min.	0830 hrs.	1730 hrs.		Mean Max	Highest Max.	Mean Min.	Lowest Min.	Mean RH %
Jan	29.3	31.8	16.8	13.9	79	42		28.5	32.5	16.0	13.4	72
Feb	31.6	35.9	17.9	14.3	64	29		30.6	34.1	15.5	12.3	25
Mar	33.6	36.4	20.5	17.2	68	27		32.0	34.4	19.9	17.9	37
Apr	32.7	35.4	21.7	19.9	72	47		33.8	36.3	22.3	19.6	37
May	33.9	37.4	21.7	18.5	78	47		32.4	37.0	21.4	19.4	55
Jun	30.3	33.8	20.8	19.3	84	60		29.6	32.2	20.4	19.0	66
Jul	28.5	30.4	20.2	18.3	89	70		28.5	30.9	20.1	18.5	63
Aug	28.1	30.5	19.9	18.6	87	68		29.0	31.6	20.1	19.3	62
Sep	28.2	31.5	19.9	18.8	87	66		29.9	32.4	20.5	19.5	61
Oct	27.4	30.5	19.7	16.6	91	78		29.5	31.4	20.0	18.8	63
Nov	26.2	29.9	17.3	13.5	82	67		27.7	30.6	19.0	16.6	68
Dec	26.8	29.4	16.6	13.6	80	61		27.1	28.2	15.8	14.2	56

19.21 37.4 19.42 18.5

29.88 37

19.25 12.3

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DIRECTOR
Meteorological Centre
Central Observatory Compound
Palace Road,
BANGALORE

STATION : BANGALORE CITY

STATION : BANGALORE CITY

2007											2008				
Month	Temperature in deg.Celsius					Mean RH %		Temperature in deg.Celsius					Mean RH %		
	Mean Max	Highest Max	Mean Min	Lowest Min	0830 hrs.	1730 hrs.	Mean Max	Highest Max	Mean Min	Lowest Min	0830 hrs.	1730 hrs.			
Jan	28.9	32.1	15.8	14.2	79	40	29.2	31.2	16.1	13.6	77	38			
Feb	30.9	33.8	17.3	13.7	73	38	29.9	33.1	18.6	16.0	75	41			
Mar	33.9	35.9	20.8	18.6	65	25	30.3	32.6	19.1	14.4	69	44			
Apr	34.1	36.4	21.7	18.2	71	34	33.0	36.9	21.5	18.9	71	37			
May	33.4	35.8	22.0	20.0	76	52	34.1	36.0	21.6	20.3	76	46			
Jun	29.9	34.4	20.9	19.7	81	61	29.5	32.0	20.4	18.7	83	59			
Jul	28.8	30.2	20.4	18.8	86	68	28.7	32.4	20.1	18.6	87	67			
Aug	27.9	31.7	20.1	19.1	88	71	27.7	29.9	20.2	19.2	89	72			
Sep	28.0	31.3	20.0	18.8	88	69	28.5	31.6	19.8	18.4	85	60			
Oct	28.5	32.3	19.7	16.7	82	64	28.1	31.4	19.4	14.7	85	70			
Nov	27.9	30.1	17.4	12.7	71	56	27.6	30.0	17.9	15.0	78	58			
Dec	26.3	29.6	16.5	11.8	81	57	27.3	28.7	16.4	13.9	80	49			

29.87

36.4 19.38

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29.67 36.7

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DIRECTOR
Meteorological Centre
Central Observatory Complex
Palace Road,
BANGALORE 560 001

STATION : BANGALORE CITY

Month	2009							2010						
	Temperature in deg.Celsius							Temperature in deg.Celsius						
	Mean Max	Highest Max	Mean Min	Lowest Min	0830 hrs.	1730 hrs.	Mean RH %	Mean Max	Highest Max	Mean Min	Lowest Min	0830 hrs.	1730 hrs.	Mean RH %
Jan	28.1	31.9	15.3	12.1	78	38		28.1	29.5	17.1	14.1	82	41	
Feb	31.8	35.2	17.7	15.3	63	26		31.8	34.4	18.2	14.3	72	29	
Mar	33.1	35.5	20.4	17.3	66	28		34.5	35.7	21.3	18.5	68	27	
Apr	34.5	37.0	22.2	20.0	70	30		34.5	37.6	22.7	20.3	71	43	
May	32.8	36.9	21.6	19.2	79	53		33.0	36.2	22.3	19.3	78	52	
Jun	29.7	31.8	20.4	18.4	84	61		29.9	34.0	21.2	19.5	86	66	
Jul	27.9	30.0	20.1	19.4	86	66		27.5	30.2	20.3	19.1	89	72	
Aug	28.6	31.1	20.3	19.3	87	65		27.4	29.8	20.5	18.8	88	69	
Sep	28.1	31.3	20.2	18.2	88	73		27.8	31.8	20.2	18.7	89	67	
Oct	28.8	31.0	19.4	17.9	77	53		28.5	30.4	20.4	18.4	87	69	
Nov	27.4	29.9	19.3	15.5	84	67		25.4	29.2	19.3	17.5	88	74	
Dec	27.0	29.3	17.7	15.0	84	62		26.4	29.9	16.9	12.9	85	56	

79.82 35 19.55 12.1

29.65 34.8 20.03 12.9

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DIRECTOR
 Meteorological Centre
 Central Observing Circle
 Bangalore
 BANGALORE

STATION : BANGALORE CITY

Month	2011							2012						
	Temperature in deg.Celsius							Temperature in deg.Celsius						
	Mean Max	Highest Max	Mean Min	Lowest Min	0830hrs.	1730hrs.	Mean RH %	Mean Max	Highest Max	Mean Min	Lowest Min	0830hrs.	1730hrs.	Mean RH %
Jan	28.9	31.3	15.7	12.6	71	34		28.9	30.6	16.2	12.0	78	38	
Feb	30.1	32.2	16.9	14.0	64	29		31.4	35.4	17.2	14.0	69	25	
Mar	33.1	34.8	19.4	15.2	61	22		34.4	35.6	20.6	17.7	66	23	
Apr	33.1	34.6	21.6	19.1	78	44		34.9	37.5	22.6	20.7	72	34	
May	32.4	34.8	21.3	19.3	80	55		33.0	35.2	22.1	19.5	79	47	
Jun	29.0	30.9	20.4	19.2	88	69		30.9	34.1	21.0	20.0	77	51	
Jul	28.1	30.4	20.1	18.9	88	68		28.8	32.2	20.4	19.2	84	59	
Aug	27.5	30.2	20.1	19.2	89	73		28.5	32.4	20.2	19.5	86	66	
Sep	28.3	30.8	20.1	18.2	86	62		29.2	32.5	20.3	19.2	82	56	
Oct	29.3	31.0	20.3	18.2	87	71		28.5	32.3	19.6	18.0	81	61	
Nov	27.3	29.5	17.9	15.0	78	61		28.1	30.8	17.6	13.3	75	52	
Dec	27.4	29.8	16.3	12.8	77	47		28.0	30.7	16.9	14.4	81	48	

29.60 34.8 17.5 12.6

30.36 34.5 19.56 12.0

DIRECTOR
Meteorological Centre
Bangalore



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1x370 MW KPCL YELAHANKA CCPP
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SECTION – C SPECIFIC TECHNICAL REQUIREMENT



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SECTION – C1 SPECIFIC TECHNICAL REQUIREMENT-MECHANICAL

- SECTION-C1-A- SCOPE OF SUPPLY & SERVICES, EXCLUSION AND TERMINAL POINTS ETC.
- SECTION-C1-B- VOID
- SECTION-C1-C- FUNCTIONAL / PERFROMANCE / DEMOSTARTION GUARANTEE
- SECTION-C1-D- QUALITY ASSURANCE
- SECTION-C1-E- PAINTING SPECIFICATION
- SECTION-C1-F- DATASHEET-A



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**SECTION – C1-A
SCOPE OF SUPPLY & SERVICES, EXCLUSION AND TERMINAL POINTS ETC.**



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1.0 GENERAL

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

2.0 SCOPE OF SUPPLY

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

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

- Entire CW Chemical Treatment Plant as per P&ID (PE-DG-409-156-A001) and Data Sheet-A.
- Complete Supply of following chemicals for a period of 6 months (this 6 months period includes one initial start up/commissioning and PG test also) for normal run.
 - Scale/Corrosion Inhibitor.
 - Biocide
- All tanks complete with inlet and outlet connections, all fittings and appurtenances etc. as specified and as required.
- All necessary valves and fittings.
- All necessary pumps, motors, actuators, etc as required.
- Following minimum number of instruments:
 - pH transmitter one number (as per P & ID : PE-DG-409-156-A001).
 - On line digital corrosion monitor one number (as per P & ID : PE-DG-409-156-A001).
 - On line digital scale monitor one number (as per P & ID : PE-DG-409-156-A001).
 - On line bio fouling monitor one number (as per P & ID : PE-DG-409-156-A001).
- Relay Based Local Control Panel (shall be located under industrial shed of cooling water treatment plant).
- Electrical scope shall be as per "Electrical scope between BHEL and Vendor".
- All necessary drains, vents, and sampling points, with valves, as specified and as required.
- Hangers and supports for piping etc. as per the requirement.
- Instrumentation (minimum) as per the enclosed P&ID (PE-DG-409-156-A001).
- Safety requirement as per Data Sheet-A.
- Start-up and commissioning spares as required.
- Mandatory spares.(As per Annexure-II)
- All special tools necessary for proper maintenance or adjustment of the equipment packed in permanent box.
- Finish paints for touch up painting of equipments after erection at site in sealed container.
- Initial charge of all lubricants and grease till Performance guarantee test & plant handover.
- Any other chemicals required to meet the guarantee parameter.
- Monitoring gadgets, instruments, and equipments required for maintenance (till PG test and plant handover).
- Monitoring gadgets, instruments and equipment required to show demonstration parameters.
- Test racks (corrosion, scaling/deposit and bio-fouling) with coupons/test kits with mounting accessories.
- All flanges/counter flanges to interconnect the pipes.
- Pipe supporting material.
- Ladder & platform to charge the chemicals.
- Wrapping and coating for underground 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 effect 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 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 6 months at site.



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- 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 maintenance 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 & Colour Scheme (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 FUNCTIONAL / PERFORMANCE / DEMONSTRATION GUARANTEE

Refer Section-C1-C

5.0 TERMINAL POINT

- a. Inlet water line (service water/potable water/Sample water from CW Pump): Consider 10 meters piping from CW Chemical Treatment Plant area.
- b. Outlet chemical line from CW Chemical Treatment Plant: upto the dosing point at CW Forebay (consider 80 meter piping distance each for both chemical dosing).
- c. The sampling line from monitoring instruments to CW forebay.
- d. All drains: Common drain shall be connected to a pit.

6.0 EXCLUSIONS

- a. Service air, Instrument air, upto the terminal point.
- b. Ventilation and fire fighting facilities.
- c. Drinking water and service water.
- d. All Civil works at site including acid/alkali resistant lines/tiles and excavation and back filling for buried pipes. However, fixing of equipment, grouting shall be done by bidder.
- e. 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).

7.0 QP AND SUBVENDOR APPROVAL

- a. The quality assurance plan is enclosed as "Quality Assurance (Section-C1-D). However requirement of detailed QP, inspection checklist, certificate of conformance etc. for each equipment and sub-vendor shall be finalized during detailed engineering stage; decision of BHEL/Customer (KPCL) shall be binding on vendor in this regard. Any changes/additional tests insisted upon by Owner during approval of QAP's shall be accepted by bidder without any commercial and delivery implication to BHEL/Customer (KPCL). Bidder shall submit the quality plans in BHEL format during detailed engineering stage. Bidder to note further that during detailed engineering all the QAP's/check lists etc. shall be submitted to Customer (KPCL) /BHEL for approval. All inspection & testing etc. shall be carried out accordingly.
- b. The sub vendor list enclosed as " List of makes of sub vendor items (ANNEXURE-I)" is indicative only and is subject to approval / acceptance by Customer (KPCL). Bidder to propose his sub vendor list with back up documents (experience list, end user certificate as applicable) etc. The same shall be subject to BHEL and Customer (KPCL) approval during detailed engineering stage without any technical, commercial & delivery implication to BHEL.

8.0 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.



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9.0 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.

10.0 DESIGN/CONSTRUCTION

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

The P&ID is enclosed herein in this section for bidder's 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.

11.0 PLANT OPERATION AND CONTROL

The operation of the Circulating Water Treatment Plant will be manual from Relay Based Local Control Panel (LCP). This is a standalone relay based system. All the analog signals are terminated at LCP and conversion of binary signals shall be at LCP only. Necessary monitoring signal interface b/w LCP and DCS shall be provided.

The Control Panel for Circulating Water Treatment Plant will be provided for Scale/Corrosion Inhibitor Dosing System, & Biocide dosing System. The local control panel houses the following.

Status of all the equipment of chemical dosing system. The status includes ON, OFF, TRIP indication of respective motor / pump.

- i) Hardwired annunciation for pump trip, Agitator trip level low etc. with adequate number of windows.
- ii) Push button for start / stop of pumps, Agitator etc.
- iii) Pump stroke indicator with local/remote stroke adjustment facility.
- iv) Local push button stations for all motor drives.
- v) LED (Seven Segment type) indicators for Analog signals.

The operation of Scale/Corrosion Inhibitor Dosing Pumps shall be local manual from LCP.

The operation of Biocide Dosing Pumps shall be local manual from LCP.

12.0 TECHNICAL DETAIL OF CW CYCLE.

SL NO	PARTICULARS	UNIT/DETAILS
A	CYCLE OF CONCENTRATION (COC)	3
B	Recirculation Volume of Cooling Tower	19794 Cum/hr (approx.).
C	Storage/Holdup volume of cooling tower basin	6600 CuM. (APPROX)
D	Temperature difference across cooling tower	10 Deg C
E	Blow down	165 CuM/Hr
F	Make up water	510 CuM/Hr
G	MOC of Condenser tube	SS SA249 TP316
H	Cooling Water System metallurgy	Shall be as per P&ID CW/ACW System (enclosed in Technical Specification).



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13.0 ADDITIONAL REQUIRMENT

- 1) Necessary piping, fitting, valves, drains, vents, sampling etc. required for the complete CW Treatment Plant. Pipe racks shall be provided by BHEL wherever available, wherever pipe racks are not available, pipe shall be laid on pedestal to be provided by BHEL. However all auxiliary steel structure (U-clamps, nuts, bolts, channels etc) for fixing pipes on pedestal or racks shall be in bidder's scope.
- 2) All insert plates, rung ladder, nuts and bolts, and flanges and matching counter flanges wherever applicable.
- 3) Embedment plates with lugs shall also be provided by bidder as per system requirement.
- 4) All channels & brackets, mounting plates as required for mounting of motors, pumps, stirrers, tank etc shall be in bidder's scope.
- 5) Permanent ladder (not rungs) for approaching the top of tanks, valves for All steel inserts with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc as required to grout in civil works and to support/hold the equipments being supplied under this specification for opening/maintenance purpose.
- 6) Any item/work either supply of equipment or erection material which have not been specifically mentioned in 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 and shall be in bidder's scope without any commercial, technical and delivery implication to BHEL.
- 7) Bidder shall perform the guarantee parameters as per 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.
- 8) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.

In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.

- 9) Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details w.r.t. existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.
- 10) Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule. Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear /MCC on account of changed loads.
- 11) Wherever CIVIL works is excluded from the bidder's scope, successful bidder shall furnish civil assignment / scope drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by vendor, BHEL reserves the right to debit cost of such rework to vendor".
- 12) System to be designed to meet all the statutory requirements. Preparation of all necessary drawings/data/ documents for obtaining necessary Approval of statutory authorities like CCOE , IBR , Weight & Measures Department and any other agency/ competent authority ,on behalf of the customer, related to installation of CW Treatment Plant (if required) is included in bidder's scope. All expenses required to obtain the approval shall also be borne by the successful bidder. Successful bidder shall inform customer well in advance requirement of authority letter along with format for the same. After issuance of authority letter by customer, it will be vendor's responsibility to regularly follow up with the concerned authorities to obtain timely approval from these authorities.



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Any delay on account of the same, unless any specific information related to above approval to be furnished by customer is delayed by customer, shall be to vendor's account and shall not be used as a reason for extension in contract completion.

- 13) Vendor to attend regular engineering meeting with BHEL and customer fortnightly in BHEL or customer office as decided during detail engineering. Vendor will depute all his concerned engineering representative along with the project manager for discussion and approval. Meeting can be held at site also.

Bidder to submit BBU during detailed engineering after approval of Basic documents. BBU shall be equal to BOQ for the package and there shall be no price and delivery implication is applicable to BHEL / CUSTOMER for the same. None of the items supplied for the project as non-billable. Incomplete BBU shall not be review by BHEL. The Break-up (%) of Supply prices of CW Treatment Plant package in the BBU shall be in line with the detail provided as "Percentage Break Up Of Supply Prices (Annexure-IX) ".

- 14) Relevant requirements as per GTR, GCC, ECC & SCC.
- 15) Any statutory requirement / clearance required for the packages from government / local body shall be in bidder's scope. Any change arising out of any new government norms, statutory requirements during the course of execution of the project shall also be complied by the bidder without any commercial implication.
- 16) In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- 17) Slings & Lifting lugs shall be provided in all equipment.
- 18) Latest version of all codes and standards to be followed.

14.0 DRAWING/DOCUMENTS REQUIREMENT (FOR MECHANICAL/ELECTRICAL/C&I/ETC)

For the Drawings/Documents requirement, please refer "**Master Drawing List with Schedule of Submission (Annexure-VI)**".

For the Drawings/Documents Distribution & Submission ,Please refer **Annexure-V**. The bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and Customer (KPCL) comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. Bidder to comply with the observations of the BHEL and CUSTOMER (KPCL) without price & delivery implication.

After award of LOI, following 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 implication.

- 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.



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- 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. Spec. for acid/alkali resistant lining and areas requiring such lining.

15.0 Reference Documents

- Circulating Water Analysis (Tertiary treated water analysis [CW make up water] [Annexure-IV].
- Data sheet- A [Section-C1-F].
- P&ID for CW Treatment Plant- PE-DG-409-156-A001.[Volume-III].
- P&ID- CW & ACW System- PE-DG-409-165-N001. .[Volume-III].
- PLOT PLAN – PE-DG-409-100-MG01. .[Volume-III].

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

Note-2: All major 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 above Note-1 & 2 shall be applicable for Electrical, C&I and Civil also.

Note-4: Ozone is being dosed @ 3 ppm continuous basis in CW make up line by BHEL (Ozone generation plant supplier).



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FUNCTIONAL / PERFORMANCE / DEMONSTRATION GUARANTEE



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SL NO	PARAMETERS
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/dm ² /day.
c)	Micro/Bio fouling conditions
i)	Total Viable Count (TVC) < 1x10 ⁵ Counts/ml
ii)	Sulphate reducing bacteria (SRB) < 1x10 ⁵ Counts/100 ml



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SECTION – C1-D QUALITY ASSURANCE



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QAP OF DOSING PUMP

LEGEND DETAILS: P - Perform, W -Witness, V - Verify, 1 - KPCL, 2 - BHEL, 3 - VENDOR/SUB-VENDOR ; IR - Inspection Report, TC - Test Certificate.												
SR NO	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE / METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSP. AGEN			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	<u>Raw Material</u>											
1.1	Plunger & head.	**Chemical & Mech. Properties	Major	Chem. Check Mech. Properties	1 / Bar or 1/ heat	Appd. Data Sheet	Appd. Data Sheet	Foundry/ Lab. TC.	3	-	2/1	** Not applicable for PP / PVC construction.
		DP Checked on Machined	Major	ASME sec VII	100%	Appd. Data Sheet	Appd. Data Sheet	Mfr's IR	3	3	2/1	
2.0	<u>Final Inspection.</u>											
2.1	Complete Pump	Dimensions, Visual & completeness	Major	Meas.	100%	Appd. Drg	Appd. Drg	Mfr's IR	3	2	1	
2.2	Complete Pump	Performance test	Critical	Meas. a. Rated Capacity b. Steady state accuracy c. Repeatability d. Volumetric Efficiency. e.flow at 100% stroke length f.vibration Noise level	100%	Appd. Data Sheet	Appd. Data Sheet / 1hrs	Mfr's IR	3	1/2	1/2	The duration of Performance test shall be minimum 1 hour
2.3	Complete Pump	Safety Valve setting	Major	Visual	100%	Appd. Drg	Appd. Drg	Mfr's IR	3	2	1	
2.4	Complete Pump	Leakage test (By throttling discharge valve)	Critical	Hydro test	100%	Appd. Data Sheet / Drg.	No leakage 2 time of rated head 1.5 time	Mfr's IR	3	2	1	Hydro test on casing shall be carried out at 2 times of rated head or 1.5 times of shut off head which ever is higher & test pressure shall be maintained for 30 min. & No leakage shall be permitted
3.0	Painting of metallic portions	Surface finish & shade.	Major	Visual.	100%	Appd. Data Sheet / Drg.	Appd. Data Sheet / Drg.	IR	3	3	2/1	
BHEL			PARTICULARS									
			NAME									
			SIGNATURE									
			DATE									



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QAP OF VALVES (GATE/GLOBE/NRV/SAFTY RELIEF VALVE)

LEGEND DETAILS: P - Perform, W -Witness, V - Verify, 1 - KPCL, 2 - BHEL, 3 - VENDOR/SUB-VENDOR.; IR - Inspection Report, TC - Test Certificate.

SR NO	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE / METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSP. AGEN			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	<u>Raw Material</u>											
1.1	Body / Bonnet	Mech. & Chemical	Major	Document Review	1 / Heat	Apprd. Drg / data sheet	Apprd. Drg / data sheet	Foundry / Lab. TC.	3	-	2/1	
1.2	Stem	Material compliance	Major	Document Review	1 / Heat	Apprd. Drg / data sheet	Apprd. Drg / data sheet	* Compliance certificate	3	-	2/1	* For the smaller diameter stems only the compliance certificate is provided. For size 12 MM dia. & above the certificate for mechanical & chemical properties are submitted.
2.0	<u>Final Inspection</u> Complete Valve	1. Dimensions	Major	Meas.	Random	Apprd. Drg	Apprd. Drg	IR	3	3	2/1	
		2. Operational check	Major	Meas.	100%	Apprd. Drg / data sheet	Smooth Operation.	IR				
		3. Leak tightness of seat & Body.	Critical	Hydro test	100%	Apprd. Drg	No leakage	IR	3	2/1	2/1	
3.0	Painting	Surface finish & shade.	Major	Visual.	100%	Manufacturer's Standard	Manufacturer's Standard	Mfr's TC	3	3	2/1	
BHEL			PARTICULARS									
			NAME									
			SIGNATURE									
			DATE									



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QAP OF ATMOSPHERIC TANK

LEGEND DETAILS: P - Perform, W -Witness, V -Verify, 1 -KPCL, 2 - BHEL, 3 - VENDOR/SUB-VENDOR IR - Inspection Report, TC - Test Certificate.

SR NO	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE / METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSP. AGEN			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	Raw Material											
1.1	Plates for Shell, Dished Ends, Nozzle Flanges & Nozzle Pipes. (Plate of dish where ever applicable)	1. Physical & Chemical Properties 2. Dimensions	Major Major	Document Review Meas.	1/Heat At Random	Appd. Drg. Appd. Drg.	Appd. Drg. Appd. Drg.	Mill TC / Lab.TC Log book	3 3	3 3	1 2/1	
2.0	In Process											
2.1	Welding Procedure	Welder's Ability to perform	Major	Document Review.	100%	ASME Sect.IX	ASME Sect.IX	QW 482, 483 & 484	3	3	2/1	1 - Previous records of welder's qualification will be reviewed. In the absence of record, welder qualification shall be done by Thermax Ltd.
2.2	Checks On Dished End (Wherever applicable)	Dimensions & Profile	Major	Meas.	100%	Appd. Drg.	Appd. Drg.	IR	3	3	2/1	
2.3	DP test on Edges, SF & Knuckle.	Surface defects on Edges, SF & Knuckle.	Major	Visual & DP Test	100%	ASME Sec VIII Div 1	ASME Sec VIII Div 1	IR	3	3	2/1	
2.4	RT of Butt welds	RT of Butt Weld joints	Major	Visual Film review	100%	ASME Sec VIII Div 1 /sect-v	ASME Sec VIII Div 1 /sect-v	RT Films / reports	3	3	2/1	
2.5	All "L" Seam & "C" Seam Set Up for Dish to Shell & Sell to Shell.	Edge Preparation, " V" Angle, Root gap, Matching, etc.,	Major	Meas.	100%	Appd. Drg.	Appd. Drg.	IR	3	3	2/1	
2.6	Back chip & DP test of Joints	Detection of internal defects.	Major	DP Test	100%	ASME Sec VIII Div 1 Appendix 8	ASME Sec VIII Div 1 Appendix 8	IR	3	3	2/1	
2.7	R.F. Pad test	Pneumatic test	Major	Pneu. Test at 1.5 Kg/Cm2	100%	-	No Leakage	IR	3	3	1	
2.8	RT of Butt welds	RT of Butt Weld joints All "L" Seam & "C" Seam	Major	Visual Film review	All T joints+ 10%	ASME Sec VIII Div 1 /sect-v	ASME Sec VIII Div 1 /sect-v	RT Films / Reports	3	3	2/1	
BHEL			PARTICULARS									
			NAME									
			SIGNATURE									
			DATE									



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LEGEND DETAILS: P - Perform, W -Witness, V - Verify, 1 -KPCL , 2 -BHEL, 3 - VENDOR/SUB-VENDOR ; IR - Inspection Report, TC - Test Certificate.

SR NO	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE / METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSP. AGEN			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
3.0	Completed Tank	a. Dimensions	Major	Measure	100%	Apprd. Drg	Apprd. Drg	IR	3	2	1	
		b. Extent of cure	Major	Acetone test	Random	BS4994 1987	BS4994 1987	IR	3	-	2,1	
		c. MOC	Major	Quality of material used	100%	Apprd. Drg	Apprd. Drg	Compliance certificate.	3	-	2,1	
		d. Leakage test	Major	Water Fill up	100%	Apprd. Drg	Apprd. Drg	IR	3	2,1	2,1	
3.1	Painting	Painting finish / DFT adhesion , Uniformity & shade/ stenciling	Major	Visual / Meas.	100%	Appd. Drg.	Appd. Drg.	IR	3	2	1	
BHEL			PARTICULARS									
			NAME									
			SIGNATURE									
			DATE									



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QAP OF RELAY PANEL

LEGEND DETAILS: P - Perform, W -Witness, V - Verify, 1 - KPCL, 2 - BHEL, 3 - VENDOR/SUB-VENDOR IR - Inspection Report, TC - Test Certificate.

SR NO	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE / METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSP. AGENCY			REMARKS
									P	W	V	
1	2	5	4	5	6	7	8	9	10			11
1	Sheet Steel (CRCA & HR)	1. Chemical Composition	Major	Chemical analysis	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Report	3	-	2/1	
		2. Bend Test	Critical	Mech. test	Sample	IS:1079 IS:513	IS:1079 IS:513	Log Book	3	-	2/1	
		3. Surface finish	Major	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	3	-	2/1	
		4. Waviness	Major	Visual	100%	Factory Standard	No Waviness	Log Book	3	-	2/1	
		5. Thickness	Major	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	3	-	2/1	
		6. Mill marking	Major	Visual	100%	Factory Standard	Factory Standard	Log Book	3	-	2/1	
2	Flats / Angles / Channels	1. Dimensions	Major	Measurement	Sample	IS:2062	IS:2062	Log Book	3	-	2/1	
		2. Surface Defects	Major	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	3	-	2/1	
		3. Straightness	Major	Measurement	100%	Factory Standard	Factory Standard	Log Book	3	-	2/1	
		4. Mill marking	Major	Visual	100%	IS:2062	IS:2062	Log Book	3	-	2/1	
3	Cables / Wires	1. Visual / Surface defects	Major	Visual	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	3	-	2/1	
		2. IR and HV	Major	Electrical	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	3	-	2/1	
		3 Conductor							-	-		
		a) Resistance	Major	Electricals	100%	BHEL Spec. and IS:1554 or IS:694		Log Book	3	-	2/1	
		b) Size	Major	Measurement	100%				-	-		
		c) Sheet colour	Major	Visual	100%				-	-		
4 Type / Routine Test Cer.		Major	Verification	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	3	-	2/1		
BHEL			PARTICULARS									
			NAME									
			SIGNATURE									
			DATE									



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT

SPEC NO: PE-TS-409-156-A008

VOLUME: IIB

SECTION: C1-D

REV NO: 00

DATE:

LEGEND DETAILS: P - Perform, W -Witness, V - Verify, 1 - KPCL, 2 - BHEL, 3 - VENDOR/SUB-VENDOR IR - Inspection Report, TC - Test Certificate.

SR NO	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE / METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSP. AGENCY			REMARKS
									P	W	V	
1	2	5	4	5	6	7	8	9	10			11
4	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc	1. Verification at make and type	Critical	Visual	Sample	BHEL Spec. and BOM	BHEL Spec. and BOM	Log Book	3	-	2/1	
		2. Verification of test certificate	Critical	Scrutiny of Type / Routine T.Cs.	100%	Relevant IS	Relevant IS	Log Book	3	-	2/1	
		3. Operation / Functional check	Critical	Electrical	Sample+ 100%@	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	3	-	2/1	
		4. I.R.	Major	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	3	-	2/1	
		5. H.V	Major	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	3	-	2/1	
		6. Calibration	Major	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	3	-	2/1	
		7. Pick up / Drop off Voltage	Major	Electrical	100%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Log Book	3	-	2/1	
5	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make	Major	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	3	-	2/1	
		2. Surface defects	Major	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	3	-	2/1	
		3. IR / HV on Terminal Blocks	Major	Electrical	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	3	-	2/1	
BHEL			PARTICULARS									
			NAME									
			SIGNATURE									
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									P	W	V	
1	2	5	4	5	6	7	8	9	10			11
6	IN PROCESS Blanking / Bending / Forming	1. Dimensions	Major	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	3	-	2/1	
		2. Surface defects after bending	Major	Visual	100%	Factory Standard	Factory Standard	Log Book	3	-	2/1	
7	Nibbling / Punching	1. Cutout Sizes	Major	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	3	-	2/1	
		2. Deburring	Major	Visual	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	3	-	2/1	
8	ASSEMBLY Frame Assembly & Sheet fixing	1. Dimensions	Major	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	3	-	2/1	
		2. Alignment	Major	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	3	-	2/1	
		3. Welding Quality	Major	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	3	-	2/1	
		4. Surface defects	Major	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	3	-	2/1	
9	Pre-treatment and Painting	1. Pretreatment Process	Major	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	3	-	2/1	
		2. Process parameters like bath temp. concentration etc.	Major	Measurement	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	3	-	2/1	
		3. Dipping / Removal Time	Major	Measurement	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	3	-	2/1	
		4. Surface quality after every dip	Major	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	3	-	2/1	
		5. Primer after phosphating	Major	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	3	-	2/1	
		6. Putty Application & Rubbing after primer	Major	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	3	-	2/1	
		7. Paint first coat	Major	Visual, Thickness	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	3	-	2/1	
		8. Putty Application and Rubbing after first coat of paint	Major	Visual	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	3	-	2/1	
		9. Paint second coat	Major	Visual, Thickness, Scratch test Colour adhesion	100%	Factory Standard & IS: 6005	Factory Standard & IS: 6005	Log Book	3	-	2/1	
BHEL			PARTICULARS									
			NAME									
			SIGNATURE									
			DATE									



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SR NO	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE / METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSP. AGENCY			REMARKS
									P	W	V	
1	2	5	4	5	6	7	8	9	10			11
10	Panel Wiring□	1. Wiring Layout	Major	Visual	100%	Approved drg. / & specs	Approved drg. / & specs	Log Book	3	-	2/1	
		2. Wiring Termination (Crimped Lugs)	Major	Visual	100%	Approved drg. / & specs	Approved drg. / & specs	Log Book	3	-	2/1	
		3. Ferrule numbers	Major	Visual	100%	Approved drg. / & specs	Approved drg. / & specs		3	-	2/1	
		4. Colour of wiring	Major	Visual	100%	Approved drg. / & specs	Approved drg. / & specs	Log Book	3	-	2/1	
		5. Size of Conductor	Major	Measurement	100%	Approved drg. / & specs	Approved drg. / & specs	Log Book	3	-	2/1	
11	Component Mounting	1. Correct components	Major	Visual	100%	Approved drg. / & specs & BOM	Approved drg. / & specs & BOM	Log Book	3	-	2/1	
		2. Fixing	Major	Visual	100%	Approved drg. / & specs & BOM	Approved drg. / & specs & BOM	Log Book	3	-	2/1	
12	FINAL Final Inspection	1. Workmanship	Major	Visual	100%	Factory Standard	Factory Standard	Inspection Report	3	2/1	-	
		2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components	Major	Visual	100%	BHEL approved drg. / Spec	BHEL approved drg. / Spec	Inspection Report	3	2/1	-	
		3. Components identification Marking / Name plates	Major	Visual	100%	BHEL approved drg. / Spec	BHEL approved drg. / Spec	Inspection Report	3	2/1	-	
		4. Dimensions	Major	Measurement	100%	BHEL approved drg. / Spec BOM	BHEL approved drg. / Spec BOM	Inspection Report	3	2/1	-	
		5. Door functioning	Major	Functional	100%	BHEL approved drg. / Spec	BHEL approved drg. / Spec	Inspection Report	3	2/1	-	
		6. Paint Shade	Critical	Visual	100%	BHEL approved drg. / Spec	BHEL approved drg. / Spec	Inspection Report	3	2/1	-	
		7. Paint Thickness	Critical	Measurement	100%	BHEL approved drg. / Spec	BHEL approved drg. / Spec	Inspection Report	3	2/1	-	
		8. Workmanship of Gaskets	Major	Visual	100%	Factory Standard	Factory Standard	Inspection Report	3	2/1	-	
		9. Wiring Layout	Major	Visual	100%	BHEL approved drg	BHEL approved drg.	Inspection Report	3	2/1	-	
BHEL			PARTICULARS									
			NAME									
			SIGNATURE									
			DATE									



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SR NO	COMPONENT & OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE / METHOD OF CHECK	EXTEND OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE NORM	FORMAT OF RECORD	INSP. AGENCY			REMARKS
									P	W	V	
1	2	5	4	5	6	7	8	9	10			11
		10. Wire Termination	Major	Pulling manually	Sample		Firm termination.	Inspection Report	3	2/1	-	
		11. Continuity	Major	Electrical	100%		Continuity OK	Inspection Report	3	2/1	-	
13	TYPE TEST	Degree of Protection	Critical	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	2/1	-	
14	ROUTINE TEST	IR before & after HV Test	Critical	Electrical	100%	BHEL approved spec., drg., BOM & relevant IS	BHEL approved spec., drg., BOM & relevant IS	Test Report	3	2/1	-	
		1. Control Logic Operation	Critical	Electrical	100%	BHEL approved drg. / Spec	BHEL approved drg. / Spec	Inspection Report	3	2/1	-	
		2. Instrument Calibratio	Critical	Electrical	100%	BHEL approved drg. / Spec	BHEL approved drg. / Spec	Inspection Report	3	2/1	-	
15	ASSEMBLY Frame Assembly & Sheet fixing	3. Temperature rise	Critical	Electrical	100%	BHEL approved spec/drg. & relevant IS.	BHEL approved spec/drg. & relevant IS.	Inspection Report	3	2/1	-	
BHEL			PARTICULARS									
			NAME									
			SIGNATURE									
			DATE									



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SECTION – C1-E PAINTING SPECIFICATION



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT

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1.0 SCOPE

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

2.0 CODES AND STANDARDS

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

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

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

2.0 PREPARATION OF SURFACES

All surfaces to be painted shall be thoroughly cleaned of all grease, oil, loose mill scale, dust, rust and any other foreign matter. Mechanical cleaning by power tool and scrapping with steel wire brushes shall be adopted to clear the surfaces. However, in certain locations where power tool cleaning cannot be carried out, sand scrapping may be permitted with steel wire brushes and/or abrasive paper. Cleaning with solvents shall be resorted to only in such areas where other methods specified above have not achieved the desired results. Cleaning with solvents shall be adopted only after written approval of the 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.



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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 Admiralty Grey	632	-	-
2.0	Boiler casing, ESP and ducting	Nut Brown	413	-	-
3.0	Crane				
3.1	Crane structure	Golden Yellow	356	-	-
3.2	Trolley and hook	Crimson	540	-	-
4.0	Fans, pumps, motors, compressors	Light Grey	631	-	-
5.0	Tanks (without insulation and cladding)				
5.1	Outdoor	Aluminium	-	-	-
5.2	Indoor	Light grey	631	-	-
6.0	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
7.0	Switchgear	Light grey	631	-	-
8.0	Control & relay panels	Light grey	631/7078 of IS 1650	-	-
9.0	Turbine	Golden Yellow	356	-	-
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	-	-



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13.6	Ash slurry pipes	Black	-	-	-
13.7	Vacuum pipes	Sky blue	101	Black	-
13.8	Fuel pipes (pulverised coal)	Light brown	410	-	-
13.9	Drainage	Black	-	-	-

Notes :

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



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**SECTION – C1-F
DATA SHEET- A**



TITLE:

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DATE:

SL NO.	DESCRIPTION	PARAMETERS
1.0	Scale Inhibitor / Corrosion Inhibitor Tanks	
1.1	Numbers To be provided	Two (2)
1.2	Type	Vertical cylindrical with dished bottom.
1.3	Type of fluid to be handled	Commercial Scale Inhibitor/ Corrosion inhibitor Solution.
1.4	Effective capacity	250 Liters each.
1.5	Minimum Free Board, in mm	300.
1.6	Material of Construction	FRP
1.7	Thickness	6 mm.
1.8	Provided with accessories as follows:	
	Feed Funnel	One number shall be provided over the top cover in each tank with sufficient size to feed Scale Inhibitor/ Corrosion inhibitor Solution in the tank.
	Agitator along with drive motor and other accessories	Slow speed agitator with reduction gear. Speed (Max)-100 rpm
1.9	Instruments	As per P&ID and system requirement.
1.10	Accessories	Chemical charging platform with steps.
2.0	Scale Inhibitor/ Corrosion Inhibitor Dosing Pumps	
2.1	Number	Two (2) [2X100%].
2.2	Location	Indoor.
2.3	Rated Capacity	20 LPH (each).
2.4	Fluid to be handled	Commercial Scale inhibitor & Corrosion inhibitor.
2.5	Service	To inject Scale Inhibitor / Corrosion inhibitor Solution into CW forebay.
2.6	Duty	Continuous and Shall be suitable for parallel operation.
2.7	Type of Pump	Electromechanical, Positive displacement, diaphragm type, constant speed, variable stroke & plunger operated reciprocating type.
2.8	Range of Capacity Adjustment	0 % - 100 %.
2.9	Facility for Capacity Adjustment	Local manual through Micrometer Dial and remote manual from Control Panel.
2.10	Suction Condition	Flooded.
2.11	Head to be developed at rated capacity	20 mwc .(min) or as per system req. (Whichever maximum)
2.12	Material of construction	
2.10.1	Housing	CI
2.10.2	Wetted part of Pump	SS316
2.10.3	Pump head	SS-316
2.10.4	Plunger	SS-316
2.10.5	Base plate	MS.
2.13	Foundation bolts and nuts	SS 316
2.14	Type of drive	Electrical Motor
2.14.1	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no way be less than the maximum power required by the Pump.
2.14.2	Rated speed (RPM)	1500 (Sync.) maximum.
2.14.3	Voltage, Phase & Frequency ($\pm$ % Variation)	415 V (+10%), 3 Phase, 50 HZ (+3 to -5%).
2.14.4	Type of coupling between Pump & Motor	Flexible Spacer.



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2.14.5	Noise level (for complete set of Pump & Motor)	Not more than 85 db (At a distance of 1.0 m from the outer surface of Motor).
2.14.6	Tests and Inspection	
	a) Material Test	Required for Pump Head and Plunger.
	b) Hydro-Test	Test Pressure - 200% of pump operating pressure or 15 kg/cm ² (g) whichever is higher. Test Duration - Half an hour (minimum).
	c) Dynamic Balancing Test	Static Balancing for all rotating parts of pumps required.
2.14.7	Performance Test	
	a) Test Code	Hydraulic Institute Standard and API-675.
	b) Tests to be done for determination of	Capacity, Volumetric Accuracy, Volumetric Efficiency and Power Consumption.
	c) Test to be carried out	Capacity, Volumetric Accuracy, Volumetric Efficiency and Power Consumption.
2.14.8	Design Temperature	80 Deg C.
3.0	Biocide Tank	
3.1	Numbers	One (1)
3.2	Type	Vertical cylindrical with dished bottom.
3.3	Type of fluid to be handled	Commercial Biocide Solution.
3.4	Effective capacity,	600 Litres.
3.5	Minimum Free Board, in mm	300.
3.6	Material of Construction	FRP
3.7	Thickness	6. mm
3.8	Provided with accessories as follows:	
3.7.1	Feed Funnel	One number shall be provided over the top cover in each tank with sufficient size to feed Bio cide Solution in the tank.
3.7.2	Agitator along with drive motor and other accessories	Slow speed agitator with reduction gear. Speed (Max)-100 rpm
3.9	Instruments	As per P&ID and system requirement.
3.10	Accessories	Chemical charging platform with steps.
4.0	Biocide Dosing Pumps	
4.1	Number	Two (2) [1W+1S].
4.2	Location	Indoor.
4.3	Type of fluid to be handled	Commercial biocide Solution.
4.4	Rated Capacity	600 LPH (each)
4.5	Service	To inject Biocide Solution into CW fore bay
4.6	Duty	Shock dosing and Shall be suitable for parallel operation.
4.7	Type of Pump	Electromechanical, Positive displacement, diaphragm type, constant speed, variable stroke & plunger operated reciprocating type.
4.8	Facility for Capacity Adjustment	Local manual through Micrometer Dial and remote manual from Control Panel
4.9	Range of Capacity Adjustment	0 % - 100 %.
4.10	Suction Condition	Flooded.
4.11	Head to be developed at rated capacity	20 mwc .(min) or as per system req. (Whichever maximum)
4.12	Material of construction	
4.12.1	Housing	CI
4.12.2	Wetted part of Pump	SS316



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4.12.3	Pump head	SS-316.
4.12.4	Plunger	SS-316.
4.12.5	Base plate	MS.
4.12.6	Foundation bolts and nuts	SS 316
4.13	Type of drive	Electrical Motor
4.13.1	Criteria for selection of drive motor	Minimum 15 % margin over BkW at rated duty point shall be taken and standard motor with next higher KW as available shall be selected. This shall in no way be less than the maximum power required by the Pump.
4.13.2	Rated speed (RPM)	1500 (Sync.) maximum.
4.13.3	Voltage, Phase & Frequency ($\pm$ % Variation)	415 V (+10%), 3 Phase, 50 HZ (+3 to -5%).
4.13.4	Type of coupling between Pump & Motor	Flexible Spacer.
4.13.5	Noise level (for complete set of Pump & Motor)	Not more than 85 db (At a distance of 1.0 m from the outer surface of Motor).
4.13.6	Tests and Inspection	
	a) Material Test	Required for Pump Head and Plunger.
	b) Hydro-Test	Test Pressure - 200% of pump operating pressure or 15 kg/cm ² (g) whichever is higher. Test Duration - Half an hour (minimum).
	c) Dynamic Balancing Test	Static Balancing for all rotating parts of pumps required.
4.13.7	Performance Test	
	a) Test Code	Hydraulic Institute Standard and API-675.
	b) Tests to be done for determination of	Capacity, Volumetric Accuracy, Volumetric Efficiency and Power Consumption.
	c) Test to be carried out	Capacity, Volumetric Accuracy, Volumetric Efficiency and Power Consumption.
4.13.8	Design Temperature	80 Deg C.
5.0	Piping , Valves, Fittings And Flanges	
	Pipe	SS 316 Sch 10 (min)
	Valves	SS 316 PN10
	Strainer	Stainless Steel to ASTM 312 Type 316 welded, schedule-10.
6.0	PIPE DIFFUSERS	
	For Scale Inhibitor/ Corrosion Inhibitor Dosing system	3 Nos (MOC: SS 316)
	For Biocide Dosing system	3 Nos (MOC: SS 316)
7.0	Safety Equipment	Four sets of safety equipment comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall also be provided. A personnel water drench shower and eye bath shall be provided.



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT

SPEC NO: PE-TS-409-156-A008

VOLUME: IIB

SECTION: C2

REV NO: 00

DATE:

SECTION – C2 TECHNICAL SPECIFICATION FOR ELECTRICAL



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
CW TREATMENT PLANT
1 x 370 MW YELAHANKA TPS

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION : **C3**

REV NO. **00** : DATE : 26.04.16

SHEET : 1 OF 3

TECHNICAL SPECIFICATION
FOR
CW TREATMENT PLANT
(ELECTRICAL PORTION)

	TITLE : ELECTRICAL EQUIPMENT SPECIFICATION FOR CW TREATMENT PLANT 1 x 370 MW YELAHANKA TPS	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION : C3
		REV NO. 00 : DATE : 26.04.16
		SHEET : 2 OF 3

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

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

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

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

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

	TITLE : ELECTRICAL EQUIPMENT SPECIFICATION FOR CW TREATMENT PLANT 1 x 370 MW YELAHANKA TPS	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION : C3
		REV NO. 00 : DATE : 26.04.16
		SHEET : 3 OF 3
3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer. 4.0 List of enclosures : a) Electrical scope between BHEL & vendor (Annexure –I) b) Standard BHEL speicification for motors. c) Datasheets(A&C) & quality plan for motors. d) Electrical Load data format (Annexure –II) e) BHEL cable listing format (Annexure –III)		

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR(FOR EPC PROJECTS)**PACKAGES : CWTP****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT:**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, optical fibre etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	Cable glands ,lugs and bimetallic strip for equipment 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 and control cables.
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR(FOR EPC PROJECTS)**PACKAGES : CWTP****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT:**

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
11	Below grade grounding	BHEL	BHEL	
12	LT Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification
15	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	
16	a) Input cable schedules (Control & Screened Control Cables) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable and electronic earthing cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish Electrical equipment layout & cable tray layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Cabling arrangement of the same (wherever overhead cable trays, trenches, cable ducts, conduits etc.) shall be decided during contract stage. Electrical equipment layout & cable tray layout drawing shall be subjected to BHEL/ customer approval without any commercial implications to BHEL.
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

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

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

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101																														
		VOLUME NO. : II-B																														
		SECTION : D																														
		REV NO. : 00 DATE :																														
		SHEET : 1 OF 4																														
1.0 INTENT OF SPECIFIATION																																
The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer’s work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station. Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.																																
2.0 CODES AND STANDARDS																																
Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards: <table><tr><td>IS:325</td><td>Three phase Induction motors</td></tr><tr><td>IS : 900</td><td>Code of practice for installation and maintenance of induction motors</td></tr><tr><td>IS: 996</td><td>Single phase small AC and universal motors</td></tr><tr><td>IS: 4722</td><td>Rotating Electrical machines</td></tr><tr><td>IS: 4691</td><td>Degree of Protection provided by enclosures for rotating electrical machines</td></tr><tr><td>IS: 4728</td><td>Terminal marking and direction of rotation rotating electrical machines</td></tr><tr><td>IS: 1231</td><td>Dimensions of three phase foot mounted induction motors</td></tr><tr><td>IS: 8789</td><td>Values of performance characteristics for three phase induction motors</td></tr><tr><td>IS: 13555</td><td>Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment</td></tr><tr><td>IS: 2148</td><td>Flame proof enclosures for electrical appliance</td></tr><tr><td>IS: 5571</td><td>Guide for selection of electrical equipment for hazardous areas</td></tr><tr><td>IS: 12824</td><td>Type of duty and classes of rating assigned</td></tr><tr><td>IS: 12802</td><td>Temperature rise measurement for rotating electrical machnines</td></tr><tr><td>IS: 12065</td><td>Permissible limits of noise level for rotating electrical machines</td></tr><tr><td>IS: 12075</td><td>Mechanical vibration of rotating electrical machines</td></tr></table> In case of imported motors, motors as per IEC-34 shall also be acceptable.			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
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3.0 DESIGN REQUIREMENTS																																
3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A																																
3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.																																
3.3 Starting Requirements																																
3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.																																
3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.																																

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
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		REV NO. : 00 DATE :
		SHEET : 2 OF 4
The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.		
3.3.3 The following frequency of starts shall apply i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature. ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour) iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor		
3.4 Running Requirements		
3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.		
3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.		
3.5 Stress During bus Transfer		
3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.		
3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.		
3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.		
3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.		
4.0 CONSTRUCTIONAL FEATURES		
4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy		
4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362. Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled		
4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.		

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
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4.4.	Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.	
4.5	Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.	
4.6	In case Class ‘F’ insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class ‘B’ insulation. In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.	
4.7	Terminals and Terminal Boxes	
4.7.1	Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A. Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet “A”.	
4.7.2	unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.	
4.7.3	Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.	
4.7.4	Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.	
4.7.5	Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.	
4.7.6	Degree of protection for terminal boxes shall be IP 55 as per IS 4691.	
4.7.7	Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.	
4.7.8.	Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.	
4.7.9	Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.	
4.8	Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.	
4.9	General	

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 20/3/15
		SHEET : 4 OF 4
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.		

		QUALITY PLAN		CUSTOMER :			PROJECT TITLE		SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE			
		SHEET 1 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVANT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVANT IS/	SUPPLIER'S TC	3	-	2	
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 2 OF 9		CUSTOMER :		PROJECT TITLE			SPECIFICATION :			
				BIDDER/ :		QUALITY PLAN			SPECIFICATION :			
				VENDOR		NUMBER PED-506-00-Q-007, REV-03			TITLE			
		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	
1.6	SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 3 OF 9		CUSTOMER :		PROJECT			SPECIFICATION :			
				BIDDER/		TITLE			NUMBER :			
				VENDOR		QUALITY PLAN			SPECIFICATION :			
		SYSTEM		NUMBER PED-506-00-Q-007, REV-03			TITLE			SECTION		
				ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			VOLUME III					
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC. 2. OTHER CHARACTERISTICS	MA MA	VISUAL TEST	100% SAMPLE	- MANUF'S SPEC.	NO VISUAL DEFECTS MANUF'S SPEC.	INSPT. REPORT LOG BOOK AND OR SUPPLIER'S TC	3 3	- -	2 2	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT * MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND. 2.DIMENSIONS INCLUDING BURS HEIGHT 3. ACCEPTANCE TESTS	MA MA MA	VISUAL MEASUREMENT ELECT. & MECH TESTS	100% SAMPLE -DO-	- MANUFR'S DRG. . MANUF'S SPEC./ RELEVANT IS	NO VISUAL DEFECTS (FREE FROM BURS) MANUFR'S DRG. RELEVANT IS	LOG BOOK -DO- SUPPLIER'S TC	3 3 3	- - -	- 2 2	
1.9	CONDUCTORS	1. SURFACE FINISH 2.ELECT. PROP. & MECH. PROP	MA MA	VISUAL ELECT. & MECH.TEST	100% SAMPLES	- RELEVANT IS/ BS OR OTHER STANDARDS	FREE FROM VISUAL DEFECTS RELEVANT IS/ BS OR OTHER STANDARDS	LOG BOOK SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3* 3	- -	2* 2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 4 OF 9		CUSTOMER :		PROJECT			SPECIFICATION :			
				BIDDER/		TITLE			NUMBER :			
				VENDOR		QUALITY PLAN			SPECIFICATION :			
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			
									VOLUME III			
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

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

		QUALITY PLAN		CUSTOMER :			PROJECT			SPECIFICATION :		
				BIDDER/ :			TITLE			NUMBER :		
				VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE		
SHEET 6 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	FOR MV MOTOR
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.6	IMPREGNATION	1.VISCOSITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	THREE DIPS TO BE GIVEN
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN SHEET 7 OF 9		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :		
				BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE		
				SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	VERIFICATION FOR MV MOTOR ONLY
		1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
									BIDDER'S/VENDORS COMPANY SEAL			

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

		QUALITY PLAN SHEET 9 OF 9		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
				SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
NOTES: 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE									
										BIDDER'S/VENDORS COMPANY SEAL		

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

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
				BIDDER/ : VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION : TITLE :			
		SHEET 2 OF 2		SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	P	W	V	11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	
NOTES: 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON 2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. 3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			



TITLE

LV MOTORS

DATA SHEET-A

1 X 370 MW YELAHANKA CCPP

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. 00 DATE 26.04.2016

SHEET 1 OF 1

- 1.0 Design ambient temperature : 50 °C
- 2.0 Maximum acceptable kW rating of LV motor : 200 KW
- 3.0 Installation (Indoors/ Outdoors) : As required
- 4.0 Details of supply system
 - a) Rated voltage (with variation) : 415V $\pm$ 10%
 - b) Rated frequency (with variation) : 50 Hz + 3 % to - 5%
 - c) Combined voltage & freq. variation : 10% (sum of absolute values)
 - d) System fault level at rated voltage : 50 kA for 1 sec
 - e) Short time rating for terminal boxes
 - o 110 kW and above (Breaker : 50 KA for 0.2 sec.. Controlled)
 - o Below 110 kW (Contactor : 50 KA protected by fuse Controlled)
 - f) LV System grounding : Solidly
- 5.0 Class of insulation : Class 'F', with temp rise limited to class B.
- 6.0 Minimum voltage for starting : (a) 85% of rated voltage
(As percentage of rated voltage)
- 7.0 Power cables data : Shall be given during detailed engg.
- 8.0 Space heater supply : 240 V, 1 ϕ , 50 Hz
- 9.0 Rating up to which Single phase motor : Acceptable below 0.20 kW
- 10.0 Locked rotor current
 - a) Limit as percentage of FLC : As per IS 12615*
- 11.0 Flame-proof motor
 - a) Enclosure suitable (As per IS: 2148) : As per requirement
 - b) Classification of Hazardous area : As per requirement
(As per IS: 5572 part-I)
- 12.0 Paint shade : Shall be given during detailed engg
- 13.0 Degree Of protection for motor/ terminal box : IP 54/ IP 55 (As per cl. no.4.1 and 4.7.6
of "General technical requirements for LV motors")
- 14.0 * Continuous duty LT motors up to 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium efficiency (IE3) as per IEC: 60034-30/ IS:12615



TITLE

LV MOTORS**DATA SHEET-A****1 X 370 MW YELAHANKA CCPP**

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. 00 DATE 26.04.2016

SHEET 1 OF 1

16.0 TESTING**16.1 Type Tests**

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

16.2 Routine Tests

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

	TITLE	MOTOR DATA SHEET – C 1 x 370 MW YELAHANKA CCPP	SPECIFICATION NO.	
			VOLUME	II B
			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			SEAL	REV.	
NAME	SIGNATURE	DATE			

	TITLE MOTOR DATA SHEET – C 1 x 370 MW YELAHANKA CCPP	SPECIFICATION NO.
		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 $\geq 55\text{KW}$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

ANNEXURE III

[illegible]



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT

SPEC NO: PE-TS-409-156-A008

VOLUME: IIB

SECTION: C3

REV NO: 00

DATE:

SECTION – C3 TECHNICAL SPECIFICATION FOR CONTROL & INSTRUMENTATION

	KARNATAKA POWER CORPORATION LIMITED 1x370 MW KPCL YELAHANKA CCPP TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT	SPECIFICATION NO.	
		VOLUME II-B	
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1. **Complete** Control & Instrumentation for CW TREATMENT PLANT is in Vendor scope of supply. Items not specifically mentioned however required for the completeness of the system shall be supplied by Vendor.
2. A Relay based control system cum Annunciation panel with solid state annunciation windows shall be in Vendor scope of supply.
3. Vendor to ensure necessary provision and hardware requirement in the Relay panel for complete CW TREATMENT PLANT.
4. Field instrumentation along with necessary fittings, accessories and valve manifold etc. and Field Junction Box (JB's), are in Vendor's scope. Each instrument/ equipment shall have a unique KKS Tag no. Field instrument specification and Data Sheet are given elsewhere in this specification. Vendor to provide local control panel wherever required.
5. All fields cabling for instruments/motor/pump/blower to JB is in Vendor's scope. The field I/O s to be grouped together in JB's suitably and a common trunk cable shall be taken to the panel.
6. Instrument installation drawings are to be provided by Vendor. All instrument fitting and erection hardware/racks as per instrument installation diagram shall be in Vendor's scope.
7. All wetted part of Level Switch, Level Gauge, Pressure gauge, Pressure switch, differential pressure switch etc. shall be of SS316.
8. Bidder shall include measurement and control instruments of transmitters only. No switches shall be considered. All the control measurement and analysers and interlocks shall have redundant sensors along with Transmitter.
9. One table and two (02 nos) chair shall be provided.
10. The requirements given are to be read in conjunction with detailed Technical specification enclosed. In case of any contradictions, the more stringent requirement shall prevail subject to BHEL approval.
11. Refer 'Electrical scope split sheet' in Electrical portion of the specification for instrument and control cable scope of supply, engineering and erection etc.
12. Supplied system shall have provision for hardwired connectivity with plant DCS of critical signals. Same shall be decided during detailed engineering.
13. Vendor to submit GA drawing of control panel indicating layout of instruments, construction details, wiring diagram, class of protection for enclosure, paint type, paint color, thickness and material of enclosure sheet, control scheme during detailed engineering.

	KARNATAKA POWER CORPORATION LIMITED 1x370 MW KPCL YELAHANKA CCPP TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT	SPECIFICATION NO.	
		VOLUME II-B	
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		SHEET 2	OF 4

14. All bidirectional drives (Motor Operated Valves, MOVs) are integral starter type. Typical Hook Up diagram of all types of drives is attached for use(subject to Customer approval).
15. Vendor shall provide Cable Schedule in BHEL excel format provided in Electrical portion of the specification. Also, Cable Interconnections details for Complete System shall be in Vendors' scope.
16. 240V AC (supply feeder)/415 V AC (3phase 4 wire) supply shall be provided by BHEL at a single point as per 'Electrical scope split sheet' in Electrical portion of the specification. Further distribution to various instruments/Equipment shall be in Vendor's scope. Vendor to include the necessary power distribution board in his scope. Any power supply other than the above, if required for any instrument/equipment has to be derived from the above supply & all the necessary hardware for the same shall be in Vendor's scope.
17. Specification for Instruments used in PID other than specified in this specification (i.e. O3 analyser, O2 purity analyser, dew point transmitter etc.) shall be evaluated during detail engineering. All Data sheets submitted by bidder are subject to customer approval.

NOTES:

01. All equipment items shall be of latest design with proven on track record from reputed experienced manufacturers of specified type and range of equipment. The make/model of various instruments/items/systems and instrument sub-vendor shall be subject to approval of BHEL/Customer during detailed engineering stage.
02. The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by Vendor without any technical, commercial and delivery implication to BHEL.
03. Documents of C&I System shall be submitted to customer/end user for approval during detail engineering. Changes, if any, shall be accommodated by the Vendor without any price/time implication.



Technical specification for
CONTROL & INSTRUMENTATION
1X370 MW YELAHANKA CCPP

SPEC NO.: **PE-TS-409-145-I**

VOLUME

SECTION **C3**

REV. NO. 00

DATE : 25.04.2016

SHEET OF

INSTRUMENTATION DATA SHEET

2.16 **General Guidelines for Provision of Instruments**

FIELD INSTRUMENTS SHALL BE SUPPLIED AS PER AGREED PID :

- PRESSURE TRANSMITTERS
- DIFF. PRESSURE TRANSMITTERS
- DISPLACEMENT TYPE LEVEL TRANSMITTERS
- THERMOCOUPLES WITH THERMOWELLS
- RESISTANCE TEMPERATURE DETECTORS (PT 100)
- PRESSURE GAUGES
- DIFFERENTIAL PRESSURE GAUGES
- TEMPERATURE GAUGES
- LEVEL GAUGES
- PRESSURE SWITCHES
- DIFFERENTIAL PRESSURE SWITCHES
- LEVEL SWITCHES
- ~~SIGHT FLOW INDICATOR~~
- ~~OIL FLOW METER~~
- ~~ROTAMETERS~~
- FLOW SWITCH
- ~~ANUBAR~~

TECHNICAL SPECIFICATIONS FOR FIELD INSTRUMENTS, PLC, VMS, CCTV AND OTHER EQUIPMENT/SYSTEMS

- All instruments offered by the Contractor 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

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

- Micro-processor based indicating type (LCD display), rack mounted with accuracy of $\pm 0.1\%$ of span, Repeatability $\pm 0.05\%$ of FSR or better, Linearity $\pm 0.1\%$ of FSR or better. Hysteresis: $\pm 0.1\%$ 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/ Hastelloy/ 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.
- 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

In Detail Technical Specification:

- 1) Type of Transmitter: Microprocessor based 2 wire type HART protocol compatible,
- 2) Accuracy : $\pm 0.1\%$ of span

- 3) Output Signal Range: 4-20 mA DC(Analog) Super imposed digital 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 6 Nos. of hand held calibrators for configuration shall be provided for maintenance of units

2.16.1 **Pressure indicators** shall be provided for

Suction and discharge lines of pumps including on header section if two or more pumps are employed for the same service and transmitters.

2.16.2 **Pressure switches** shall be provided for

- (a) On all process lines / equipment where parameter abnormality / status including pre-trips alarms to be communicated to the operator in control room.
- (b) For all permissives and protection conditions governed by safety operation of the equipment e.g., pressure adequate, pressure very high / low conditions.
- (c) For all interlock conditions which governs starting of standby equipment or subsequent equipment for safety operation of the system.

- (d) 3 switches shall be employed for protection in case of critical applications.

Inlet and outlet of filters / strainers.

2.16.3 **Differential Pressure Switches** shall be provided

- (a) Across filters / strainers for remote monitoring
- (b) Across condenser CW line for remote monitoring and interlocks.

2.16.4 **Differential pressure indicators** shall be provided

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

2.16.5 **Pressure Transmitters** shall be provided

- (a) At suction and discharge of all major pumps.
- (b) For all control applications as demanded by the process. It shall be noted that for all critical control applications, 3 transmitters shall be provided.
- (c) Pressure conditions of all major vessels / tanks like deaerator, hotwell, HP / IP / LP drums, etc.
- (d) All inputs for equipment / unit performance calculation.

2.16.6 **Differential pressure transmitters** shall be provided for

- (a) all the requirements of differential pressure, flow and level measurements.
- (b) control applications.

All inputs for equipment / unit performance calculation.

2.16.7 **Temperature indicators (Thermometers)** shall be provided.

- (a) On all process lines where local indication is warranted by the system either for monitoring or testing.

- (b) On the inlet / outlet equipment such as heaters, desuperheaters, Heat exchangers and coolers for both the fluid media.

2.16.8 **Temperature switches** shall be provided

- (a) On all process lines where parameter abnormality is to be communicated to the operator in control room.
- (b) For all permissive, interlock and protection conditions governed by the safety operation of the equipment. For all critical services 3 nos., shall be provided for protection application.

2.16.9 **Resistance temperature detectors (RTD's)** shall be provided for all services where maximum temperature does not exceed 150 degree centigrade. RTD shall be 3 wire type, duplex with thermowell.

E.g., Suction / Discharge of pumps, inlet / outlet of heat exchangers, pump / motor bearings, motor windings, etc. RTD is employed for remote display, for control applications and density correction for flow measurement.

2.16.10 **Thermocouple**: Shall be provided for all services where normal operating temperature exceeds 150⁰C.

- (a) The element shall be duplexed integral with thermowell, K-type for temperature upto 600⁰C and R-type for temperature above 600⁰C.
- (b) The thermocouple is employed for remote display, for control applications and density correction for flow measurements.
- (c) Compensating cable shall be provided with all thermocouples as required to make the system complete.

2.16.11 **Temperature transmitters**: Shall be provided where thermocouples / RTD are used for control application. For bearing temperature, winding temperature and metal temperature, field located remote multiplexing units with digital communication to control room electronics can be considered. Otherwise, thermocouples with compensating cable to control room also can be run.

Temperature transmitters shall be mounted in marshalling cabinets in electronic cubicle room, compensating cables shall be run from the temperature element to the temperature transmitters.

2.16.12 **Level gauges:** Shall be provided 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. All high pressure vessel shall be provided with level gauges on either end as per Boiler statutory requirement.

2.16.13 **Level switches** : The instrument shall be provided on all equipment (storage vessel) where parameter abnormality / status to be communicated to the operator in the control room.

All permissive, interlock and protection conditions governed by the safety operation of the equipment. For all critical services, 3 switches shall be provided for protection application.

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.

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

The instrument shall be differential pressure type or displacement type.

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

Coolant from the equipment (coolers).

The instrument shall be rotary type with glass mounted for indication.

Upto 4 inch on-line flow glasses shall be supplied and above 4 inch bypass type flow glasses shall be provided.

2.16.16 **Flow Switches** shall be provided at different outlet header of identical equipment to alarm in the event of inadequate coolant requirement. (or) lub oil.

2.16.17 **Flow elements** shall be provided as mentioned below.

Orific plate shall be provided as shown in the PID.

2.16.18 **Control valves** shall be provided for all control application as required and in line with the system requirement. If the process

(b) **Gas analysers**

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

- HRSG stack for each HRSG: SO₂, NO_x, SPM.

2.16.25 **Transmitter racks**

All the pressure, flow and level transmitters shall be grouped depending the geographical locations and mounted on transmitter racks.

2.16.26 **Junction boxes shall be provided for :**

- (a) Termination of all sensors and transmitters located area-wise.
- (b) Termination of transmitters mounted on the transmitter racks.
- (c) Termination of both the contacts of switches and duplex elements of temperature measurement.

2.17 **Instrumentation and Control Cables**

Instrumentation and control cables and power cables shall be supplied to :

- (a) Connect field instruments to marshalling cabinets in the control room through field junction boxes.
- (b) Connect limit switches, torque switches, proximity switches, and position transmitters to their respective motor control centres / switchgears and marshalling cabinets through field junction boxes.
- (c) Connect interposing relay contacts from relay cabinet in the control room, the motor control centres / switchgears and solenoid valves through power supply distribution board.
- (d) Control desk cabling, annunciation/SER system cabling, power supply cables from distribution board to system cabinet.

Specification for cables is covered in Electrical Section.

2.18 **Impulse Pipes and Fittings**

Impulse pipes, tubes, fittings and air supply and signal piping / tubing shall be supplied for all the instruments under the scope of this specification as per Table 1 in this section.

2.19 **Selection of Ranges for Instruments**

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

- (a) For pressure and draft measurements, the maximum operating pressure shall be within 70 to 80% of the maximum scale range. All pump suction measurement 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.
- (b) For temperature measurement, the maximum operating temperature will be within 80 to 90% of the maximum scale range.
- (c) For pressure switches and temperature switches, the set points shall fall within 40% to 70% of the scale range selected.
- (d) 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 stacked with overlap to cover permissive, alarm and trip levels.

2.20 **Performance Test Points**

- (a) Pressure, temperature and flow test points shall be provided in line with performance test code requirements
- (b) Pressure test points shall be complete with root valves and shall terminate with a nipple
- (c) Temperature test points shall be provided with thermowell.
- (d) All instruments required for performance testing to prove the performance of the Instrumentation and Control Equipment shall be provided by the Contractor for the duration of the performance test. These test instruments shall have test certificates from reputed test house valid for the duration of the performance test.

- 2.22.3.6 Tables suitable for dot matrix/laser/inkjet printers shall be provided. The exact details shall be finalised & approved during detailed engineering.

2.23 **Specifications for Instruments**

2.23.1 **Pressure Indicators**

Direct reading, pipe mounted Pressure gauges of aluminium casing with 150 mm inch phenolic dial (white dial with black numerals), 316 SS Bourdon tube, nylon movements and micrometer type adjustable pointer, accuracy of $\pm 0.5\%$ of span including accessories like syphons for steam services, snubbers for pump discharge applications and chemical diaphragm for corrosive and oil services and name plate. Material of accessories will be SS. IP65 or equivalent degree of protection for enclosure. Over range protection will be 25% above maximum pressure. Armoured capillary of 15m shall be provided. Bourdon tube shall be drawn tube for pressure < 70 bar (g) and bored tube for > 70 bar (g).

2.23.2 **Pressure Switches**

Non indicating type, field mounted Pressure Switches of aluminium casing (epoxy coated), and 316 SS element and accuracy of $\pm 1\%$ of span, including accessories like syphons for steam services, snubbers for pump discharge applications and chemical diaphragm for corrosive and oil services, name plate and mounting brackets. 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 repeatability shall be $\pm 0.5\%$ of full scale range.

2.23.3 **Pressure Transmitters**

Micro-processor based **Smart Electronic Transmitters**, rack mounted with accuracy of $\pm 0.1\%$ of span, field zero and span adjustment, self diagnostics, temperature sensor for compensation. Power supply 24 V DC; output signal of 4-20 mA DC and digital signal with HART protocol. Two nos. HART communicator with pre-loaded device program shall be provided for smart pressure / differential pressure transmitters. IP 65 or equivalent degree of protection. Aluminium housing with epoxy coating, 316 SS 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. Material for accessories will be SS.

2.23.4 **Differential Pressure Indicators**

Direct reading type, pipe mounted, bellows or diaphragm operated differential pressure indicators; aluminium casing (epoxy coated) with 150 mm dial, 316 SS pressure element; accuracy of $\pm 0.5\%$ of span including accessories like snubbers for pump discharge application, chemical diaphragm with 15 m PVC covered SS armoured capillary for each limb for corrosive and oil services and 3 way manifold. Material of accessories will be SS. IP 65 or equivalent degree of protection. Over range protection will be 50% above maximum pressure.

2.23.5 **Differential Pressure Switches**

Bellows or diaphragm operated non-indicating field mounted type; aluminium casing (epoxy coated); 316 SS pressure element nylon movement; accuracy of $\pm 1\%$ of span with an adjustable contact including accessories like snubbers for pump discharge applications, chemical diaphragm with 15 m capillary for each limb for all corrosive and oil services and 3 way manifold. Material of accessories will be SS. Auto reset micro switch with tamper proof external adjustable set values with 2 SPDT contacts rated for 0.2 A at 220 V DC. IP 65 or equivalent degree of protection over range protection 50% above maximum pressure. Repeatability shall be $\pm 0.5\%$ FSR.

2.23.6 **Smart Electronic Transmitters for Measurement of Pressure, Differential Pressure(DP) & Flow/Level(DP Type):**

Micro-processor based indicating type (LCD display), rack mounted with accuracy of $\pm 0.1\%$ of span, Repeatability : $\pm 0.05\%$ of FSR or better, Linearity : $\pm 0.1\%$ of FSR or better. Hysteresis: $\pm 0.1\%$ 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/ Hastelloy/ 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.

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.

2.23.7 **Thermometers**

Indicating type, field mounted, filled system with ten (10) metres capillary and six (6) inch white dial with black numerals with micrometer pointer housed in aluminium casing (epoxy coated) with an accuracy of $\pm 1\%$ of span, response time of 2-4 seconds, auto temperature calibration, linear calibration over the range and 316 SS thermowell having a process connection of M33 x 2 thread. Material of accessories will be SS. IP 54 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 (latest) requirements.

2.23.8 **Thermowells**

Pipe/equipment mounted temperature test wells of 316 SS (SS 446 for flue gas services) with a process connection of M33x2 thread. 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. In case flanged wells are required for any specific application, the same shall be supplied as required. The thermowell construction shall meet the ANSI 19.3. (latest) requirements.

2.23.9 **Temperature Switch**

Non-indicating type, field mounted, filled system with ten (10) metre capillary housed in Aluminium casing (epoxy coated) with an accuracy of $\pm 1\%$ span, auto temperature calibration, linear calibration over the range and 316 SS thermowell having a process connection of M33x2 thread. Micro switch with reset type with adjustable set values with 2 SPDT contacts rated for 0.2 A, 220 V DC. IP 54 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 (latest) requirements. Scale shall be provided for setting. Repeatability shall be $\pm 0.5\%$ of full scale. For ambient temperature applications switches designed for cross ambient operation shall be used.

2.23.10 **Thermocouple Assembly**

Duplex type with accuracy of $\pm 0.5\%$ of span, 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. Material of accessories will be SS. IP 54 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 with ungrounded junction. For metal temperature measurement weldable thermocouple pads shall be provided with thermocouple extension wires of required length. Element size shall be 18 AWG. Insulation resistance at 540°C shall not be less than 5 M Ω . Temperature devices provided with thermowells shall be calibrated with the associated thermowell as an assembly construction and shall meet the ANSI 19.3 (latest) requirements.

2.23.11 **Resistance Temperature Detectors (RTD)**

Duplex type with accuracy of $\pm 0.5\%$ of span, response time 1-2 seconds; Spring loaded mineral insulated three (3) wire RTD assembly with 316 SS Thermowell housed in aluminium casing (epoxy coated) having a process connection of M33 x 2 thread. IP 54 or equivalent degree of protection for enclosure. Material of accessories will be SS.

2.23.12 **Temperature Transmitters Smart Electronic Transmitters:**

Temperature transmitters shall be provided where thermocouples/RTD'S are used for control application.

Indicating type, control room mounted temperature transmitters with an accuracy of $\pm 0.25\%$, ref. junction compensation, span/zero adjustment, burn out protection upscale, input/output isolation, circuit ungrounded, ambient temperature error 0.1%/10°C to provide linear output of 4-20 mA DC (2 wire system). Nema 4 or equivalent degree of protection for enclosure. Material of accessories will be SS.

2.23.13 **Level Gauges**

Reflex / tubular type with automatic ball check valves, illuminator, pyrex / borosilicate glass, guard rods and Holders. Material of accessories will be SS.

2.23.14 **Level Switches**

External magnetic float operated level switches for tanks and vessels and top mounted level switches for sumps and underground tanks. Micro switch with 2 SPDT contacts rated for 0.2 A, 220 V DC. Material of float will be 316 SS and the material of accessories will be SS. IP 54 or equivalent degree of protection for enclosure.

2.23.15 **Displacement Type Level TransmittersSmart Electronic Transmitters:**

Displacement type level transmitters of float length of 14 inches or 32 inches with an accuracy of $\pm 0.5\%$ 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. IP 54 or equivalent degree of protection for enclosure. Displacer / float material of 316SS. The material of accessories will be SS.

2.23.16 **Flow Glasses**

Online flow glasses for pipe size up to 80 mm with a rotary wheel (not a flapper type) suitable for installation on vertical or horizontal pipe lines, material pyrex tempered glass. The material of accessories will be SS.

2.23.17 **Flow Elements**

316 SS long radius, weld in flow nozzles with D and D/2 pressure tappings; 316SS flow orifice plate assembly with flange tap connections; β ratio of 0.5 to 0.7. Element material of SS 316. The material of accessories will be SS. End connections for flow elements will be butt welded except orifice plate on condensate return line to CST which will be flanged. The flow elements shall be designed in accordance with ISO 5167 / BS 1042. The accuracy of the flow element for steam flow / feed water flow measurement shall be $\pm 2\%$ or better. Unit of measurement shall be metric tonnes / hour.

2.23.18 **Air Filter Regulator (AFR)**

Constant bleed type AFR with an accuracy of $\pm 0.1\%$, inlet pressure range of 5-8 kg/ cm² and suitable spring ranges (AFR) for use with positioners in control valves, control damper, E/P convertors and shut off valves for phosphor bronze filter element; Filtering particles above five microns. Weather and water proof enclosure. Material of accessories will be SS.

2.23.19 **Electro-Pneumatic Convertors (E/P)**

Two wire type E/P convertors with an accuracy of $\pm 0.5\%$ 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 polyurethane paint); NEMA 4 or equivalent degree of protection for enclosure. Material of accessories will be SS.

2.23.20 **Pressure and Differential Pressure Transmitter Racks**

Open type transmitter racks to mount all pressure, differential pressure and flow transmitters with vibration damper (Keldur); air supply lines and header will be provided with bulk head fittings to receive impulse lines; Also provided with blow down/drain header. The material of accessories will be SS.

2.23.21 **Junction Boxes**

Wall/column mounted junction boxes having screwed terminals and cable entry only at the bottom and sealed with fire proof compound; The material of accessories will be SS. IP 54 or equivalent degree of protection for enclosure. Separate terminal blocks shall be used for analog and digital signals and also for signals with different voltages.

2.23.22 **Interposing 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 change over contacts rated for 0.2A 220 V DC. Free wheeling diode across relay coil and self reset type status indicator flag (electronic) shall be provided.

2.23.23 **System Cabinets**

Indoor located, free standing vertical type system cabinets with 3 mm thick sheet metal of cold rolled steel; double doors; antivibration pads of 15 mm thick; Fluorescent lighting; cooling fans in each cabinet fire proof compound for sealing cable entry; fire detector for each cabinet; space heater for each cabinet (strip type). Door locking facility shall be provided. Beacon lamp shall be provided in each row of 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 atleast 10% additional cards, to accommodate for engineering flexibility or future expansion.

	TITLE INSTRUMENTATION AND CONTROL SYSTEMS - CONTROL VALVES SPECIFICATION	SECTION: D SHEET 1 of 1															
<u>Control Valves</u> Balanced, modulating, globe type cage guided, diaphragm type of actuator, provision for hand wheel operation with accessories viz. Air filter regulator, air lock device, solenoid valve, position transmitters, limit switches. Valves shall be sized to have an opening of 15% at minimum flow condition and 85% maximum flow condition. Trim exit velocity shall be limited as per ISA standard. Anti – cavitation trims shall be used to limit trim velocity for all critical applications where flashing or cavitation is expected. Noise level shall not exceed 85 dBA at distance of about 1.5 M from the valve. In case of predicted noise level above 85 dBA, suitable low noise trim shall be provided. Noise abatement shall be obtained by valve body and trim design, and not by use of silencer. Leakage class for double seated valve shall not exceed 0.05% and single seated valve shall not exceed 0.01%. Either extended type bonnet or cooling fin type bonnet shall be provided for service above 200°C and for other service the bonnet type shall be standard. The end connections shall be socket welded for sizes below 50 NB and butt welded for sizes 50 NB and above. Flanged connection shall be provided for DM services. Water seal shall be provided for valves that could be subjected to below atmospheric conditions. Material of trim shall be minimum 316 SS with guide bushings of hardened SS such as 17-4 pH, 440C or 316SS Stellite faced. Valve stem shall preferably be of chrome plated 316 SS. The body material for control valves shall generally be as follows: <table> <tr> <td>HP/IP steam services</td><td>-</td><td>WC9</td></tr> <tr> <td>HP/IP Feed water services</td><td>-</td><td>WCC</td></tr> <tr> <td>DM water services</td><td>-</td><td>SS 316</td></tr> <tr> <td>Condensate, Spray water</td><td>-</td><td>WCB</td></tr> <tr> <td>LP feed water, LP steam, Gland steam, Air, Fuel, Gas and lube / control oil services</td><td></td><td></td></tr> </table>			HP/IP steam services	-	WC9	HP/IP Feed water services	-	WCC	DM water services	-	SS 316	Condensate, Spray water	-	WCB	LP feed water, LP steam, Gland steam, Air, Fuel, Gas and lube / control oil services		
HP/IP steam services	-	WC9															
HP/IP Feed water services	-	WCC															
DM water services	-	SS 316															
Condensate, Spray water	-	WCB															
LP feed water, LP steam, Gland steam, Air, Fuel, Gas and lube / control oil services																	
	ISSUE R0																



Technical specification for
CONTROL & INSTRUMENTATION
1X370 MW YELAHANKA CCPP

SPEC NO.: **PE-TS-409-145-I**

VOLUME

SECTION

REV. NO.

00

DATE : 25.04.2016

SHEET

OF

JUNCTION BOX SPECIFICATION

	TITLE: STANDARD TECHNICAL SPECIFICATION (CONTROL & INSTRUMENTATION)	SPECIFICATION NO. PES-145-070	
		VOLUME II B	
		SECTION D	
		REV. 00	DATE: 31.12.2008
		SHEET 2 OF 3	

JUNCTION BOXES (JB) METAL TYPE

01. The Junction box enclosures shall comprise of a case and cover/door constructed from cold rolled sheet steel of thickness 3 mm. The construction shall ensure adequate strength and rigidity. Junction boxes and pull boxes shall be hot dipped galvanized and confirm to meet IP 65 class as per IS : 2147 with providing all facilities as below .

02. The junction boxes shall also be meet the following minimum requirements :

a) Junction boxes shall be provided with lockable door on the front side. The locks of the junction boxes shall be(Industrial Type) identical and operable by one key . Top of the boxes shall be arranged to slope towards rear of the box. Junction box shall have gland plate of 3mm sheet at bottom for indoor mounted boxes with neoprene/synthetic gasket lining of 6mm thick including door lining also. Suitable industrial type hinges & MS handle shall be provided for opening of the boxes smoothly & able to take load of door without any trouble /hampering IP 65 protection class.

b) All the junction boxes shall be suitable for mounting on walls, columns, structures etc. The brackets, nuts, bolts, screws. Glands and lugs required for erection shall be included in Supplier's scope of supply.

c) M6 Ni plated brass earthing stud 3 nos (2 external & 1 inside the JB)shall be provided for each junction boxe.

d) Terminal blocks shall be of **Cage Clamp Terminal blocks of Wago/Phoenix Make suitable for 2.5 mm² cable shall be** properly arranged inside JB with end plate & end clamp in DIN rail mounted & marked up with TB nos from top to bottom to facilitate easy termination of the cables. Adequate space from left/right hand ,top/bottom side of wall of JB to TB end & in between TB's shall be min. **100mm** gap all around shall be provided.

e) 20 % Spare terminals shall be provided for each of the junction boxes distributed overall terminal blocks.

f) Construction details shall be as per enclosed drawing attached in page 03 of 03 of this technical requirements. The exact size and dimensions of junction boxes shall be as decided during detailed during detailed engineering stage keeping in view the nos of terminals required etc. The same shall be subject to approval during detailed engineering stage.

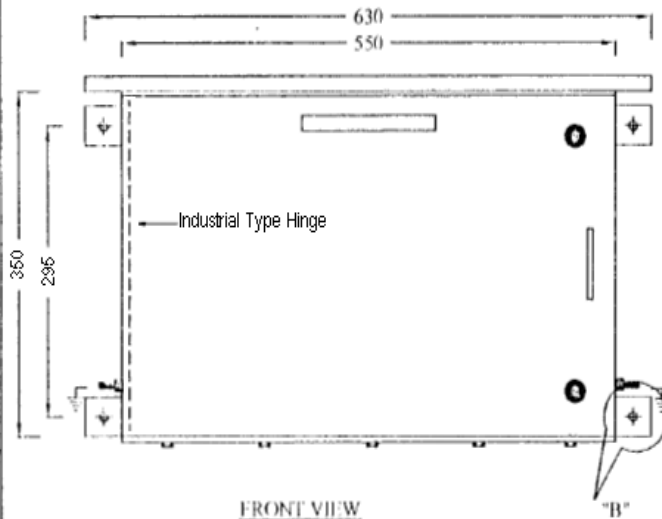
g) The Supplier shall furnish general arrangement, cross section details of junction boxes and the same shall be subject to BHEL/CUSTOMER's approval during detailed engineering stage.

h) The color of the Junction Boxes shall be Exterior Epoxy based to shade **Opaline Green to shade 275 of IS 5(Semi glossy)** , interior **brilliant white(Glossy)** & paint thickness shall be 100-150 micron.

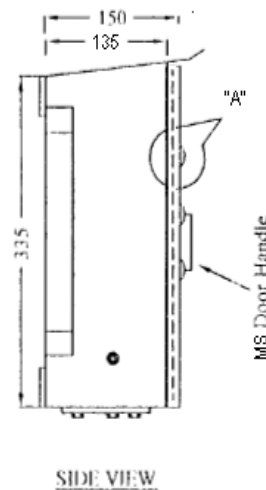
03 **REMARKS**
Subsequent to order, bidder to furnish filled in BOM schematics / GA drgs etc.

04 **TESTING**
High voltage & Insulation Resistance test. & IP 65 (if not conducted earlier)

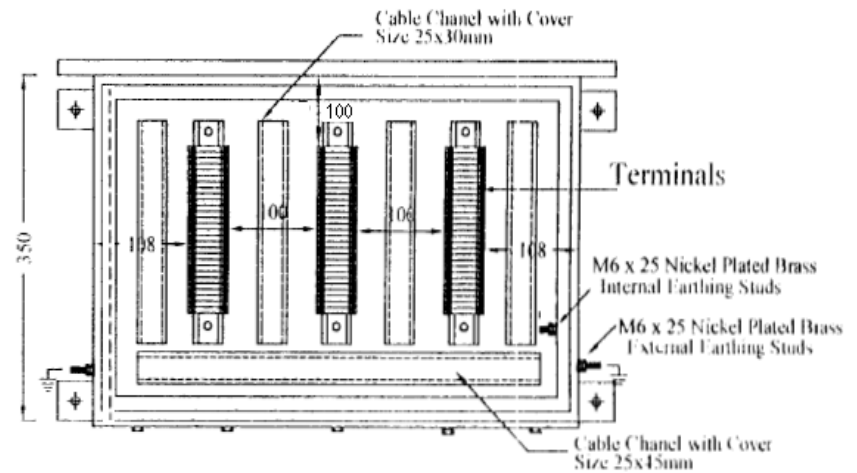
Typical Drg. for 72 Ways JB



FRONT VIEW



SIDE VIEW



OPEN DOOR VIEW

NOTE :

All Dimensions are in mm.

1) Sheet Thk . 3.0mm CRCA

2) Protection IP65

3) Paint :

a) Hot Dip Galvanizing.

b) External:- Epoxy based to shade Opaline Green to shade 275 of IS 5 (Semi glossy)

Internal:- Brilliant white (Glossy)

4) Panels are Wall mounting type with smooth finish.

5) All doors are open through hinged with handle & lock arrangement.

6) All doors , gland plate & removables are to be gasketed.

7) Fixing Bolts : 4 Set of zinc plated Fasteners each Set Consists of 1 No - M10 x 60mm Bolt , 1 No - Spring washer, 2 Nos Plain washer & 1 No - M10 nut.

8) Terminal blocks are be provided with number markers Continuously from top to Bottom

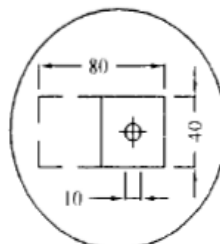
9) Paint thickness shall be 100-150 micron. 80-100 micron for Powder coating.

10) Door locks for all the boxes will have identical with a common key

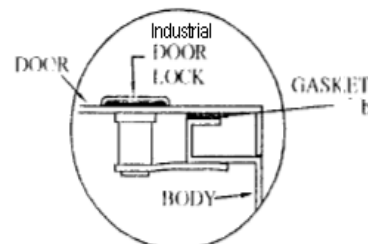
11) Quantity - As per scope of supply.



BOTTOM VIEW



VIEW "B"



VIEW "A"

BILL OF MATERIAL

Sl	Description	Make	Qty
1	2.5 Sq.mm Cage Clamp type With 6.6 Polyamide Terminal block	WAGO / Phenix	87 Nos.

Rev	Drw	Name	Date	Sign	Customer Project	Title	Sheet No. - 01/01	Rev
01	Ckd.					GA FOR 72 WAY JUNCTION BOX	Scale - N.T.S.	01
	Appd.							



Technical specification for
CONTROL & INSTRUMENTATION
 1X370 MW YELAHANKA CCPP

SPEC NO.: **PE-TS-409-145-I**

VOLUME

SECTION

REV. NO.

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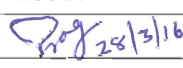
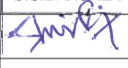
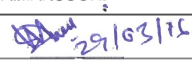
SHEET

OF

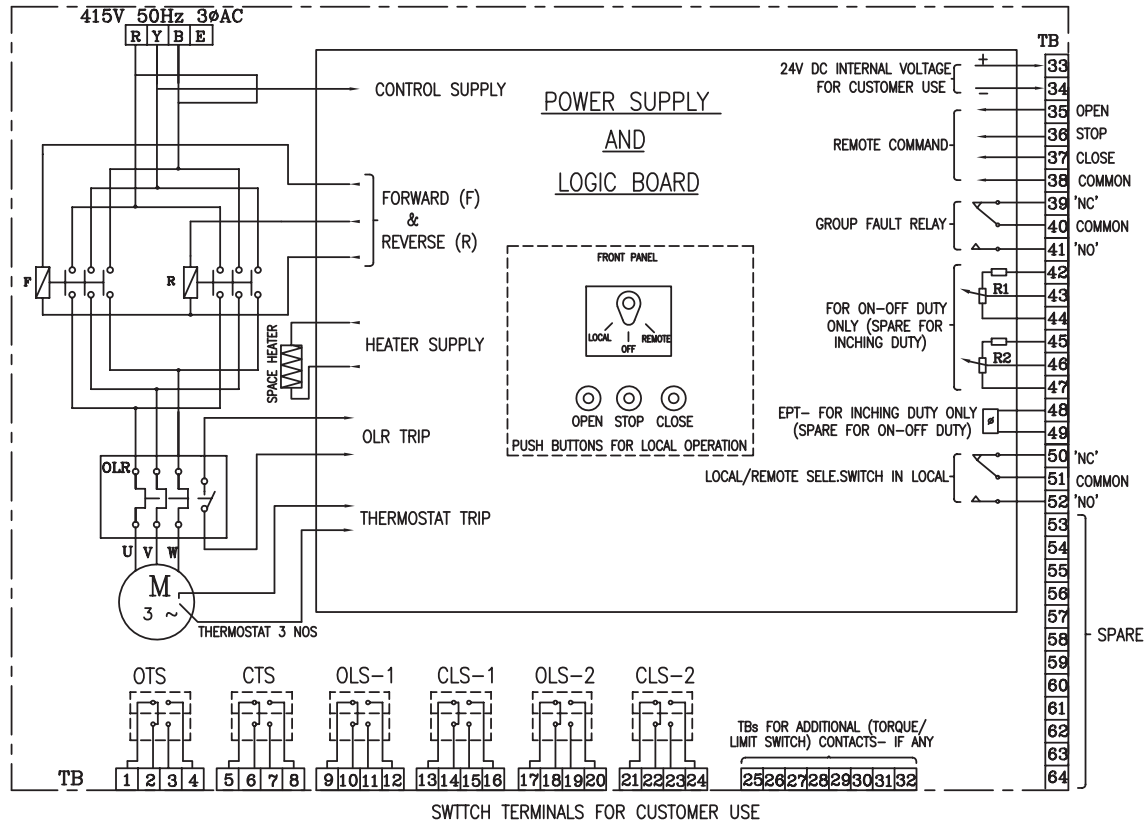
MOTOR OPERATED VALVE ACTUATOR DATASHEET

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-SS-999-145-I007	
			VOLUME II B	
			SECTION D	
			REV. NO. 03	DATE: 20.06.13
			SHEET 1	OF 3
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL*	* PROJECT	1x370 MW YELAHANKA CCPP		
	OFFER REFERENCE			
	* TAG NO. SERVICE			
	* DUTY	☒ ON / OFF	☒ INCHING	AS REQUIRED
	* LINE SIZE (inlet/outlet): MATERIAL			
	* VALVE TYPE	☒ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY		
	* OPENING / CLOSING TIME			
	* WORKING PRESSURE			
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%		
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY		
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY		
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY		
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, IP:55		
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL		
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.		
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.		
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING SERVICE - 150 STARTS/HR MINIMUM & FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM.		
HANDWHEEL	* REQUIRED	☒ YES ☐ NO		
	* ORIENTATION	☐ TOP MOUNTED ☒ SIDE MOUNTED		
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.			
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY		
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY		
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT- INCLUSIVE OF I.S. TOLERANCE		
	ACTUATOR APPLICABLE WIRING DIAGRAM	☒ ENCLOSED (BIDDER TO CONFIRM) A: ☒ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ☐ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram		
	* COLOUR SHADE	☐ BLUE (RAL 5012) ☐		
	PAINT TYPE (## Refer Notes)	☐ ENAMEL ☐ EPOXY ☐		
	SHAFT RPM	BIDDER TO SPECIFY		
	OLR SET VALUE	BIDDER TO SPECIFY		
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY		
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY		
	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC		
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V		

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-SS-999-145-I007		
			VOLUME II B		
			SECTION D		
			REV. NO. 03	DATE: 20.06.13	
			SHEET 2	OF 3	
Data Sheet A & B					
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)		
	@ ENCLOSURE CLASS OF MOTOR	☒ p IP 67 ☐ FLAME PROOF			
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B			
	@ WINDING TEMP PROTECTION	☒ THERMOSTAT (3 Nos.,1 IN EACH PHASE) ☐			
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED			
INTEGRAL STARTER	INTEGRAL STARTER	☒ REQUIRED ☐ NOT REQUIRED			
	TYPE OF SWITCHING DEVICE	☒ CONTACTORS ☐ THYRISTORS			
	TYPE	☒ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)			
	IF SMART				
	a) SERIAL LINK INTERFACE	☐ INTEGRAL ☐ FIELD MOUNTED			
	b) SERIAL LINK PROTOCOL	☐ FOUNDATION FIELD-BUS ☐ PROFI-BUS ☐ DEVICE NET ☐			
	c) SERIAL LINK MEDIA	☐ TWISTED PAIR Cu-CBL ☐ CO-AXIAL Cu-CBL ☐ OFC			
	d) HAND HELD PROGRAMMER	☐ REQUIRED ☐ NOT REQUIRED			
	e) TYPE OF HAND HELD PROGRAMMER	☐ BLUETOOTH ☐ INFRARED ☐			
	f) MASTER STATION	☐ REQUIRED ☐ NOT REQUIRED			
	g) MASTER STN INTRFACE WITH DCS	☐ MODBUS ☐ TCP/IP			
	h) DETAILS OF SPECIAL CABLE	☐ ENCLOSED ☐ NOT REQUIRED			
	STEP DOWN CONT. TRANSFORMER	☒ REQUIRED			
	OPEN / CLOSE PB	☒ REQUIRED ☐ NOT REQUIRED			
	STOP PB	☒ REQUIRED ☐ NOT REQUIRED			
	INDICATING LAMPS	☒ REQUIRED ☐ NOT REQUIRED			
	LOCAL REMOTE S/S	☒ REQUIRED ☐ NOT REQUIRED			
	STATUS CONTACTS FOR MONITORING	☒ REQUIRED ☐ NOT REQUIRED			
INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY)				
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	☒ INTERPOSING RELAY ☐ OPTO COUPLER ☐ EITHER			
	QUANTITY	☒ 2 NOS. ☐ 3 NOS.			
	DRIVING VOLTAGE	☒ 20.5 – 24V DC ☐ _____ V DC			
	DRIVING CURRENT	☒ 125mA MAX ☐ _____ mA MAX			
	LOAD RESISTANCE	☒ > 192 ohms - <25 k ohms ☐ > _____ ohms - < _____ ohms			
TORQUE SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY			
	OPEN / CLOSE	☒ 1 No. ☐ 2Nos. / ☒ 1 No. ☐ 2Nos			
	CONTACT TYPE	2 NO + 2 NC			
	RATING	5A 240V AC AND 0.5A 220V DC			
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE			
	ACCURACY	+3% OF SET VALUE			
LIMIT SWITCH (Not Applicable for Smart Actuator) (\$\$ Refer Notes)	MFR & MODEL NO.	BIDDER TO SPECIFY			
	OPEN : INT : CLOSE	☒ 1 No ☐ 2 Nos.	2 Nos. (ADJ.)	☒ 1 No. ☐ 2Nos.	
	CONTACT TYPE	2 NO + 2 NC			
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC			

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-SS-999-145-1007	
			VOLUME II B	
			SECTION D	
			REV. NO. 03	DATE: 20.06.13
			SHEET 3	OF 3
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)	☐ REQUIRED ☐ NOT REQUIRED	AS REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY		
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ☒ ELECTRONIC (2 WIRE) CONTACTLESS		
	SUPPLY	☒ 24V DC ☐		
	OUTPUT	☒ 4-20mA		
	ACCURACY	± 1% FS		
SPACE HEATER	@SPACE HEATER	REQUIRED		
	@ POWER SUPPLY (NON INTEGRAL)	230V AC, 1 PH., 50 Hz		
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY		
	@ RATING			
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED		
	ENCL CLASS ACTUATOR/MOTOR T.B.	@ ☐ IP 68 @ ☐		
	@ EARTHING TERMINAL	REQUIRED		
	PLUG & SOCKET (9 PIN) (FOR COMM, LS/TS FEED BACK, PoT)	☐ REQUIRED ☒ NOT REQUIRED ☐ 2 NOS. ☐		
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:		
	@ SPACE HEATER CABLE GLAND	SIZE:		
	OTHER CONTROL CABLE GLANDS-1	☐ 1No. for BFV of CW PUMP (Cable size 2Px1.5mm2)		
	OTHER CONTROL CABLE GLANDS-2	QUANTITY & SIZE :		
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY		_____ Kg.
NOTES: 1. SCOPE: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY. 2. CODES & STANDARDS: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH: IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722 3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C. 4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED. 5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE. 6. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%. 7. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING. \$\$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE. ## EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.				
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	VENDOR COMPANY SEAL
	PRAG JAIN	S.S.BANSALA	M.A.MANSOORI	NAME
				SIGNATURE
	28.03.2016	28.03.2016	28.03.2016	DATE
NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @ = TO BE FILLED BY ES				

DRAWING NO. 3-V-MISC-24227



CONTACT DEVELOPMENT DIAGRAM

OTS	1-2	OPEN AT OVER TORQUE DURING OPENING TRAVEL			
	3-4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL			
CTS	5-6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL			
	7-8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL			
OLS-1	9-10				
	11-12				
CLS-1	13-14				
	15-16				
OLS-2	17-18				
	19-20				
CLS-2	21-22				
	23-24				
SWITCH	TERMINAL NO.	FULL OPEN	INTERMEDIATE		FULL CLOSE
		a	b		
VALVE POSITION					
 INDICATES CONTACT CLOSED					
 INDICATES CONTACT OPEN					
CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC					

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH

VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF 100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	CLS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CTS	#
# - CLS NOT TO BE CONNECTED IN TRIP CIRCUIT				
* - BYPASS OTS FOR INITIAL 5% OF TRAVEL (FOR GATE VALVES ONLY)				

NOTE:-

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

REV	DATE	ALTERED
		CHD & APPD

CAUTION: The information on this document is the property of BHARAT HEAVY ELECTRICALS LTD. It must not be used directly or indirectly in any way detrimental to the interest of the company.

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

		BHARAT HEAVY ELECTRICALS LTD.,		DRN	NAME	SIGN	DATE	NO. OF VAR.
365-121		UNIT: HIGH PRESSURE BOILER PLANT.		CHD	D.DINAKARAN	D.D	07.10.04	
		TIRUCHIRAPALLI-620014.		APPD	K.ARUNACHALAM	K.A	07.10.04	
DEPT	VL		SCALE	WEIGHT (KG).	REFERENCE INFORMATION			NO. OF ITEMS
CODE								
TITLE				CARD CODE	DRAWING NO.			REV
WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER				U 01	3-V-MISC-24227			0

Size A3



Technical specification for
CONTROL & INSTRUMENTATION
 1X370 MW YELAHANKA CCPP

SPEC NO.: **PE-TS-409-145-I**

VOLUME

SECTION

REV. NO.

00

DATE : 25.04.2016

SHEET

OF

Instrumentation Check list



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

CHECK LIST FOR PRESSURE SWITCH

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

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

Note :

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



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

CHECK LIST FOR TRANSMITTER

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

Legend :

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

Note :

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



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

CHECK LIST FOR PRESSURE & DP GAUGE

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

Legend :

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

Note :

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



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

CHECK LIST FOR LEVEL GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS / DRWGS	P	W	V	
	TYPE						
	MODEL/ TAG NO.						
	DAIL SIZE						
	RANGE/SCALE						
	END CONNECTION						
2	DIMENSIONS, PROCESS CONNECTION	ONE / LOT		P	W	V	
3	ACCURACY			P	W	V	
4	MATERIAL TC FOR			P	V	V	
	BODY ISO.						
	VALVE						
	GAUGE GLASS						
5	HYD. TEST	SEE NOTE-1 BELOW		P	W	V	
6	ACCESSORIES AS APPLICABLE			P	W	V	

Legend :

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

Note :

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



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

CHECK LIST FOR ANNUNCIATORS

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

Legend :

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

Note :

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



Technical specification for
CONTROL & INSTRUMENTATION
1X370 MW YELAHANKA CCPP

SPEC NO.: **PE-TS-409-145-I**

VOLUME

SECTION

REV. NO.

00

DATE : 25.04.2016

SHEET

OF

APPLICABLE CABLE TYPES

CABLE SIZES FOR 1X370 MW CCPP AT YELHANKA	
Sl no.	Cable Type
G-TYPE	
1	2P X 0.5 sqmm
2	4P X 0.5 sq mm
3	8P X 0.5 sqmm
F-TYPE	
1	4P X 0.5 sqmm
2	8P X 0.5 sqmm
3	12P X 0.5 sqmm
4	20P X 0.5 sqmm
CONTROL CABLE	
1	3C X 2.5 sqmm



SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A	
VOLUME	II B
SECTION	D
REV. NO. 03	DATE : 16-09-2013
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1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site, **supervision, erection, and commissioning at site** of Local Panels required for control and monitoring of the 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 : 1998 : Code of practice for phosphating of iron and steel.
- b) IS-5 : 2007 : Colors for ready mixed paints and enamels.
- c) IS-1248:2003 : Direct Acting Indicating Analog Elec Measuring Instruments.
- d) IS/IEC 60947:Part 1:2004 : Low Voltage switchgear & control gear: Part-I (General Rules)
- e) IS-8828:1996 : Circuit breaker for household and similar installations.
- f) IS-13947 (Part-I):1993 : Low Voltage switchgear & control gear : Part-I (General Rules)
- g) ISA-18.1:1979 : Annunciator Sequences and Specification
- h) NFPA-496:2003 : Purged & Pressurised Enclosure for Electrical Equipment in Hazardous Locations.

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

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

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

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

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel

Frame thickness: Not less than 3.0mm

Enclosure thickness: Not less than 2.5 mm for load bearing sections (Mounted with instruments)
1.6 mm for doors and Not less than 2.0 mm for others

Panel Height: Not less than 2365 mm (Refer data sheet-A (No. PES-145A-DS1-0)

Gland plate thickness: 3.0mm

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

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

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



SPECIFICATION FOR LOCAL PANELS

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- 3.1.7 The class of protection shall be in accordance with IP-42 unless otherwise specified in the data sheet – A (No. PES-145-54A-DS1-0).
- 3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as given in data sheet-A (No. PES-145A-DS1-0). Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.
- 3.1.9 The cable glands of the required size and type as given in data sheet-A (No. PES-145A-DS1-0) shall be supplied alongwith the Panel.
- 3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function. No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.
- 3.1.11 Single / dual control power supply feeders of voltage class as specified in data sheet-A (No. PES-145A-DS1-0) shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.
- 3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm² size. AC & DC wires shall be kept separate from each other. Separate coloured wires to be used for AC and DC circuits. All wires shall be properly numbered and identified with ferrules as per the Control scheme / wiring diagram. Wires shall be routed and run through PVC troughs.
- 3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm² to 2.5mm² external cables. **The TB points in terminal block shall be cage clamp type / screw type.** The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm **height from finished floor. The panel shall have ten (20) percent spare terminal.**
- 3.1.14 The interior of each panel shall be suitably illuminated through fluorescent **lamps / tube lights with shrouded cover of minimum 15W** operable on 240V 50 Hz AC power supply through panel door switch. A 15 Amp. 3-pin Power receptacle shall be provided.
- 3.1.15 Suitable space heaters operable on 240 Volts 50 Hz AC power system shall be provided at the panel bottom. These shall be designed to maintain the panel temperature five (5) deg. C above the ambient temperature during maintenance shutdown. Suitable isolating and control devices comprising of MCB, thermostat etc. shall be provided for the space heater.
- 3.1.16 The panel shall be provided with a copper earth bus of 25 x 6 mm size running throughout the width of the panel. It shall be terminated internally with 10 mm bolts at extreme ends for connection to; main station earth. The panel mounted equipments / devices shall be connected to earth bus through green coloured PVC insulated stranded copper conductor of 2.5 mm² size.
- 3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte



SPECIFICATION FOR LOCAL PANELS

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Sheet / 2 mm Anodised Aluminium Plate. The inscription shall be with white letters on black background on traffolyte sheet. The labels shall be fixed by self tapping non-rusting screws.

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

3.2 Hazardous Area Panel Requirement

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

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

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

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

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

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

3.3 Control & Monitoring devices

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

3.3.2 Alarm Annunciator System

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

3.3.3 Relays

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

3.3.4 Timers

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



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3.3.5 Control / Selector Switches

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

3.3.6 Push Buttons / Indicating Lights

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

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

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

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

3.3.7 Ammeters

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

3.3.8 Miniature Circuit Breaker (MCB)

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

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

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

4.0 TESTING AND INSPECTION

4.1 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.



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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



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5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

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

5.2. Mandatory Spares

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

5.3. Recommended Spares

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

6.0 DRAWINGS AND DOCUMENTS

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

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

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

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

7.0 MARKING AND PACKING

7.1 Panel with all instruments / devices mounted on it shall be suitably packed & protected for the entire period of 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 no. PES-145A-DS1-0 |
| - Data sheet C for Local Panels | : | Data sheet no. PES-145A-DS2-0 |

	DATA SHEET FOR LOCAL PANELS		SPECIFICATION NO.: PE-SS-999-145-054A	
			VOLUME	
			SECTION	
			REV. NO. 02	DATE: 16.09.2013
			SHEET 1	OF 3
TAG No. Qty.....			Data Sheet No.: PES-145A-DS1-0	
Data Sheet A & B				
DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL	MANUFACTURER			
	CONSTRUCTION		☒ FOLDED ☐ WELDED	
	ENCLOSURE SHEET THICKNESS (As per Section 8.13, Volume V of contract specification)	FRONT	☐ 2.0 mm	
		OTHER	☐ 2.0 mm	
		DOOR	☐ 1.6 mm	
		HEIGHT	☐ 2365 mm for stand alone panels. ☐ Other	
	OTHER	☐ Load bearing sheet front shall have 3mm thickness		
TECHNICAL	INPUT POWER SUPPLY * (As per Electrical specification) (ANY OTHER POWER REQUIREMENT TO BE DERIVED FROM THIS SUPPLY ONLY)		☒ 240V 50 Hz AC ☐ 220V DC ☒ 415V 3 PHASE W ☐ 400V 3 PHASE W	
	NO. OF FEEDERS (As per Electrical specification)		☒ ONE ☐ TWO	
	STARTER WITH MCC		☐ REQUIRED ☒ NOT REQUIRED	
	IPR POSITION		☒ MCC ☐ RELAY PANEL	
	CONTACT RATING OF RELAY		☒ 5 Amp, 230 V AC ☒ 0.25 Amp, 220V DC	
	CONTROL SUPPLY		☐ 110V AC ☐ 220V AC ☐ 220V DC ☐ Other. (As per requirement)	
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		<u>20</u> NOS. (AS REQUIRED)	
	TEMP SCANNER (IF REQUIRED –NO. OF CHANNELS TO BE SPECIFIED UNDER SEC-C)		☐ REQUIRED ☒ NOT REQUIRED	
	PAINT TYPE (As per Annex-1, Section 7.6, Volume IV of contract specification)		☐ EPOXY ENAMEL ☐ EPOXY POWDER COATED	
	MIMIC (TYPE OF MIMIC- MATERIAL, THICKNESS TO BE SPECIFIED DURING DETAILED ENGG.)		☒ REQUIRED ☐ NOT REQUIRED	
	PANEL COLOUR (EXTERNAL) (As per Annex-1, Section 7.6, Volume IV of contract specification)		☐ LIGHT GREY ☐ OPALINE GREEN	
	FINISH (EXTERNAL) (As per Annex-1, Section 7.6, Volume IV of contract specification)		☐ MATT ☒ GLOSSY ☐ SEMI GLOSSY	
	PANEL COLOUR (INTERNAL) (As per Annex-1, Section 7.6, Volume IV of contract specification)		☐ WHITE ☐ CREAM ☒ OFF WHITE	
	FINISH (INTERNAL) (As per Annex-1, Section 7.6, Volume IV of contract specification)		☒ MATT ☐ GLOSSY ☐ SEMI GLOSSY	
	CLASS OF PROTECTION		☒ IP-55 (FOR INDOOR SERVICE) ☒ IP-67 (FOR OUTDOOR SERVICE) ☐ ANY OTHER	
	CONTROL HARDWARE		☒ RELAY BASED	
	FOUNDATION ARRANGEMENT		☐ FOUNDATION BOLTS ☐ ANCHOR FASTENERS	
	WEIGHT OF PANEL (Kg.)		(Vendor to specify)	

	DATA SHEET FOR LOCAL PANELS		SPECIFICATION NO.: PE-SS-999-145-054A	
			VOLUME	
			SECTION	
			REV. NO. 02	DATE: 16.09.2013
TAG No. Qty.....		Data Sheet No.: PES-145A-DS1-0		
Data Sheet A & B				
DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
	PANEL TYPE	☐ PRESSURISED ☐ UNPRESSURISED As per Requirement		
	CABLE GLAND	☒ DOUBLE COMPRESSION		
	AMMETER (TYPE OF INPUT) *	☐ 1 Amp CT ☐ 4-20 mA		
	SCOPE OF SUPERVISION FOR ERECTION & COMMISSIONING	☐ APPLICABLE ☒ NA		
	* TO BE CO-ORDINATED WITH PEM ELECTRICAL			
NAME	PREPARED BY AANCHAL CHOUDHARY	CHECKED BY SACHIN SRIVASTAVA	APPROVED BY MA MANSOORI	COMPANY SEAL NAME: SIGNATURE: DATE:
DESIGNATION	SR.ENGR	DY.MNGR	D. GM	
SIGNATURE				
DATE	16.09.2013	16.09.2013	16.09.2013	



DATA SHEET FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS-999-145-054A

VOLUME

SECTION

REV. NO. 02

DATE: 16.09.2013

SHEET 3 OF 3

TAG No. Qty.....

Data Sheet No.: PES-145A-DS1-0

Data Sheet C

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

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

	DATA SHEET FOR LOCAL PANELS			SPECIFICATION NO.: PE-SS-999-145-054A	
				VOLUME	
				SECTION	
				REV. NO. 02	DATE: 16.09.2013
TAG No. Qty.....			Data Sheet No.: PES-145A-DS1-0		
Data Sheet C					
DATA SHEET-C FOR LOCAL PANEL (TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)					
	PANEL TYPE				
	CABLE GLAND				
	AMMETER (TYPE OF INPUT)				
	SCOPE OF SUPERVISION				
NAME SIGNATURE DATE	PREPARED BY		CHECKED BY		APPROVED BY
	AANCHAL CHOUDHARY		SACHIN SRIVASTYAVA		MA MANSOORI
	16.09.2013		16.09.2013		16.09.2013
					COMPANY SEAL NAME: SIGNATURE: DATE:



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT

SPEC NO: PE-TS-409-156-A008

VOLUME: IIB

SECTION:

REV NO: 00

DATE:

ANNEXURES TO SECTION C

**TITLE:**

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-I)

SPEC NO: PE-TS-409-156-A008

**LIST OF MAKES OF SUB-VENDOR ITEMS
(INDICATIVE)**



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-I)

SPEC NO: PE-TS-409-156-A008

SR No.	Items	Approved Vendor	Place / Location	Remarks
3.0	Strainers (Y-Type & Basket Type)	Multitex Filtration Engg Ltd.	Noida	
		Sarojini Enterprises	Kolkata	
		Otoklin Filters	Mumbai	
		BHATIA ENGINEERING CO.	Delhi	
		JAYPEE INDUSTRIES PVT. LTD.	Delhi	
		FILTRATION ENGINEERS (I) PVT. LTD.	MUMBAI	
		OTOKLIN GLOBAL BUSINESS LIMITED	Mumbai	
		SUNGOV Engg. PVT. LTD.	Delhi	
		Grand Prix	Faridabad	
4.0	Fittings (metallic)	M.S. Fittings	Kolkata	
		Metal Iloyds	Mumbai	
		True Forge	Faridabad	
		Tube Products	Baroda	
		NL Hazra	Kolkata	
		Gujrat Infra Pipes	Baroda	
		Edwards	USA	
		Pipefit Engineers	Baroda	
		Siddarth & Gautam	Faridabad	
		EBY	Mumbai	
		Reliance Forge	Mumbai	
5.0	MS/GI ERW Pipes	SAIL	Rourkela	
		Jindal	Ghazibad/ Hissar	Upto 300 NB ERW Pipes as per IS 1239/3589
		Surya Roshni	Bahadur Garh	Upto 400 NB ERW Pipes as per IS 1239/3589 and SAW as per IS 3589
		TATA Tube	Jamshedpur	Upto 150 NB ERW Pipes as per IS 1239
		PSL	Chennai/Vizag/Kutch/Daman	Spiral Weld SAW as per IS 3589
		Lalit Profile	Thane	Spiral Weld SAW as per IS 3589
		Samshi Pipes Industries	Vadodara	Spiral Weld SAW as per IS 3589
		Mukut Pipes	Rajpura	Longitudinal SAW (Single side weld) as per IS 3589
		Indus Tubes	G B Nagar	Upto 300 NB ERW Pipes as per IS 1239/3589
		Mann Ind	Indore	Spiral Weld SAW as per IS 3589
		Surendra Engg	Rajpura	Spiral Weld SAW as per IS 3589
		Pratibha Pipes & Structure Pvt Ltd	Thane	Spiral Weld SAW as per IS 3589



TITLE:

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(ANNEXURE-I)

SPEC NO: PE-TS-409-156-A008

		JCO Gas Pipe	Chindwara	Spiral Weld SAW as per IS 3589
		Nukat Tanks and Vessels	Tarapur	Longitudinal SAW (Single side weld) as per IS 3589
		DADU Pipes	Sikrandrabad	Upto 300 NB ERW Pipes as per IS 1239/3589
		Good Luck Tubes	Sikandrabad	
		Advance Steel Tubes	Sahibabad	
		Bihar Tubes	Sikandrabad	
		Hi Tech Pipes	Sikandrabad	
		Ratnamani	Kutch/Ahmedabad/Chhatral	Upto 400 NB ERW Pipes as per IS 3589 and SAW as per IS 3589
		Maharashtra Seamless	Raigad	200-500 NB ERW Pipes as per IS 3589
		Welspun	Anjar/Bharuch	Upto 400 NB ERW Pipes as per IS 1239/ 3589 and SAW as per IS 3589
6.0	Seamless Pipes	ISMT	Ahmednagar/Baramati	
		Maharashtra Seamless	Raigad	
7.0	S.S. Pipes (For small Quantity 500 m)	REMI	Mumbai	
		Ratmani	Ahmedabad	
		Apex Tubes	Behror	
		Choksi	Ahmedabad	
8.0	CI Gate/ Globe/NRV/ SRV (Manual and motorized)	H.Sarkar	Howrah	SIZE UPTO 300NB
		A.V. VALVES LTD	Agra	
		Leader	Jalandhar	
		SURYA VALVES AND INSTRUMENTS MFG CO.	Chennai	FOR GV UPTO 450NB, GLV UPTO 300NB AND CHECK VALVES UPTO 350NB.
		ATAM VALVES PVT. LTD.	JALANDHAR	(1) CARBON IRON GATE VALVES: 65 NB TO 450 NB (UPTO PN-16.0) (2) CARBON IRON GLOBE VALVES & NON RETURN VALVES: 65 NB TO 150 NB (UPTO PN-16.0)
		FLUIDLINE VALVES COMPANY PVT.LTD.	Mumbai	1. CI Gate- CL125 & up to 900 NB, 2. CI Globe- CL125 & up to 450 NB, 3. CI SCNRV- CL125 & up to 600 NB.



TITLE:

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SPEC NO: PE-TS-409-156-A008

		G.M. DALUI AND SONS PVT.LTD.	Howrah	
		KBL	Kondhapuri	Additionally approved for FM approved Gate valve 50-250 NB
		Bankim	Kolkata	
		VENUS PUMPS AND ENGG. WORKS	Kolkata	1) CI GATE VALVE SIZES 65NB-800NB ,2) CI GLOBE VALVE FOR SIZES 65NB-400 NB AND 3) CI SCNRV FOR SIZES 65 NB -600 NB.
9.0	GM valve	A.V. VALVES LTD	Agra	
		ATAM VALVES PVT. LTD.	Mumbai	GUN METAL GATE/GLOBE/NRV: 15 NB TO 50 NB (UPTO PN-16.0) & 15 NB TO 50 NB (UPTO #150)
		Leader	Jalandhar	
		VALTECH INDUSTRIES		GUN METAL SCREWED END TYPE , SCREWED IN BONNET , OUT SIDE SCREW & YOKE TPE , PN 16 , SIZES UPTO 50.
		SANT VALVES PVT. LTD.	Jalandhar	UP TO SIZE 100-NB ONLY.
10.0	Solenoid Valve	Rotex	Baroda	
		Avcon	Mumbai	
		Asco	Chennai	
		SMC	Noida	
		Nucon	Hyderabad	
		Rotex	Baroda	
		Avcon	Mumbai	
11.0	PLC Based Panels	SIEMENS	Nasik	
		SCHNEIDER	Nasik	
		ROCKWELL	Sahibabad	
		GE Intelligent Platform	BANGALORE	
		Honeywell Automation India Limited	Pune	
		ABB	Bangalore	
		SIEME	Nasik	
		SCHNEIDER	Nasik	
12.0	Battery (Ni Cd for PLC)	Amco saft	Bangalore	
		HBL Power System	Hyderabad	
		SAFT	France/Sweden	
13.0	Motor	Marathon,	kolkata	For HT and LT motor
		Crompton Greaves	Ahmednagar	For HT and LT



TITLE:

**KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-I)**

SPEC NO: PE-TS-409-156-A008

				motor
		NGEF	Bangalore	Upto 15 KW
		ABB	Bangalore/Faridabad	Upto 200 KW
		Siemens	Mumbai	For HT and LT motor
		Jyoti	Baroda	For LT motor only
		LHP	Solapur	Upto 120 KW
		BHEL	Bhopal	For HT motor only
		Bharat Electric (BHEL)		For LT motor only
		Bharat Bijlee	Mumbai	Upto 160 KW(For LT motor only)
		KEC	Bangalore/Hubli	Upto 90 KW
14.0	Battery (maintenance free for PLC/ Fire Alarm Panel)	EXIDE	Kolkata	
		HBL Power System	Hyderabad	
		AMAR RAJA	Tirupati	
15.0	Steel Plate, Structural Steel and section for Fire water storage tank	SAIL		
		Essar Steel		
		TISCO		
		RINL		
		Jindal		
		Lloyd		
		Ispat		
		Indian Iron & Steel Co. Ltd		
16.0	Pressure Gauge/DP Gauge	Gluck (I) Manufacturing Co	Mumbai,	
		H Guru	Rishra/Muzaffarpur/Bangalore	
		AN Instruments	Kolkata	
		ASHCROFT INDIA PVT LTD.	GIDC Chhatral Kalol	
		FORBES MARSHALL (HYD) LTD.	HYDERABAD	
		GAUGE BOURDON INDIA PVT. LTD.	Mumbai,	
		H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	BANGALORE	
		WIKA	Pune	
		Manometer India	Mumbai,	
		Baumer Technologies India Pvt. Ltd.	VAPI	
		GIC(Gauges Bourdon)	Panvel	
17.0	Pressure/DP/Vacuum Switch	Indfoss	Ghaziabad	
		SOR	USA	
		Dressor	USA	
		Delta control	UK	
		Trafag	Ranipet	
		GIC(Gauges Bourdon)	Panvel	
		ASHCROFT INDIA PVT LTD.	USA/GERMANY	
		Switzer	Chennai	


TITLE:

**KARNATAKA POWER CORPORATION LIMITED
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SPEC NO: PE-TS-409-156-A008

18.0	Level Switch (Float/Displacer)	DK Instruments	Kolkata	
		Levcon	Kolkata	
		Sigma	Mumbai	
		V-Automat	New Delhi	
		SBEM	Pune	
		Flow Star	Faridabad	
19.0	Level Indicator	Flow Star	Faridabad	
		Scientific Devices	Mumbai	
		Gauges Bourden	Panvel	
		SBEM	Pune	
		Pune Techtrol	Pune	
		Levcon	Kolkata	
		Sigma	Mumbai	
		V-Automat	New Delhi	
		DK Instruments	Kolkata	
20.0	OWS/PC	HP/Compaq /Dell/HCL/IBM/Lenovo		
21.0	Printer	HP/Cannon/Epson/Xerox/IBM/ Lexmark		
22.0	UPS	HITACHI-HIREL	Gandhinagar	
		APC	Bangalore	
		Delta	Gurgaon	
		Emerson	Mumbai	
		DB Power	Pune	
		Aplab	Mumbai	
23.0	Control / Power Cable	Cords Cable	Bhiwadi	
		Radiant Cables	Hyderabad	
		PolyCab	Daman	
		KEI	Bhiwadi	
		Nicco	Kolkata	
		Ravin Cables	Pune	
		Incab	Pune	
		HVPL	Faridabad	
		Torrent cable	Nadiad	
		Havells	Alwar	
		Paramount	Khushkhhera	
		SRI Ram Cables	Bhiwadi	
		Thermocables	Hyderabad	
		Torrent cable	Nadiad	
		Universal Cables	SATNA	
		Gemscab	Bhiwadi	
		Delton	Faridabad	
24.0	Battery Charger for PLC/Diesel Engine	Chloride Power	Kolkata	
		Chabbi	Jalgaon	
		AMAR RAJA	Tirupati	
		Statcon	Noida	
		HBL Power System	Hyderabad	



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SPEC NO: PE-TS-409-156-A008

		Dubas	Bangalore	
		Caldyne	Kolkata	
25.0	Fibre Optic Cable	Birla Ericsson	Rewa	
		Finolex	Pune/Goa	
		Aksh Fibre	Bhiwadi	
26.0	Pressure Transmitter and Diff. pressure Transmitter	Emerson	USA/Pawane	
		Laxons Automation	Daman	
		YIL	Bangalore	
		Siemens	Thane	
		Fuji	China	
		Yokogawa	Japan	
		Honeywell	USA/Pune	
27.0	Level Transmitter	ABB LIMITED		
		Endress + Hauser (India) Pvt. Ltd.,		
		Moore Industries International Inc.		
		NIVO CONTROLS PVT. LTD.		
		Pune Techtrol Pvt. Ltd.		
		EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.		
		SIEMENS LIMITED		
		SMART INSTRUMENTS LTD, BRAZIL		
		SBEM PVT. LTD.		
		Honeywell Automation India Limited		
		TOSHNIWAL INDUSTRIES PVT. LTD.,		
		V. AUTOMAT & INSTRUMENTS (P) LTD.		
		YOKOGAWA INDIA LIMITED,		
28.0	AGITATOR	REMI	MUMBAI	
		FIBRE & FIBRE PRODUTS		
		STANDARD ENGINEERS	MUMBAI	
		CROMPTON GREAVES	AHAMADNAGAR	
29.0	ORIFICE PLATE	MICRO PRECISION	FARIDABAD	
		INSTRUMENTAION LTD	PALGHAT	
		CARLO DYNAMICS	HYDRABAD	
30.0	BUTTERFLY VALVE	ADVANCE VALVES PVT. LTD.	NOIDA	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		INSTRUMENTATION LTD.	PALAKKAD-KERALA	
		INTERVALVE (INDIA) LTD.	PUNE	
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI	
		SURYA VALVES AND INSTRUMENTS MFG CO.	CHENNAI	


TITLE:

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SPEC NO: PE-TS-409-156-A008

		PENTAIR VALVES AND CONTROLS INDIA PRIVATE LIMITED	NAVI MUMBAI	
		UPADHAYA VALVES MANUFACTURERS PRIVATE LIMITED,	KOLKATA	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	
		WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD.	NEW DELHI	
31.0	DUAL PLATE CHECK VALVE	ADVANCE VALVES PVT. LTD.	NOIDA	
		ASIAN INDUSTRIAL VALVES & INSTRUMENTS.	CHENAI	
		FLUIDLINE VALVES COMPANY PVT.LTD.	GHAZIABAD	
		R AND D MULTIPLES (METAL CAST) PVT LTD	MUMBAI	
		VENUS PUMPS AND ENGG. WORKS	KOLKATA	
32.0	ELECTRICAL HOIST	ARMSEL MHE PVT. LTD	BANGALORE	
		ALPHA SERVICES	NEW DELHI	
		CONSOLIDATED HOISTS PVT LTD	PUNE	
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		EDDY CRANES PVT. LTD.	MUMBAI	
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD	
		GLOBAL TECHNOLOGIES	HYDERABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		LIFTING EQUIPMENTS AND ACCESSORIES	NEW DELHI	
		MANGLA HOISTS PVT LTD	NEW DELHI	
		REVA INDUSTRIES LTD.	FARIDABAD	
		ROCKWELL HOISTO CRANES PVT. LTD.	JHAJJAR-HARYANA	
		SAFEX ENERGY PVT. LTD.	AHMEDABAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA-	
33.0	INSTRUMENT FITTING	AURA INCORPORATED	NEW DELHI	
		ASTEC VALVES & FITTINGS PVT. LTD.,	MUMBAI	
		ARYA CRAFTS & ENGINEERING PVT. LTD.	MUMBAI	
		COMFIT & VALVE PVT. LTD.	AHMEDABAD	
		FLUIDFIT ENGINEERS PVT. LTD.	MUMBAI	
		FLUID CONTROLS PVT. LTD.	MUMBAI	
		HP VALVES & FITTINGS INDIA PVT. LTD.	CHENNAI	
		PRECISION ENGINEERING INDUSTRIES	MUMBAI	
		PANAM ENGINEERS,	MUMBAI	
		PERFECT	MUMBAI	



TITLE:

KARNATAKA POWER CORPORATION LIMITED
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TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-I)

SPEC NO: PE-TS-409-156-A008

		INSTRUMENTATION CONTROL (INDIA) PVT. LTD.		
		VIKAS INDUSTRIAL PRODUCTS	NOIDA	
34.0	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	MUMBAI	
		FLEXPRO ELECTRICALS PVT. LTD.	GUJARAT	
		K.S.INSTRUMENTS PVT.LTD.	BANGLORE	
		SUCHITRA INDUSTRIES	BANGLORE	
		SHRENIK & COMPANY,	GUJARAT	
35.0	ROTAMETER	EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.	PUNE	
		FLOW STAR ENGINEERING PVT. LTD.,	FARIDABAD	
		FLOWTECH INSTRUMENTS SERVICRS	GUJARAT	
		INSTRUMENTATION ENGINEERS PVT LTD	HYDERABAD	
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	NAVI MUMBAI	
36.0	SIGHT FLOW INDICATORS	B.K.EQUIPMENTS PVT.LTD.	CHENNAI	
		BLISS ANAND PVT. LTD.	GURGAON	
		FLOWTECH INSTRUMENTS SERVICRS	GUJARAT	
		INSTRUMENTATION ENGINEERS PVT LTD	HYDERABAD	
		SIGMA INSTRUMENTS CO.	MUMBAI	
		SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	NAVI MUMBAI	
		TELACE EQUIPMENT PVT.LTD.	CHENNAI	
37.0	TEMPERATURE ELEMENT	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	GOA	
		DETRIVE INSTRUMENTATION & ELECTRONICS LTD.	MUMBAI	
		PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD.	GOA	
		TECHNO INSTRUMENTS	GUJARAT	
		TEMPSSENS INSTRUMENT (I) PVT LTD	UDAIPUR	
		TM TECNOMATIC SPA	ITALY	
		TOSHNIWAL INDUSTRIES PVT. LTD.,	AJMER	
		THERMAL INSTRUMENT INDIA PVT. LTD.	MUMBAI	
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI	
38.0	TEMPERATURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	KOLKATA	
		ASHCROFT INDIA PVT LTD.	GUJARAT	
		BUDENBERG GUAGE CO.LTD.	UK	



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SPEC NO: PE-TS-409-156-A008

		FORBES MARSHALL (HYD) LTD.	HYDERABAD	
		GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	GOA	
		GOA THERMOSTATIC INSTRUMENTS PVT.LTD.	GOA	
		GAUGE BOURDON INDIA PVT. LTD.	MUMBAI	
		H.GURU INDUSTRIES	KOLKATA	
		H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	BANGLORE	
		BAUMER TECHNOLOGIES INDIA PVT. LTD.	MUMBAI	
39.0	BALL VALVE	BDK	HUBLI	
		LEADER	JALANDHAR	
		BANKIM	KOLKATA	
		H SARKAR	KOLKATA	
		AV VALVES	AGRA	
		HAWA VALVES	MUMBAI	
		FLOW CHEM	AHMEDABAD	
		STEEL STRON VALVES	MUMBAI	
		AKAY VALVES LTD.	MUMBAI	
		AQUA VALVES PVT.LTD.	KARNATAKA	
		CRESCENT VALVES	MUMBAI	
		FISHER SANMAR LIMITED	CHENNAI	
		HABONIM VAAS AUTOMATION PVT LTD.,CHENNAI	CHENNAI	
		KIRLOSKAR BROTHERS LTD.	PUNE	
		KSB PUMPS LTD.	MUMBAI	
		MICROFINISH VALVES PVT LTD.	HUBLI	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
		PEC VALVES	MUMBAI	
40.0	SLUICE GATE	H SARKAR	KOLKATA	
		JASH ENGINEERING	INDORE	
		YASHWANT	MIRAJ	
		GLOBETECH	HOWRAH	
41.0	DIAPHRAGM VALVE	PROCON ENGINEERES	MUMBAI	
		HAWA VALVES	MUMBAI	
		BDK VALVES	HUBLI	
		FOURESS	BANALORE	
		INERVALVE	GUJRAT	
42.0	3 WAY VALVE	HI TECH	AHMEDABAD	
		ADVANCE VALVES PVT.LTD	NOIDA	
		BDK	HUBLI	
		FOURESS ENGG.INDIA LTD.	MUMBAI	
		FLUIDLINEVALVES COMPANY PRIVATE LTD.,	MUMBAI	



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
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(ANNEXURE-I)

SPEC NO: PE-TS-409-156-A008

		INSTRUMENTATION LTD.	PALAKAD	
		KIRLOSKAR BROTHERS LTD.	PUNE	
		VENUS PUMP & ENGG. WORKS	KOLKATA	
		SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY	CHENNAI	
		STAFFORD CONTROLS LIMITED	PUNE	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
43.0	PLUG VALVE	FISHER SANMAR LIMITED	CHENNAI	
		BDK	HUBLI	
		LARSEN & TOUBRO LTD.	MUMBAI	
		LEADER	JALANDHAR	
		MICON VALVES (INDIA) PVT.LTD	MUMBAI	
44.0	FLANGES (SS/CS)	BHARAT FORGE	PUNE	
		RELIANCE FORGE	MUMBAI	
		MS FITTINGS	KOLKATA	
45.0	POSITIVE DISPLACEMENT PUMP	MILTON ROY INIDA	CHENNAI	
		SWELLORE	AHMEDABAD	
		VK PUMP	NASIK	
		DENCIL PUMP	MUMBAI	
46.0	VALVES (GATE/GLOBE/NRV/ BALL)-CPVC/PVC/PP/ HDPE/PVDF	GEROGE FISHCHER IPING SYSTEMS PVT LTD	DELHI	
		ASTROL PLYTECHINC LTD	AHMEDABAD	
47.0	PIPE/FITTINGS/ FLANGES CPVC/PVC/ PP/HDPE/PVDF	GEROGE FISHCHER IPING SYSTEMS PVT LTD	DELHI	
		ASTROL PLYTECHINC LTD	AHMEDABAD	
48.0	RUBBER LINING FOR PIPES/TANKS	RISHI INDUSTRIES	SONEPET	
		INDUSTRIAL LINING LTD	BARODA	
		MIL	CHENNAI	
49.0	NON METALIC PUMP (CENTRIFUGAL)	Anticorrosive Pumps	Mumbai	
		Rajedia Pumps	Gujrat	
		Price Pumps	Mumbai	
50.0	Blower	Everest	Delhi	
		Kay International	Haryana	
		Swam Pneumatics	Delhi	
		Kulkarni brothers	Mumbai	
51.0	TEMPERATURE SWITCH	INDFOSS (INDIA) LTD.	GAZIABAD	
		DRESSER INDUSTRIES	USA	



TITLE:
KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-I)

SPEC NO: PE-TS-409-156-A008

		INC.		
		SWITZER INSTRUMENT LTD.	CHENNAI	
		SOR INC.	USA	
		TOSHNIWAL BROTHERS (P) LTD.	DELHI	
		VASU TECH LIMITED	DELHI	
52.0	HDPE TANK	SINTEX		
53.0	FRP TANK	TIANODE	CHENNAI	
		BHAVI PLAST	MUMBAI	
54.0	HYDROGEN DETECTOR	Detection Instruments	INDIA	
		HACH	USA	
		HONEYWELL	UK	
		ORBIT	INDIA	
55.0	RESIDUAL CHLORINE ANALYZER AND pH METER.	EMERSON		
		HACH		
56.0	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	
57.0	PAINT	BERGER		
		ASIAN PAINTS		
		SHALIMAR		
		J&N		
		HIND RECTIFIER	NASIK	
58.0	Chain pulley block	INDEF		
		BRADY		
		Lifting Equipment		
		GRIP ENGG		
		Tractel tirfor		
		REVA		
		TECHNO INDUSTRIES		
59.0	HAND PUMP (MOTOR OPERATED BARREL PUMP)	JYOTI		
		SOLVACID		
		SLEEK		

**TITLE:**

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-I)

SPEC NO: PE-TS-409-156-A008

		FLUDIYNE		
		Mach Powerpoint		
60.0	STRUCTURE STEEL	SAIL		
		TISCO		
		JINDAL		
		BHUSWAL		

NOTES-

1. All the finally selected sub vendors shall be subject to customer approval during detailed engineering without any delivery/ commercial implications to BHEL/ Customer (KPCL).
2. The sub vendor list enclosed is indicative only and is subject to approval / acceptance by customer (KPCL).
3. Bidder to propose his sub vendor list with back up documents (experience list, end user certificate as applicable) etc. The same shall subject to BHEL and Customer approval during detailed engineering stage without any technical, commercial & delivery implication to BHEL or customer.

Bidder to propose sub vendor within 4 weeks of placement of LOI. Thereafter no request for additional sub vendor shall be entertained.

4. The inspection category will be intimated after award of contract by BHEL/customer. However the same will be adhered by the bidder without any commercial and delivery implication to BHEL/ Customer (**KPCL**)..



TITLE:

**KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-II)**

SPEC NO: PE-TS-409-156-A008

MANDATORY SPARES LIST

**TITLE:**

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-II)

SPEC NO: PE-TS-409-156-A008

S. No	Spares	Unit	Quantity
1.0	HP / LP and CW Chemical Dosing System:		
	Following spares shall be supplied for each type of pump and agitator under each system.		
(a)	Dosing Pumps		
(i)	Plunger / Diaphragm	Set	One (1)
(ii)	Pump bearings	Set	One (1)
(iii)	"O" Rings / Gland packing	Set	One (1)
(iv)	Ball valves / Globe valves	Nos.	One (1)
(v)	Relief valves	Nos.	Two (2)
(vi)	Oil and grease seals	Nos.	One (1)
(b)	Motorised Agitator		
(i)	Impeller / Propeller with shaft	No.	One (1) for each agitator.
2.0	<u>PH measurement</u>		
(i)	PH electrode	Nos.	Two (2)
(ii)	Temperature compensation	Nos.	Two (2)
(iii)	Cell housing	No.	One (1)
(iv)	PCB assembly	No.	One (1)
(v)	Fuses (each type)	Nos.	Five (5)

**TITLE:**

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-III)

SPEC NO: PE-TS-409-156-A008

LIST OF TOOLS & TACKLES

Bidder to consider necessary tools and tackles for mechanical, electrical and control & instrument as per their system requirement. In addition bidder to adhere relevant clauses of tender specification also. List of tools and tackles to be furnish by bidder during bid submission.



TITLE:

**KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-IV)**

SPEC NO: PE-TS-409-156-A008

CIRCULATING WATER ANALYSIS (TERTIARY TREATED WATER ANALYSIS)



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-IV)

SPEC NO: PE-TS-409-156-A008

TERTIARY TREATED WATER ANALYSIS

SL NO	PARAMETERS	UNIT	RESULTS
1	Colour	Hazen Units	<5
2	Odour		Unobjectionable
3	Turbidity	NTU	0.6
4	pH Value		7.2-7.3
5	BOD	ppm	<5
6	COD	ppm	<10
7	Total Suspended Solids	ppm	4.0
8	Total dissolved solids	ppm	<800
9	Alkalinity	ppm	24.7
10	Chloride as Cl	ppm	<200
11	Sulphate as SO ₄	ppm	<60
12	Silica-Dissolved as SiO ₂	ppm	23.5
13	Silica-Colloidal as SiO ₂	ppm	3
14	Ca Hardness as CaCO ₃	ppm	140
15	Mg Hardness as CaCO ₃	ppm	94
16	Total Hardness as CaCO ₃	ppm	300
17	% sodium	ppm	12.14
18	Ammonical Nitrogen	ppm	6.57
19	Iron as Fe	ppm	0.31
20	Manganese as Mn	ppm	< 0.05
21	Total Kjeldhal Nitrogen	ppm	3.4
22	Total Residual Chlorine	ppm	< 0.5
23	Phosphate as PO ₄	ppm	1.3
24	Free Ammonia	ppm	< 0.5
25	Total phosphorus	ppm	1.0
26	Oil and Grease	ppm	<1.0
27	Nitrate Nitrogen	ppm	1.3
28	Sulphide	ppm	<0.05
29	Fluoride as F	ppm	0.39
30	Copper as Cu	ppm	<0.05
31	Zinc as Zn	ppm	<0.05
32	Lead as Pb	ppm	<0.02
33	Total Chromium as Cr	ppm	<0.05
34	Mercury as Hg	ppm	<0.001
35	Cyanide as CN	ppm	<0.05
36	Phenolic components as C ₆ H ₅ OH	ppm	<0.05
37	Nickel as Ni	ppm	<0.05
38	Arsenic as AS	ppm	<0.001
39	Coliform Organisms/100 ml	ppm	<1
40	Faecal Coliform Organisms/100 ml	ppm	<1
41	MPN count/100	ppm	<1
42	E-coil	ppm	Present



TITLE:

**KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-V)**

SPEC NO: PE-TS-409-156-A008

DRAWINGS/DOCUMENTS DISTRIBUTION & SUBMISSION

**TITLE:**

**KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-V)**

SPEC NO: PE-TS-409-156-A008

- Bidder shall submit soft copy/hard copy/CD ROMs of all the finally approved drawings and O&M Manuals as required by Customer/Customer consultant/BHEL-site/BHEL-PEM. The exact number of hard copies/CD ROMs of these documents to be submitted shall be notified to the bidder at the time of detailed engineering and bidder shall submit the same without any commercial/delivery implications to BHEL/Customer.
- 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.
- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.
- Editable copy of all the drawings and documents shall be provided.
- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copies whichever is later.
- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.
- Vendor to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.
- Bidder to submit instrument schedule, cable schedule and valve schedule in MS- Excel format during detailed engineering.
- Bidder to also furnish the auto cad copy/MS-Excel/MS-word (as applicable) of the following documents after award of contract. However any other auto cad copy/MS-Excel/MS-word of any other document as per the insistence of BHEL and customer will also be submitted by the bidder without any delivery and commercial implication to BHEL and customer.
 - P&IDs.
 - Equipment lay out of the CW Treatment plant area.
 - Cable tray lay out.
 - Civil scope drawings.
 - Piping lay out drawing.

Other requirements

- Successful bidder shall furnish detailed erection manual for each of the equipment as well as complete system supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.
- Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
- In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion. However, in case changes are necessitated due to any constraints at customer end, delay in review/ approval of such revised drawing beyond one month will be to customer's account.



TITLE:
KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-V)

SPEC NO: PE-TS-409-156-A008

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
	PROGRESS REPORT (MONTHLY)					
C	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 -FICHTNER
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 copies whichever is later.
- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required. Vendor to come for meeting with the concerned dealing persons as per BHEL or customer (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 CW Treatment plant area.
 - Cable tray lay out.
 - Civil scope drawings.
 - Piping lay out drawing.



TITLE:

**KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-VI)**

SPEC NO: PE-TS-409-156-A008

MASTER DRAWING LIST WITH SCHEDULE OF SUBMISSION

**TITLE:**

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-VI)

SPEC NO: PE-TS-409-156-A008

After award of LOI, following minimum drawing/documents shall be submitted by the bidder for BHEL and 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.

For the Drawings/Documents Submission Procedure, please refer **Annexure-V**. The submission of soft copy or hard copy of the drawing/document whichever is later will be considered as final date of submission of the drawing/document. The bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. Bidder to comply with the observations of the BHEL and CUSTOMER without price & delivery implication.

Bidder to note that the drawings to be submitted by bidder in the event of award of contract shall be as per the below given drawing/document list. Bidder to note that any additional drawings/documents requirement during detailed engineering shall be provided by bidder without any technical, commercial and delivery implications to BHEL. Bidder confirmed drawings submission schedule as follows:

- a. Drawing/documents submission schedule: First submission of basic drawings/ documents – (Please refer MDL for list of basic drawing/documents & submission schedule).
- b. Every revised submission incorporating comments – within 7 days.

Bidder further confirmed that drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.

(a) List and schedule of drawings/documents to be submitted after award of contract:-

SL. No	DOCUMENT / DRAWING NO.	DRAWING / DOCUMENT TITLE	SCHEDULE OF SUBMISSION FROM LOI (week)	SIZE
CW TREATMENT				
1	PE-V0-409-156-A010	TECHNICAL DATA SHEET FOR METERING PUMPS OF CW TREATMENT PLANT	10	A4
2	PE-V0-409-156-A013	INSTRUMENT SCHEDULE OF CW TREATMENT PLANT	10	A4
3	PE-V0-409-156-A024	CABLE SCHEDULE FOR CW TREATMENT PLANT	12	A4
4	PE-V0-409-156-A025	ERECTION PROCEDURE OF CW TREATMENT PLANT	14	A4
5	PE-V0-409-156-A003	EQUIPMENT LAYOUT OF CW TREATMENT PLANT	4	A1
6	PE-V0-409-156-A021	LIST OF DRIVES AND, I/O LIST	12	A4
7	PE-V0-409-156-A023	CABLE TRAY / TRENCH LAYOUT & CONDUIT ROUTING DRG. ALONG WITH EARTHING LAYOUT FOR CW TREATMENT PLANT	12	A1
8	PE-V0-409-156-A022	HMI PICTURE/ PLANT SCHEMATICS	12	A3
9	PE-V0-409-156-A016	PIPING LAYOUT FOR CW TREATMENT PLANT	10	A1
10	PE-V0-409-156-A002	P&I DIAGRAM OF CW TREATMENT PLANT	4	A1
11	PE-V0-409-156-A015	GA & WIRING DIAGRAM FOR CONTROL PANEL OF CW TREATMENT PLANT	12	A4
12	PE-V0-409-156-A008	GA DRAWING OF ALL TANKS/ VESSELS OF CW TREATMENT PLANT	8	A3
13	PE-V0-409-156-A014	VALVE SCHEDULE OF CW TREATMENT PLANT	10	A4
14	PE-V0-409-156-A017	O&M MANUAL OF CW TREATMENT PLANT	24	A4
15	PE-V0-409-156-A019	Electrical load data OF CW TREATMENT PLANT	8	A4
16	PE-V0-409-156-A007	PG test procedure for CWTP	20	A4
17	PE-V0-409-156-A011	DATA SHEET OF HORIZONTAL CENTRIFUGAL PUMPS OF CW TREATMENT PLANT	10	A4
18	PE-V0-409-156-A020	Cable schedule OF CW TREATMENT PLANT	12	A4
19	PE-V0-409-156-A006	Manufacturing quality plan for dosing pumps with motor OF CW TREATMENT PLANT	10	A4
20	PE-V0-409-156-A004	QAP FOR TANKS/ VESSELS OF CW TREATMENT PLANT	8	A4

**TITLE:**

**KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-VI)**

SPEC NO: PE-TS-409-156-A008

21	PE-V0-409-156-A018	DATA SHEET OF MOTOR OF CW TREATMENT PLANT	10	A4
22	PE-V0-409-156-A012	DATA SHEET FOR INSTRUMENTS OF CW TREATMENT PLANT	10	A4
23	PE-V0-409-156-A005	Manufacturing quality plan for horizontal centrifugal pumps with motor OF CW TREATMENT PLANT	10	A4
24	PE-V0-409-156-A026	ENGINEERING BOQ OF CW TREATMENT PLANT	20	A4
25	PE-V0-409-156-A009	JUNCTION BOX DETAILS	12	A4
26	PE-V0-409-156-A027	LCP DOCUMENTS FOR CW TREATMENT PLANT	16	A4
27	PE-V0-409-156-A028	UPS AND BATTERY SIZING CALCULATION, DATA SHEET AND GA FOR UPS	16	A4
28	PE-V0-409-156-A029	QAP FOR UPS	16	A4
29	PE-V0-409-156-A030	QAP / CHECK LIST FOR ALL INSTRUMENTS	16	A4
30	PE-V0-409-156-A031	QAP AND FAT FOR LCP	16	A4

In addition of above following documents shall also be submitted by bidder during detail engineering:-

a) Storage instructions

- (b) Bidder to note that drawings/documents submission shall be through web based Document Management System. Bidder would be provided access to the DMS for drawings/documents approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.
- Internet explorer version – Minimum Internet Explorer 7
 - Internet speed – 2 mbps (Minimum preferred)
 - Pop ups from our external DMS IP (124.124.36.198) should not be blocked
 - Vendor's internal proxy setting should not block DMS application's link
 - o (<http://124.124.36.198/wrenchwebaccess/login.aspx>)
 - DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.
 - For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>



TITLE:

**KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-VII)**

SPEC NO: PE-TS-409-156-A008

FORMAT FOR OPERATION AND MAINTENANCE MANUAL



TITLE:
KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-VII)

SPEC NO: PE-TS-409-156-A008

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

Project name :
Project number :
Package Name :
PO reference :
Document number :
Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	<u>Cover page</u>				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	<u>Index</u>				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	<u>Description of Plant/System</u>				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				
4.0	<u>Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)</u>				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	<u>Operation Guidelines for plant personal/user/operator</u>				
5.1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-VII)

SPEC NO: PE-TS-409-156-A008

5.2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5.3	Do's & Don't of the equipments.				
5.4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5.5	Parameters to be monitored with normal values and limiting values				
5.6	Trouble shooting with causes and remedial measures				
5.7	Routine operational checks, recommended logs & records				
5.8	Changeover schedule if more than one auxiliary for the same purpose is given				
5.9	Painting requirement and schedule				
5.10	Inspection, repair, Testing and calibration procedures				
6.0	<u>Maintenance guidelines for plant personal</u>				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centres, Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	Statutory and other specific requirements considerations.				
8.0	List of reference documents				
9.0	Binding as per requirement				

**TITLE:**

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-VIII)

SPEC NO: PE-TS-409-156-A008

SITE STORAGE AND PRESERVATION

ANNEXURE-VIII

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHANICAL BOPs

(Doc No: PE-DC-SSG-A001 REV.00)



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

CONTENT

- 1 SCOPE OF THE DOCUMENT
- 2 PURPOSE OF STORAGE & PRESERVATION
- 3 MEASURES TO BE TAKEN FOR STORAGE AND PRESERVATION
 - a) GENERAL STORAGE REQUIREMENTS
 - b) GENERAL PRESERVATION REQUIREMENTS
 - c) GENERAL INSPECTION REQUIREMENTS
- 4 TYPE OF STORAGE FOR VARIOUS EQUIPMENT
5. CONCLUSION
6. STACKING ARRANGEMENT FOR PLATES AND STRUCTURAL STEEL

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. 'No smoking' signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.
11. Following preservatives/preservation methods can be used depending upon type of equipment
 - a. Rust preventive fluid (RPF)
 - b. Rust protective paints
 - c. Tarpaulin covers, in case of outdoor storage
 - d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –
 - Ingress of moisture and corrosion damages.
 - Damage to protective coating.
 - Open ends in pipes, vessels and equipment -
 - In case any open ends are noticed, same shall be capped.
2. Any damages to equipment / materials.
 - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
 - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere. (C)**

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.



ii **Semi-closed storage. (S)**

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.





iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as “scrap yard” slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.



The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H ₂ SO ₄)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self-life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self-life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

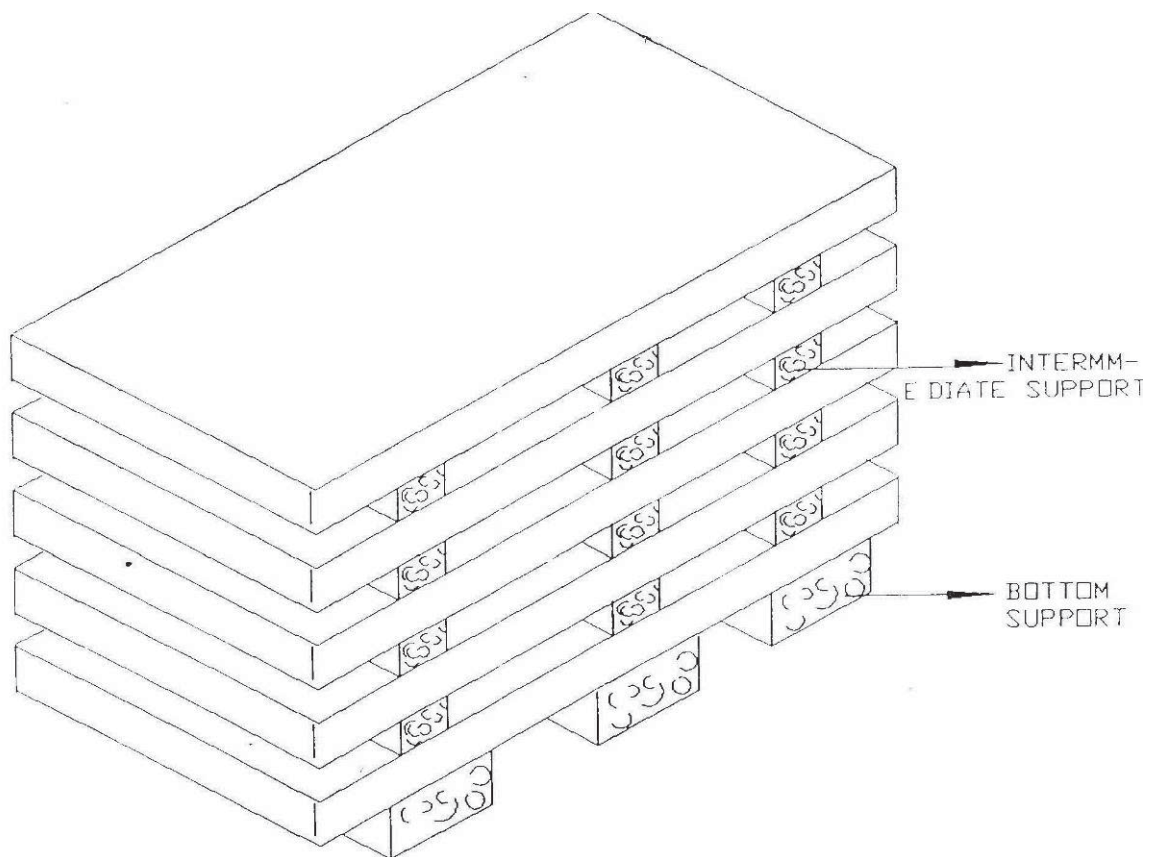


Figure – 1 – PLATE STACKING ARRANGEMENT

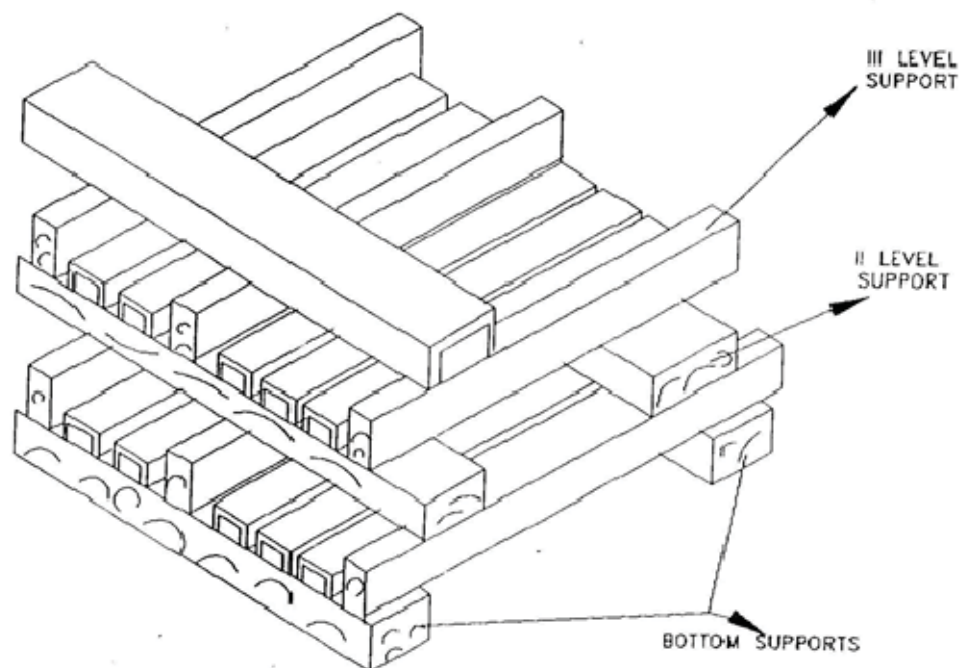


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT



TITLE:

**KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-IX)**

SPEC NO: PE-TS-409-156-A008

PERCENTAGE BREAK UP OF SUPPLY PRICES

**TITLE:**

**KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT
(ANNEXURE-IX)**

SPEC NO: PE-TS-409-156-A008

The Break-up (%) of Supply prices of CW Treatment Plant package in the BBU shall be in line with the below provided details:

Break-up (%) of Supply prices (Refer Cl. No. 2.1 of Price Schedule) CW Treatment plant package. (To be used during contract execution for payment).		
1.	Lump sum firm price for supply of tanks inclusive of all taxes, duties and other levies as applicable.	20% of sl no 2.1 of Price Schedule
2.	Lump sum firm price for supply of Pumps, Valves, Agitators & Strainers. inclusive of all taxes, duties and other levies as applicable.	20% of sl no 2.1 of Price Schedule
3.	Lump sum firm price for supply of Control & Monitoring Instruments inclusive of all taxes, duties and other levies as applicable.	15% of sl no 2.1 of Price schedule.
4.	Lump sum firm price for supply of Piping & Fittings inclusive of all taxes, duties and other levies as applicable.	5% of sl no 2.1 of Price Schedule.
5.	Lump sum firm price for supply of chemicals inclusive of all taxes, duties and other levies as applicable for CW treatment plant.	25 % of sl no 2.1 of Price Schedule.
6.	Lump sum firm price for supply of Relay based control panel inclusive of all taxes, duties and other levies as applicable.	10% of sl no 2.1 of Price Schedule.
7.	Lump sum firm price for supply of safety & Balance items inclusive of all taxes, duties and other levies as applicable.	5% of sl no 2.1 of Price Schedule.



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT

SPEC NO: PE-TS-409-156-A008

VOLUME: III

SECTION:

REV NO: 00

DATE:

VOL-III



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT

SPEC NO: PE-TS-409-156-A008

VOLUME: III

SECTION:

REV NO: 00

DATE:

1.0 DRAWINGS/DOCUMENTATION REQUIREMENT ALONG WITH BID.

Bidder to furnish 4 sets of techno-commercial bid including following documents/information **(For Electrical and C&I please refer the respective section of the specification)**.

- Deviation if any in the enclosed Schedule of deviation with cost of withdrawal only with mention of specification clause for which deviation is being asked. (Stamped & Signed)
- Compliance cum confirmation certificate.(Stamped & Signed)
- Schedule of Declaration. (Stamped & Signed)
- Un Price Schedule duly filled in. (Stamped & Signed).
- List of start-up, erection & commissioning spares, if any, (Stamped & Signed).
- List of tools & tackles,if any, (Stamped & Signed).

Bidder to note that if bidder has taken any deviation from the technical specification requirements, the same shall be clearly mentioned in the bid in the BHEL prescribed format of Schedule of Deviations attached as Volume - III of this technical specification.

In case of no deviation, Bidder to furnish signed and stamped copy of "Schedule of Deviations with cost of withdrawal" stating **"No Deviation"**.

No other technical document is required along with bidder's offer. Any other document submitted by bidder shall not be evaluated by BHEL and shall be considered as withdrawn.

Bidder to note that any un-declared deviation mentioned in bidder offer other than specified in the scheduled of Deviations shall be considered as null and void.



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT

SPEC NO: PE-TS-409-156-A008

VOLUME: III

SECTION:

REV NO: 00

DATE:

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing / stamping this compliance certificate (every sheet) and furnish same with the offer.

- a. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions, other than those mentioned under "exclusion and those resolved as per 'Schedule of Deviations', with regard to same.
- b. There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'
- c. Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL / CUSTOMER approval & 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. This is within the contracted price without any extra implications to BHEL after award of the contract.
- d. All drawings/ data-sheets / calculations etc. submitted along with the offer shall not be taken cognizance off.
- e. The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified / intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre-bid discussions, otherwise BHEL / Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

- f. The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- g. All sub vendors shall be subject to BHEL / CUSTOMER approval in the event of order.
- h. Guarantee for plant/equipment shall be as per relevant clause of GCC / SCC / Other Commercial Terms & Conditions
- i. In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities within the scope of work as tender specification. This clause will apply in case during site commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account
- j. Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's / Customer's / Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.
- k. As built drawings shall be submitted as and when required during the project execution.
- l. The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.
- m. Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.
- n. Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
- o. In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.

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



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT

SPEC NO: PE-TS-409-156-A008

VOLUME: III

SECTION:

REV NO: 00

DATE:

PRE-BID CLARIFICATION SCHEDULE

S. NO.	SECTION/CLAUSE/PAGE NO.	STATEMENT OF THE REFERRED CLAUSE	CLARIFICATION REQUIRED

The bidder hereby clarifies that above mentioned are the only clarifications required on the technical specification for the subject package.

Signature: _____

Name: _____

Designation: _____

Company: _____

Date: _____

Company Seal



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
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DATE:

DEVIATION SHEET (COST OF WITHDRAWAL)**TENDER ENQUIRY REFERENCE:-****NAME OF VENDOR:-**

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWAL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWAL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWAL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
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TECHNICAL DEVIATIONS

COMMERCIAL DEVIATIONS

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	DESIGNATIONS	SIGN & DATE

NOTES:

1. For self-manufactured items of bidder, cost of withdrawal of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatchable items, cost of withdrawal of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
12. Cost of withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.
13. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.
14. In case of discrepancies in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT

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VOLUME: III

SECTION:

REV NO: 00

DATE:

SUGGESTIVE PRICE FORMAT FOR CW TREATMENT PLANT FOR 1X370 MW KPCL YELAHANKA CCPP.

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, assembly, inspection and testing at vendor's & sub-vendor's works, painting, forwarding ,supply & delivery at site including mandatory spares, startup, erection and commissioning spares as required, chemicals, properly packed for transportation, loading/unloading/handling & storage at site, in site transportation, assembly, Erection & Commissioning, trial run, Supervision of CW Treatment system preparation & submission of drawing/documents including "As Built" drawings, site testing, carrying out performance guarantee tests at site and handover in flawless operating condition to end customer of the entire CW Treatment Plant as per the details in different sections / volumes of BHEL Technical specification (PE-TS-409-156-A008) ,for 1x370 MW KPCL Yelahanka CCPP .	
	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 price for design, engineering, manufacture, fabrication, assembly, inspection and testing at vendor's & sub-vendor's works, painting, forwarding, supply & delivery at site including startup, erection and commissioning spares as required, properly packed for transportation, of the entire CW Treatment Plant as per the details in different sections / volumes of BHEL Technical specification (PE-TS-409-156-A008) , for 1x370 MW KPCL Yelahanka CCPP .	
2.2	Total lump sum price for supply/delivery of mandatory spares of the entire CW Treatment Plant as per the details in different sections / volumes of BHEL Technical specification (PE-TS-409-156-A008) ,for 1x370 MW KPCL Yelahanka CCPP .	
2.3	Total lump sum price for loading/unloading/handling & storage at site, in site transportation, assembly, Erection & Commissioning, trial run, preparation & submission of drawing/documents including "As Built" drawings, site testing, of the entire CW Treatment Plant as per the details in different sections / volumes of BHEL Technical specification (PE-TS-409-156-A008) ,for 1x370 MW KPCL Yelahanka CCPP .	
2.4	Total lump sum price for carrying out performance guarantee tests at site and handover in flawless operating condition to end customer of the entire CW Treatment Plant as per the details in different sections / volumes of BHEL Technical specification (PE-TS-409-156-A008) ,for 1x370 MW KPCL Yelahanka CCPP .	
2.5	Total lump sum price of supply of CW treatment chemicals of the entire CW Treatment Plant as per the details in different sections / volumes of BHEL Technical specification (PE-TS-409-156-A008) ,for 1x370 MW KPCL Yelahanka CCPP .(bidder to give break-ups in separate sheet).	
2.6	Total lump sum price for Supervision of CW Treatment program of the entire CW Treatment Plant as per the details in different sections / volumes of BHEL Technical specification (PE-TS-409-156-A008) ,for 1x370 MW KPCL Yelahanka CCPP .	



TITLE:

KARNATAKA POWER CORPORATION LIMITED
1x370 MW KPCL YELAHANKA CCPP
TECHNICAL SPECIFICATION FOR CW TREATMENT PLANT

SPEC NO: PE-TS-409-156-A008

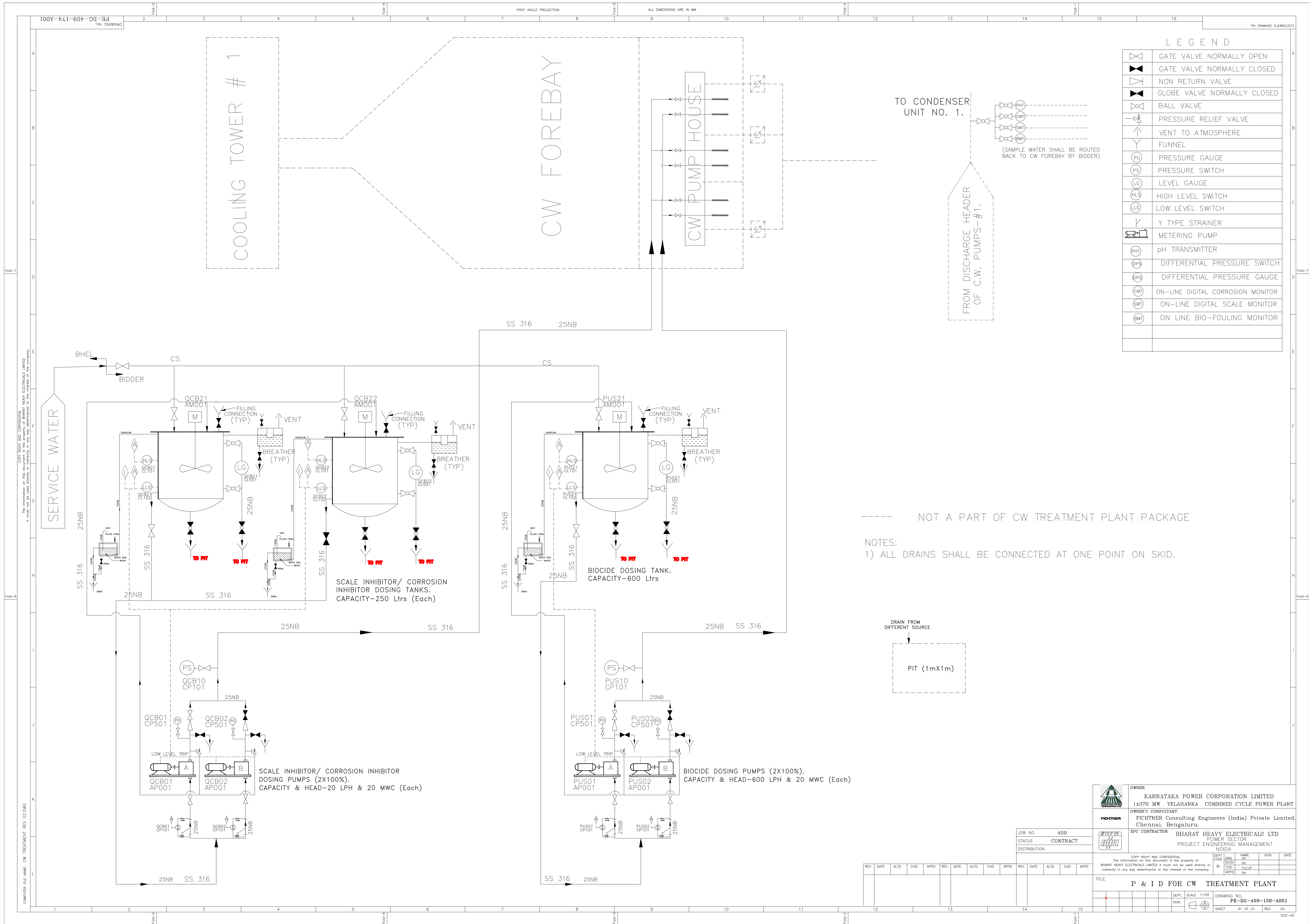
VOLUME: III

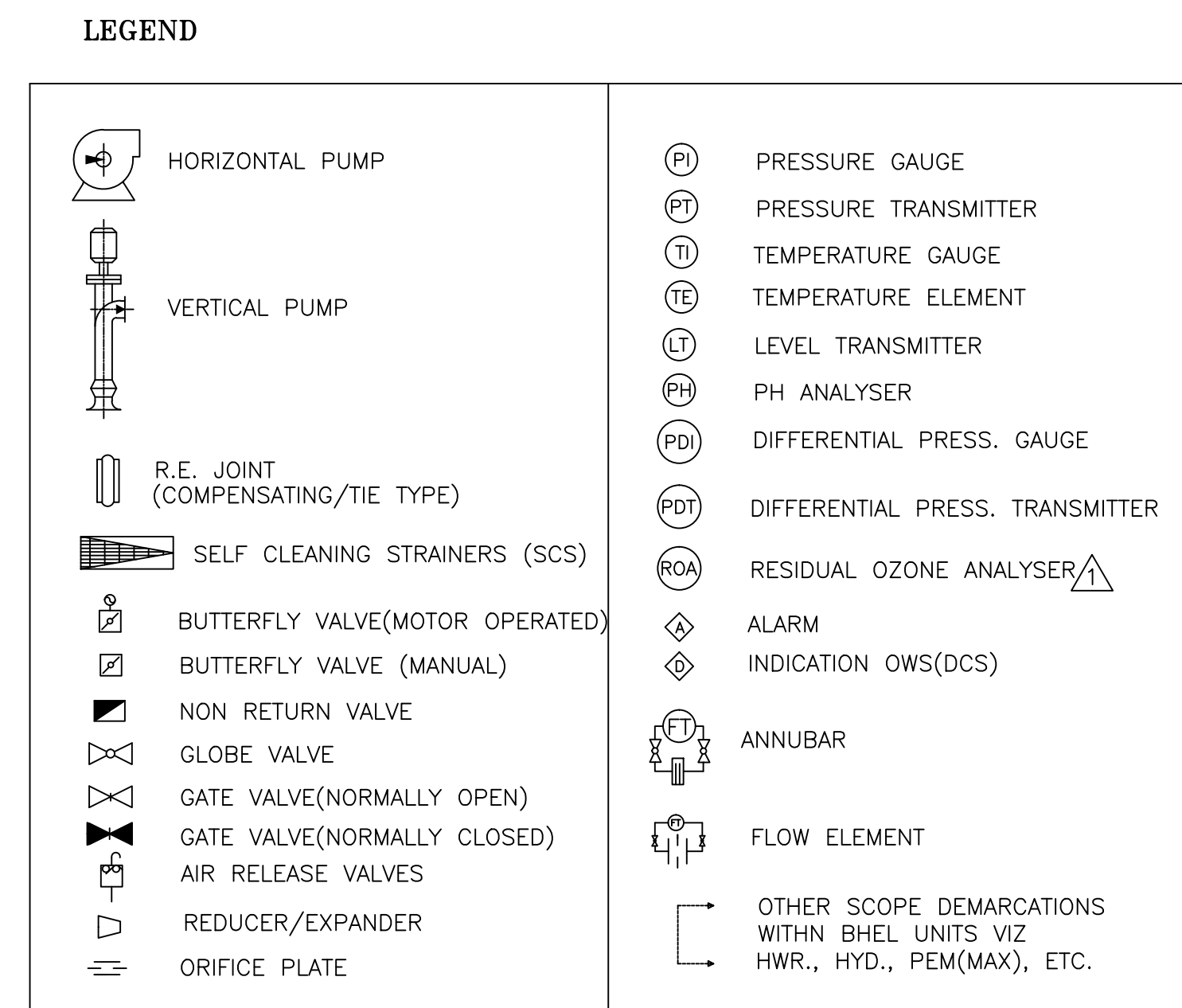
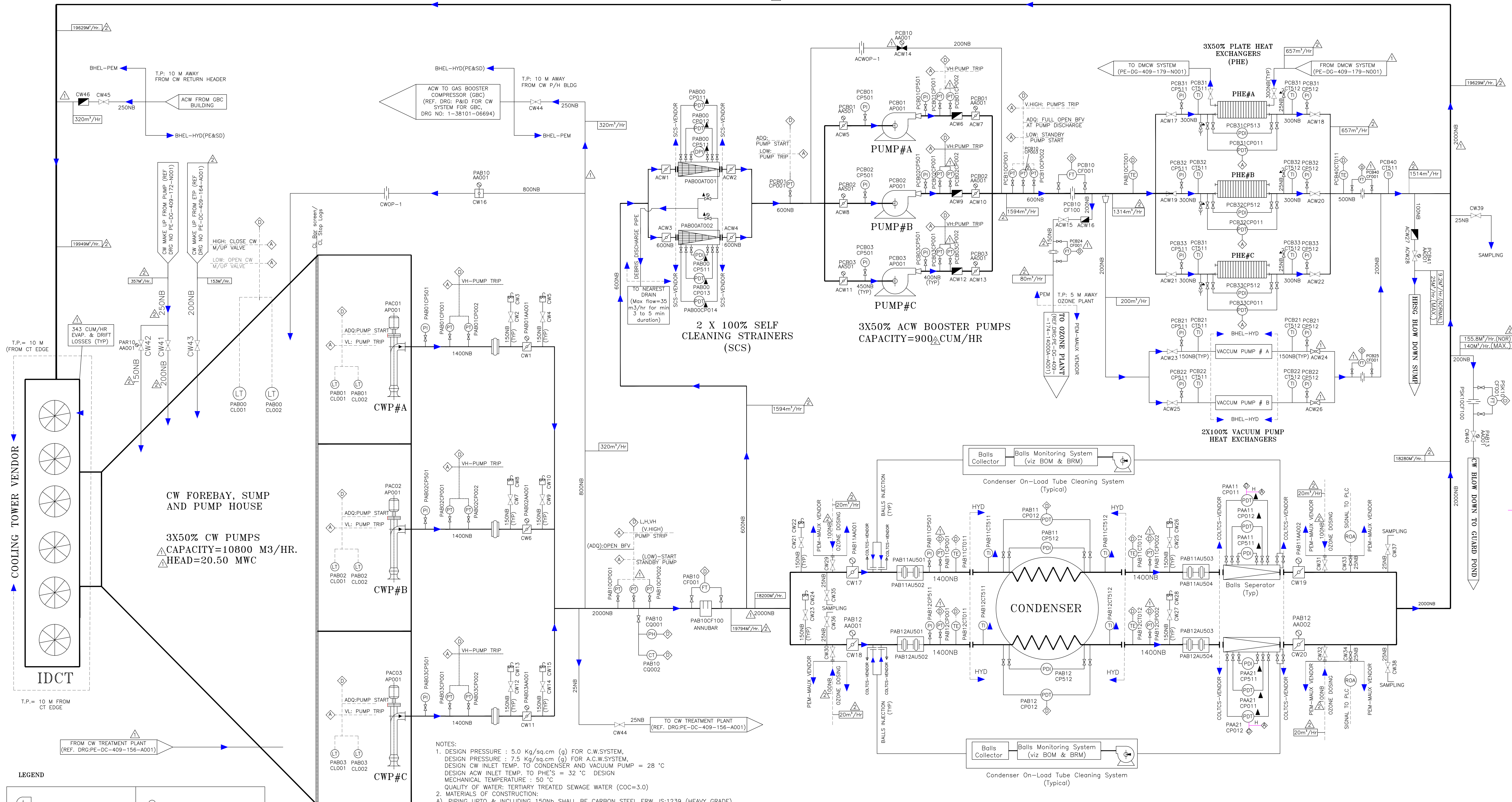
SECTION:

REV NO: 00

DATE:

DRAWINGS





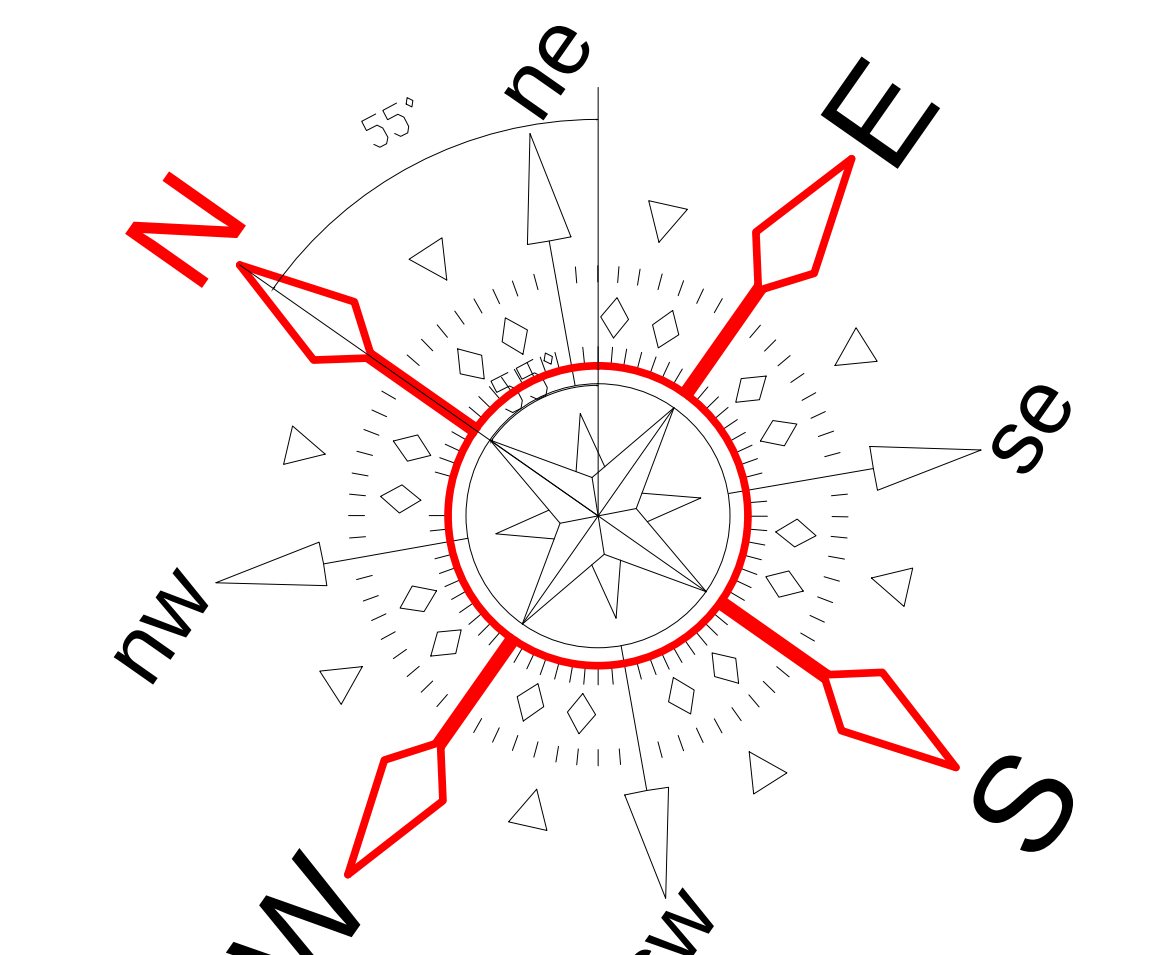
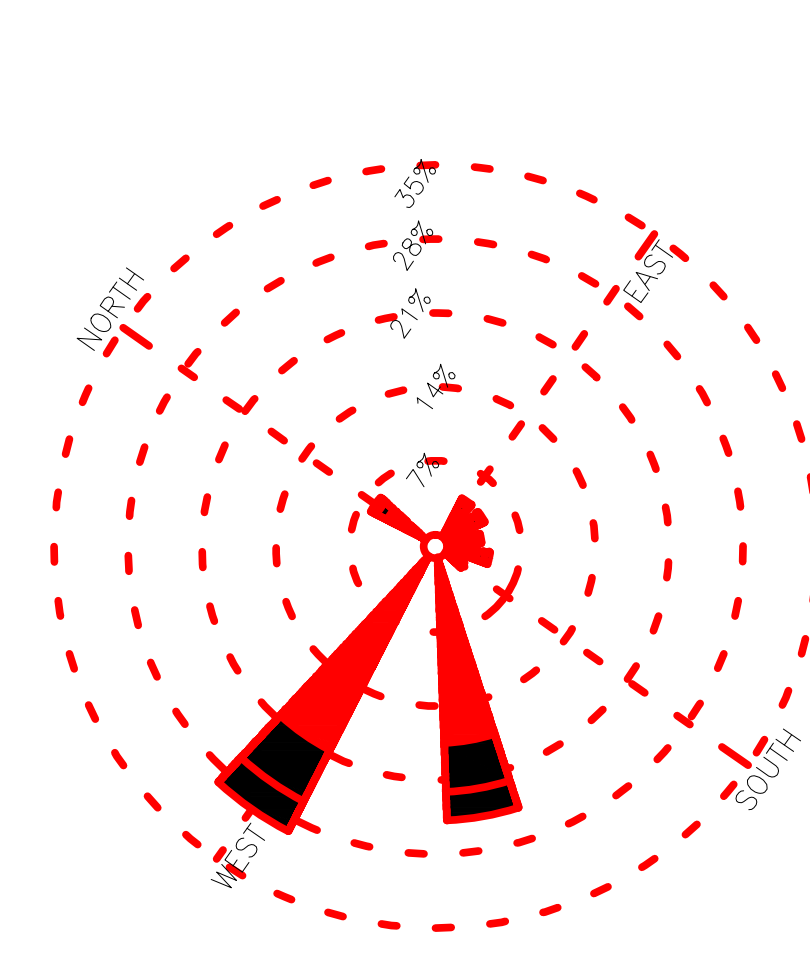
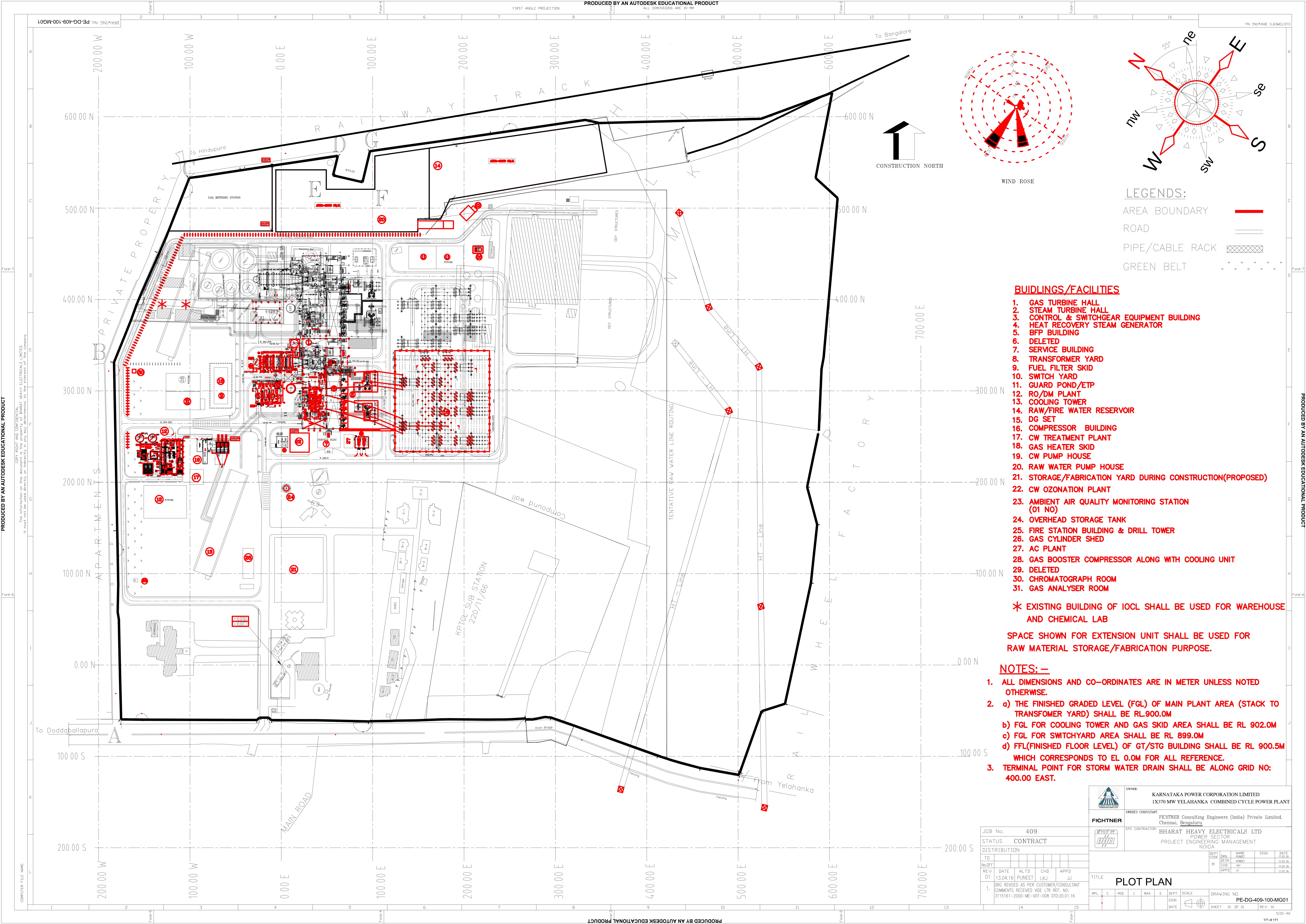
PIPE SIZES OF CS MATL.

NB	OD	THICK.
15	21.8	3.2
25	34.2	4.0
40	48.8	4.0
50	60.8	4.5
80	89.5	4.8
100	115.0	5.4
150	166.5	5.4
200	219.1	6.4
250	273.0	6.4
300	323.9	6.4
350	355.6	7.9
400	406.4	7.9
450	457.0	7.9
500	508.0	8.0
600	610.0	8.0
800	813.0	10.0
1100	1118	12.0
1400	1422	14.0
2000	2032	16.0

- NOTES:
- 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 PUMP = 28 °C DESIGN ACW INLET TEMP. TO PHE'S = 32 °C DESIGN MECHANICAL TEMPERATURE : 50 °C QUALITY OF WATER: TERTIARY TREATED SEWAGE WATER (COC=3.0)
 - MATERIALS OF CONSTRUCTION:
 - PIPING UPTO & INCLUDING 150NB SHALL BE CARBON STEEL ERW, IS:1239 (HEAVY GRADE)
 - PIPING >150 NB SHALL BE CARBON STEEL IS 2062, PLATES ROLLED AND WELDED AS PER IS 3589.
 - MATERIALS OF CONSTRUCTION FOR BUTTERFLY VALVES AND GATE/ GLOBE/ CHECK VALVES/ARV'S SHALL BE AS PER CW/ ACW DESIGN PHILOSOPHY (REFER DOC. NO. PE-DC-409-165-N001).
 - ALL PRESSURE TAPPING & ROOT VALVES TO BE OF 15NB.
 - DRAIN & VENT VALVES:
 - ACW SYSTEM : 50NB SIZE DRAIN & VENT VALVES SHALL BE PROVIDED FOR PIPE SIZES 400 NB & ABOVE AND 25NB DRAIN & VENT VALVES SHALL BE PROVIDED FOR PIPE SIZES UPTO 350NB AS PER LAYOUT REQUIREMENTS.
 - CW SYSTEM : 150NB SIZE DRAIN & VENT VALVES SHALL BE PROVIDED AS REQD. AS PER LAYOUT REQUIREMENTS.
 - INSTRUMENTS MARKED WITH **A** SHALL BE SUPPLIED ALONGWITH THE EQUIPMENTS.
 - R.E.JOINT AT CONDENSER INLET & OUTLET SHALL BE COMPENSATING/TIE TYPE.
 - AIR RELEASE VALVES (150NB) SHALL BE PROVIDED, IF REQUIRED AS PER SURGE STUDIES.
 - PAINTING/PROTECTION OF PIPES: PAINTING OF PIPES SHALL BE DONE AS PER DOCUMENT "PAINTING SCHEME FOR LP PIPING", BHEL PIPING CENTER DOCUMENT NO "7237-OPC:12"
 - BURIED/UNDERGROUND PIPING SYSTEM:
 - WHERE PIPELINES ARE BURIED, UNDERGROUND PROTECTION SHALL BE PROVIDED FOR THE PIPING SYSTEM AS INDICATED IN ANY ONE OF THE METHODS GIVEN BELOW:
 - COAL TAR PRIMER, COAL TAR ENAMEL, INNER WRAP OF FIBRE GLASS, FINAL OUTER WRAP OF ENAMEL IMPREGNATED FIBRE GLASS. TOTAL THICKNESS OF COATING SHALL NOT BE LESS THAN 4.0MM.
 - OR
 - WITH ANTI-CORROSIVE TAPE OF MINIMUM 4.0MM THICK CONFORMING TO IS-10221 AND AWWA C 203-93.
 - PIPE SURFACES SHALL BE CLEANED BY SHOT OR SAND BLASTING BEFORE APPLICATION.
 - BURIED PORTION COMING UNDER RAIL OR ROAD SHALL BE EITHER CONCRETE ENCASED OR CULVERTS
 - CW CONDUITS LAID UNDER GROUND SHALL BE ENCASED IN RCC WITH A MINIMUM THICKNESS OF 250 MM.
 - REFERENCE DRG./DOCUMENTS:
 - P&ID-DMCW SYSTEM, DRG. NO. PE-DG-409-179-N001.
 - CW & ACW SYSTEM DESIGN PHILOSOPHY AND SYSTEM WRITE UP, DOC. NO. PE-DC-409-165-N002.
 - P&ID OF CW OZONE GENERATION PLANT, DOC NO: PE-DG-409-174-14000A-A001.
 - DESIGN MEMORANDUM FOR CW TREATMENT PLANT, DOC NO: PE-DC-409-156-A001.
 - GA DRAWING OF SURFACE CONDENSER, DOC NO: HY-DG-1-36010-68801.
 - P&ID OF COOLING WATER FOR GAS BOOSTER COMPRESSOR (GBC), DOC NO: 1-38101-06694.

S.NO	EQUIPMENT	NOS. WORK, + STANDBY	CW REQD. PER UNIT CUB.M/HR.	CW REQD. PER UNIT CUB.M/HR	PRESS. DROP M.WC	TEMP. RISE °C	REMARKS
1	CONDENSER	1 + 0	18200	18200	6.0	10	1X100% CONFIG.
2	PHE	2 + 1	657	1314	7	8.7	3X50% CONFIG.
3	VACUUM PUMP	1 + 1	100	200	6	4.0	2X100% CONFIG.

JOB NO. 409		KARNATAKA POWER CORPORAION LTD (KPCL)	
STATUS CONTRACT		1X370 MW YELAHANKA CCPP	
REV.	DATE	ALTD	CHD
02	13.04.16	GC	VK
DRG REVISED IN LINE WITH RESOLUTION IN REFETING WITH KPCL AT BLR VIDE MDM DTD 16 TO 18.02.16 AND IN LINE WITH FICHTNER COMMENTS VIDE TRANSMITTAL REF. 3115161-KPCL-ME-VDT-125, DTD 03.03.16 DN WATER BALANCE DIAGRAM.		FICHTNER Consulting Engineers (India) Private Limited, Chennai, Bengaluru.	
Bharat Heavy Electricals Ltd		POWER SECTOR PROJECT ENGINEERING MANAGEMENT Noida	
TITLE		P&ID-CW & ACW SYSTEM	
SEPT. SCALE: SCALE		BHEL DRAWING NO. PE-DG-409-165-N001	
SIGN DATE		SHEET 1 OF 1	REV. 02



- LEGENDS:**
- AREA BOUNDARY
 - ROAD
 - PIPE/CABLE RACK
 - GREEN BELT

- BUILDINGS/FACILITIES**
- 1. GAS TURBINE HALL
 - 2. STEAM TURBINE HALL
 - 3. CONTROL & SWITCHGEAR EQUIPMENT BUILDING
 - 4. HEAT RECOVERY STEAM GENERATOR
 - 5. BFP BUILDING
 - 6. DELETED
 - 7. SERVICE BUILDING
 - 8. TRANSFORMER YARD
 - 9. FUEL FILTER SKID
 - 10. SWITCH YARD
 - 11. GUARD POND/ETP
 - 12. RO/DM PLANT
 - 13. COOLING TOWER
 - 14. RAW/FIRE WATER RESERVOIR
 - 15. DG SET
 - 16. COMPRESSOR BUILDING
 - 17. CW TREATMENT PLANT
 - 18. GAS HEATER SKID
 - 19. CW PUMP HOUSE
 - 20. RAW WATER PUMP HOUSE
 - 21. STORAGE/FABRICATION YARD DURING CONSTRUCTION(PROPOSED)
 - 22. CW OZONATION PLANT
 - 23. AMBIENT AIR QUALITY MONITORING STATION (01 NO)
 - 24. OVERHEAD STORAGE TANK
 - 25. FIRE STATION BUILDING & DRILL TOWER
 - 26. GAS CYLINDER SHED
 - 27. AC PLANT
 - 28. GAS BOOSTER COMPRESSOR ALONG WITH COOLING UNIT
 - 29. DELETED
 - 30. CHROMATOGRAPH ROOM
 - 31. GAS ANALYSER ROOM

✱ EXISTING BUILDING OF IOCL SHALL BE USED FOR WAREHOUSE AND CHEMICAL LAB

SPACE SHOWN FOR EXTENSION UNIT SHALL BE USED FOR RAW MATERIAL STORAGE/FABRICATION PURPOSE.

- NOTES: —**
- 1. ALL DIMENSIONS AND CO-ORDINATES ARE IN METER UNLESS NOTED OTHERWISE.
 - 2. a) THE FINISHED GRADED LEVEL (FGL) OF MAIN PLANT AREA (STACK TO TRANSFORMER YARD) SHALL BE RL.900.0M
b) FGL FOR COOLING TOWER AND GAS SKID AREA SHALL BE RL 902.0M
c) FGL FOR SWITCHYARD AREA SHALL BE RL 899.0M
d) FFL(FINISHED FLOOR LEVEL) OF GT/STG BUILDING SHALL BE RL 900.5M WHICH CORRESPONDS TO EL 0.0M FOR ALL REFERENCE.
 - 3. TERMINAL POINT FOR STORM WATER DRAIN SHALL BE ALONG GRID NO: 400.00 EAST.

JOB No. 409	
STATUS CONTRACT	
DISTRIBUTION	
TO	
No OFF	
REV	DATE
01	13.04.16
ALT	PUNEET
CHD	LKJ
APPD	JJ
1. DRG REVISED AS PER CUSTOMER/CONSULTANT COMMENTS RECEIVED VIDE LTR REF. NO: 3115161-2000-ME-VDT-008 DTD:20.01.16	

OWNER
KARNATAKA POWER CORPORATION LIMITED
IX370 MW YELAHANKA COMBINED CYCLE POWER PLANT

OWNER'S CONSULTANT
FICHTNER Consulting Engineers (India) Private Limited,
Chennai, Bengaluru

EPC CONTRACTOR
BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

DEPT CODE	NAME	SIGN	DATE
DRN	PUNEET		11.01.16
CHD	LKJ		11.01.16
APPD	JJ		11.01.16

TITLE
PLOT PLAN

MPL	C	MSE	I	MAX	E	DEPT.	SCALE
						SIGN	
						DATE	

DRAWING NO.
PE-DG-409-100-MG01

SHEET	01	OF	01	REV.	01
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