

1x370 MW YELAHANKA COMBINED CYCLE POWER PLANT

KARNATAKA POWER CORPORATION LIMITED

**TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT
REV 00**

SPECIFICATION NO.: PE-TS-409-164-A001



BHARAT HEAVY ELECTRICALS LIMITED

POWER SECTOR

PROJECT ENGINEERING MANAGEMENT

NOIDA, INDIA



TITLE:	SPECIFICATION NO.: PE-TS-409-164-A001	
	TECHNICAL SPECIFICATION FOR	
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	1x370 MW YELAHANKA	
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SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

SUB-SECTION IA - Specific Technical Requirements (Mech.)

SUB-SECTION IB - Specific Technical Requirements (Electrical)

SUB-SECTION IC - Specific Technical Requirements (C & I)

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SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)



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1.0 GENERAL

The intent of this specification is to cover design, engineering, manufacture, fabrication, assembly, inspection & testing at vendor's & sub-vendor's works, painting, forwarding, supply and delivery at site including start up and commissioning spares, mandatory spares, properly packed for transportation, loading/unloading / handling and storage at site, in site transportation, assembly, erection and commissioning, trail run, preparation and 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 the entire **EFFLUENT TREATMENT PLANT** as per the details in different sections/ volumes of this specification for **1x370 MW YELAHANKA COMBINED CYCLE POWER PLANT**.

2.0 SCOPE OF SUPPLY (MECHANICAL)

Broad scope of supply (Mechanical) for this package is detailed below and as indicated in relevant portion of this specification. Please refer Electrical and C&I specifications also for respective scope of Electrical and C&I items.

The Effluent treatment plant as specified in Technical data sheets & technical specifications, and shall consist of at least the followings:

- 2.1 Entire Effluent treatment plant as per P&ID (PE-DG-409-164-A001 REV 00- P & ID FOR EFFLUENT TREATMENT PLANT), Data Sheet-A and technical specification requirements.
- 2.2 Two (2) numbers (1Working + 1Standby) HRSG Blow Down Transfer Pumps along with electric motor drive with piping, valves, fittings and instrumentation as indicated in P & ID enclosed for Effluent treatment plant.
- 2.3 Two (2) numbers (1Working + 1Standby) GT/ST Area Floor Wash Collection Pit Dewatering Pumps along with electric motor drive with piping, valves, fittings and instrumentation as indicated in P & ID enclosed for Effluent treatment plant.
- 2.4 Two (2) numbers (1Working + 1Standby) Burnt Oil Collection Transfer Pumps along with electric motor drive with piping, valves, fittings and instrumentation as indicated in P & ID enclosed for Effluent treatment plant.
- 2.5 Two (2) numbers (1Working + 1Standby) Treated Effluent Disposal Pumps along with electric motor drive with piping, valves, fittings and instrumentation as indicated in P & ID enclosed for Effluent treatment plant.
- 2.6 Plates/tubes for one number lamella Clarifier/ Tube settler along with oil skimmer system, oil collection drum, sludge disposal system etc. as indicated in P & ID enclosed for Effluent treatment plant.
- 2.7 One (1) number Alum dosing tank for Effluent treatment plant with flushing arrangement, instrumentation, valves, fittings, ladders, agitator, basket, lifting lugs and piping etc. as indicated in P & ID enclosed for Effluent treatment plant.
- 2.8 One (1) number flash Mixers agitator along with electric motor drive with piping, valves, fittings and instrumentation as indicated in P & ID enclosed for Effluent treatment plant.
- 2.9 One (1) number Slope Oil storage tank to collect oil from lamella clarifier/ Tube settler as indicated in P & ID enclosed for Effluent treatment plant.
- 2.10 Two (2) numbers Oil Collection drums tank to collect oil from Slope Oil storage tank as indicated in P & ID enclosed for Effluent treatment plant.
- 2.11 Two (2) numbers Sludge Collection drums tank to collect Sludge from lamella clarifier/ Tube settler as indicated in P & ID enclosed for Effluent treatment plant.
- 2.12 Electric operated or manual operated hoist for all the pumps as per the details indicated in technical specification.
- 2.13 Electrical scope shall be as per "Electrical scope between BHEL and Vendor" enclosed with the technical specification.



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- 2.14 All necessary drains, vents, and sampling points, with valves, as specified and as required.
- 2.15 Hangers and supports as per the requirement.
- 2.16 All the interconnecting piping between different sumps and equipments as per the enclosed P&ID (PE-DG-409-164-A001 REV 00- P & ID FOR EFFLUENT TREATMENT PLANT).
- 2.17 Instrumentation (minimum) as per the enclosed P&ID (PE-DG-409-164-A001 REV 00- P & ID FOR EFFLUENT TREATMENT PLANT).
- 2.18 All tanks as per P&ID (PE-DG-409-164-A001 REV 00- P & ID FOR EFFLUENT TREATMENT PLANT) & Data Sheet-A complete with inlet and outlet connections, drain system, inlets water connection, all fittings and appurtenances etc. as specified and as required.
- 2.19 Bidder to note that the equipment, valves, instruments indicated in the P&ID (PE-DG-409-164-A001 REV 00- P & ID FOR EFFLUENT TREATMENT PLANT) attached in the technical specification are minimum and are in bidder's scope. During detailed engineering, bidder to furnish complete and detailed scheme in all respects including all valves, equipment's etc. for smooth, safe, efficient and trouble free operation of the plant meeting the specification requirement and also considering the applicable statutory requirement.
- 2.20 Necessary piping, fitting, valves, drains, vents, sampling etc. required for the complete Effluent 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.
- 2.21 All insert plates, rung ladder, nuts and bolts, and flanges and matching counter flanges wherever applicable.
- 2.22 All handrails for all the sumps, lamella clarifier / Tube settler.
- 2.23 Embedment plates with lugs shall also be provided by bidder as per system requirement.
- 2.24 All channels & brackets, mounting plates as required for mounting of motors, pumps, stirrers, tank etc shall be in bidder's scope.
- 2.25 Start-up and commissioning spares as required.
- 2.26 Mandatory spares as indicated under Annexure –VI.
- 2.27 All special tools necessary for proper maintenance or adjustment of the equipment packed in permanent box. Operating platforms, permanent ladders (not rugs), supports and other structural works for each tanks, valves etc. to facilitate accessibility for operation and maintenance.
- 2.28 All necessary structural steel for pipe supporting structure, platforms, walkways / pathways and access stairs, mechanical plant and equipment, mechanical services and pipe work associated with Effluent Treatment Plant.
- 2.29 Finish paints for touch up painting of equipments after erection at site in sealed container. Bidder shall also provide one final coat additionally of same DFT as specified in tender specification at site after completion of erection of each equipment / item.
- 2.30 All pipes, fittings etc required for hand railing, platforms, and ladders shall be in the scope of bidder.
- 2.31 All handrails for all the sumps, each inclined surface settlers and Tube settler shall be of 32 mm nominal bore MS pipes (medium class) as per IS: 1161 galvanised using 750 gm/sq. m of zinc. Hand railing shall be a two-rail system with the top rail 1000 mm above the walkway surface and the intermediate rail 450 mm below the top rail. Handrail post spacing shall be limited to 1500 mm as far as possible but can be proportioned to the length of the opening. In such a case spacing shall not exceed 1850 mm center to center of posts. Hand railing shall be shop fabricated for specific locations and field welded or bolted to the erected structural steel. Railings shall be provided with 100 mm wide and 8 mm thick MS strip at bottom as toe guard all along the length of railing



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in horizontal plane. For RCC stairs, hand railing with 20 mm square MS bar balustrade with suitable MS flat and Aluminium / Teakwood handrail shall be provided, unless specifically mentioned otherwise.

- 2.32 Monitoring gadgets, instruments and equipments required for commissioning & maintenance (till PG test and plant handover).
- 2.33 Instrument hook up material shall be in bidder's scope.
- 2.34 Permanent ladder (not rungs) for approaching the top of tanks, valves, all steel inserts with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc as required to grout in civil works and to support/hold the equipments being supplied under this specification for opening/maintenance purpose.
- 2.35 Wherever pipe racks are not available, pipes shall run on pedestals or below ground. All auxiliary structure & fixing items such as U clamps, nuts, bolts, channels, insert plates etc. required to lay the pipes on pedestals shall be in bidder's scope of work. Wrapping, coating and protection of all the buried pipe is also in bidder's scope. Wrapping, coating and protection of the entire buried pipe shall be as per IS 10221 or AWWA C 203-93.
- 2.36 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 and shall be in bidder's scope without any commercial, technical and delivery implication to BHEL.
- 2.37 All other items are also included in scope of supply as specified in other part of the specification.
- 2.38 All required elbow, tee, pipe fittings etc. required for erection of the complete system including piping shall be in bidder's scope. Bidder to provide the detailed BOQ during detail engineering.
- 2.39 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.
- 2.40 All the first fill and one Year's topping requirements of consumable such as greases, oil, lubricants, servo fluids/control fluids etc. which will be required to put the equipment covered under the scope of specifications, into successful commissioning / initial operation and to establish completion of facilities shall be in bidder's scope. Suitable standard lubricants as available in India are desired.
- 2.41 All blank flanges/counter flanges, isolations valves, tees etc. to interconnect the pipes at all terminal points.
- 2.42 One set of all special tools & tackles of reputed make necessary for proper maintenance or adjustment of the equipment being supplied by the bidder, packed in permanent box.
- 2.43 Four (4) nos. Trolley.
- 2.44 One (1) Number weighing scale.
- 2.45 All the Isolation gates and shutters as required each complete with all accessories.

2.46 PIPING

All the piping as listed below shall be in bidder's scope. The below indicated pipes shall be designed, supplied, erected, laid and tested by the bidder. Elbows, tees, flanges, hangers and supports, embedment plates with lugs etc. required for the below given piping shall also be provided by the bidder. For estimation purpose, Bidder to consider entire yard piping between each sump and equipments/ terminal points etc. as underground piping. The excavation & backfilling of earth for buried pipes is in BHEL scope.

- 2.46.1 All piping within the Effluent Treatment Plant area and between each sump and equipments/ terminal points etc. as per the details indicated in the P&ID (PE-DG-409-164-A001 REV 00- P & ID FOR EFFLUENT TREATMENT PLANT).



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- 2.46.2 Inlet and outlet pipes for each sumps, pits, pumps, other equipments, etc. with pipe connections to the respective sumps, pits, equipments as indicated in the P&ID (PE-DG-409-164-A001 REV 00- P & ID FOR EFFLUENT TREATMENT PLANT). The piping distance has been indicated in the enclosed P&ID (PE-DG-409-164-A001 REV 00- P & ID FOR EFFLUENT TREATMENT PLANT).
- 2.46.3 Service water piping as applicable as per the Terminal Points.
- 2.46.4 In addition, any additional piping and associated accessories required to complete the system shall be in bidder's scope.
- 2.46.5 The Yard piping as per details provide in below table:

Sr. No.	PIPING	TOTAL PIPING LENGTH IN METERS (BIDDER'S SCOPE)
i.	Piping distance from HRSG Blow down sump to CW Forebay	230 Meters.
ii.	Piping distance from Burnt Oil Collection Pit to ETP Area (50 NB)	100 Meters
iii.	Piping distance from Burnt Oil Collection Pit to ETP Area (65 NB)	210 Meters
iv.	Piping distance from GT/ST Area Floor Wash Collection Pit to Line from Burnt Oil Collection Pit to ETP Area	100 Meters.
v.	Piping distance from Guard Pond to Final disposal point at plant boundary	500 Meters

3.0 SCOPE OF SUPPLY (ELECTRICAL)

Complete electrical as per specification / details indicated in Section IB (Specific Technical Requirement Electrical) and IIB (General Technical Requirement Electrical).

4.0 SCOPE OF SUPPLY (C&I)

Complete C&I as per specification / details indicated in Section IC (Specific Technical Requirement C&I) and IIC (General Technical Requirement C&I).

5.0 SCOPE OF SUPPLY (CIVIL)

Total Civil is in BHEL's Scope of work, however complete grouting for equipment, pumps, etc. fixing of equipments, pumps, etc. as required shall be in bidder's scope.

Detailed Civil Input drawing shall be provided by bidder. Successful bidder shall furnish civil assignment 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.

The excavation & backfilling of earth for buried pipes is in BHEL scope.

6.0 SCOPE OF SERVICES

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

- 6.1 Design and engineering of entire Effluent treatment plant.
- 6.2 Unloading, Storage, handling and transportation at site.
- 6.3 Minor Civil work including chipping of foundation, grouting below base plate for all structures, equipment ,



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grouting of anchor bolts wherever these are not placed in the foundation during casting of foundation itself etc. To the extent possible, vendor shall ensure to supply all foundation bolts timely so as to facilitate placement of these bolts while casting the foundation. Wrapping, coating and protection of all the buried pipe shall be as per IS 10221.

- 6.4 Pre- Commissioning work such as flushing, hydraulic testing etc. Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities shall be arranged by the successful bidder at their own cost.
- 6.5 Erection and Commissioning of entire Effluent treatment plant.
- 6.6 Arrangement of all lubricants, instruments, reagents for carrying out trial run, commissioning and PG test.
- 6.7 Monitoring gadgets, instruments and equipments required for maintenance (till PG test & Plant Hand over).
- 6.8 All personnel required during commissioning, trial run and PG Test.
- 6.9 Trial run for requisite period.
- 6.10 Performance testing.
- 6.11 Painting of all equipment within scope of supply as per Annexure V. Final touch up painting at site.
- 6.12 Preparation of civil assignment drawings i.e. pedestals details; insert plates / embedment's plates required for supporting pipes and equipment etc. and review of civil drawing prepared by BHEL based on civil assignment drawing of bidder. In case any modification is required in the civil work already done based on civil inputs given by vendor, rework shall be done at the cost and risk of the vendor.
- 6.13 Preparation & submission of all drawings as per list enclosed Annexure IV in Section IA, and Drawing/Document submission schedule enclosed Annexure VII in Section IA.
- 6.14 Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.
- 6.15 All other facilities/ services as described in sections/volumes on site services in specification and related to Effluent Treatment Plant scope of work.
- 6.16 Relevant requirements as per GTR, GCC, ECC & SCC.
- 6.17 Any other service required for making the installation complete in all respect within battery limits and for satisfactory erection & commissioning of the system as well as to meet any statutory requirement relevant to the package, unless specifically EXCLUDED from scope of services.

7.0 TERMINAL POINTS

- 7.1 Service water connection (50 NB connections) - At 5 meter distance from ETP area. However distribution and piping inside Effluent treatment plant area shall be in bidder's scope.
- 7.2 Drinking water (or potable water) of 40 NB connections - At 5 meter distance from ETP area. However distribution and piping inside Effluent treatment plant area shall be in bidder's scope.

8.0 EXCLUSIONS

- 8.1 All civil works including foundation of equipment. However complete grouting for equipment, fixing and any concreting inside vessels and lining shall be in the scope of the bidder.
- 8.2 Air conditioning.
- 8.3 Other exclusions are mentioned in the electrical & C&I parts of this specification.
- 8.4 Drinking water (or potable water), service water up to terminal points.



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8.5 Excavation & filling of earth for buried pipes if and as required.

8.6 All the Chemicals.

9.0 QP AND SUB VENDOR APPROVAL

- 1) The quality assurance plan is enclosed elsewhere in technical specification. 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 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. 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/BHEL for approval. All inspection & testing etc. shall be carried out accordingly.
- 2) The sub vendor list enclosed elsewhere in technical specification is indicative only and is subject to approval / acceptance by customer. 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.

10.0 PERFORMANCE GUARANTEE TEST

The Performance guarantee test shall be as per Annexure-III/Section-IA.

11.0 DRAWING/DOCUMENTS REQUIREMENT

For the Drawings/Documents submission schedule, please refer Annexure VII.

For the Drawings/Documents Submission Procedure, please refer Annexure IV. 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.

12.0 SPARES

- 12.1 All the spares for the equipment under the contract provided by the vendor will strictly conform to the specifications and documents and will be identical to the corresponding main equipment/components supplied under the contract.
- 12.2 The quality plan and the inspection requirement finalized for the main equipment will also be applicable to the corresponding spares.

12.3 MANDATORY SPARES

- The list of mandatory spares considered essential by the BHEL & Customer is indicated in Annexure VI.
- All mandatory spares shall be delivered at site at least two months before scheduled date of initial operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipments.
- Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.
- The Bidder shall note that if there in any change/ variation in equipment / system during detail engineering which causes any change/ variation in the essential spares quantity, the same shall be supplied without any commercial implications. The price indicated for the mandatory spares shall be considered for the purpose of evaluation.



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12.4 **START-UP AND COMMISSIONING SPARES**

- Start-up and Commissioning spares are those which would be required during plant or equipment testing, start-up and commissioning. All spares used until the plant is finally handed over by the Contractor to the Owner come under this category. All start-up and commissioning spares as required shall be in Bidder's scope.
- Bidder shall be responsible for the ready and timely availability for all the start-up and commissioning spares as required during various stages of erection, testing, cleaning and commissioning upto handing over of plant.

12.5 **MAINTENANCE TOOLS AND TACKLES**

- One set of all special tools shall be furnished and shipped with each piece of equipment for dismantling, maintenance, adjustment, and calibration of the equipment. The tools shall be shipped in separate heavily constructed wooden boxes provided with hinged covers and padlock hasps.
- The Contractor shall supply under this contract all maintenance tools for each piece of equipment / system and it shall be boxed separately and the boxes shall be appropriately marked for shipment and identification of contents.
- A weather-proof itemised list of the contents shall also be attached to the outside of each container.
- The maintenance tools shall include all special handling rigs, bars, slings, cable and all specialised equipment for control system maintenance such as extender boards, scopes, and all software and hardware. Further, Bidder shall also include a full set of regular maintenance tools and tackles required. Bidder shall also include all maintenance tools and tackles in their scope. Total price of all the maintenance tools and tackles shall be included in the quoted lumpsum price.

13.0 **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 certificate.(Stamped & Signed)
- Schedule of Declaration. (Stamped & Signed)
- Electrical Load data in BHEL format (Stamped & Signed)
- Price Schedule duly filled in. (Stamped & Signed).

Any other documents submitted by bidder except as asked in the bid's specification shall not be evaluated & considered as **null & void**.

14.0 **ADDITIONAL TECHNICAL REQUIREMENT**

- 14.1 For selection of pump head during detailed engineering, Bidder will consider 12 m static head + 10% margin in addition to the losses in straight length and bend in pipes and valves etc.
- 14.2 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.
- 14.3 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.
- 14.4 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



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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.

- 14.5 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.
- 14.6 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".
- 14.7 The complete system shall be proven and necessary design documentation in support of proveness shall be submitted by the successful bidder in support of the systems, if asked by the customer without any price and delivery implication to BHEL and customer.
- 14.8 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.
- 14.9 The total space available for the complete Effluent Treatment Plant Area has been indicated in the Key plan attached elsewhere in the Technical specification. Bidder to accommodate all the equipments within the allocated space.
- 14.10 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.
- 14.11 KKS numbering as per BHEL/Customer requirement shall be provided by the Bidder during detailed engineering stage without any commercial/delivery implication to BHEL.
- 14.12 Any statutory requirement / clearance required for the packages from government / local body shall be in bidder's scope.
- 14.13 In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- 14.14 Latest version of all codes and standards to be followed.
- 14.15 Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the works for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same
- 14.16 All drawings/documents shall be approved by BHEL/Customer during detailed engineering stage. Successful vendor shall comply with the comment of the customer/BHEL without price & delivery implication.
- 14.17 Site facility as available or as extended by Customer shall only be provided.
- 14.18 DESIGN CRITERIA AND TECHNICAL DETAILS
 - The Raw water analysis, and quality of other waste leading to Central Monitoring basin to be adopted for Design of Effluent treatment Plant has been indicated elsewhere in the specification.
 - The effluent water from the Effluent treatment plant shall meet the guaranteed parameters specified elsewhere.



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- Plant shall be designed considering the available head at the terminal point.
- Complete Effluent treatment Plant shall be designed to run continuously.
- All the equipments of Effluent treatment plant shall be designed for outdoor duty.
- Capacity of monorail hoists/ E.O.T crane or chain pulley block wherever indicated in technical specification are minimum and capacity of such hoists/ cranes etc. shall be suitable for handling 125% of maximum weight to be handled during erection and maintenance of the equipments in the pump house, buildings etc. as the case may be.
- Any statutory requirement / clearance required for the packages from government / local body shall be in bidder's scope.
- In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- Latest version of all codes and standards to be followed.
- The treated water shall also be used for gardening purpose. Bidder to check all the regulations for the water used for gardening purpose. The system shall be designed in such a way that the water can be used for gardening purpose as per the norms of Central pollution control board, Karnataka pollution control board, WHO etc. All the arrangements to meet the norms is in bidder's scope though not indicated in the technical specification. Taking the clearance form respective agencies is also in bidder's scope.
- **Tanks, Dosing pumps (for Lamella Clarifier/Tube Settlers)**
 - i) The chemical preparation tanks and dosing pumps shall be designed to dose chemicals considering the following dosage rate for all the Lamella clarifiers/ Tube Settlers:
 - a) Alum 70 mg/litre on 100% basis
- **Lamella Clarifier / Tube Settlers**
 - i. The tube settler/ Lamella Clarifier shall be capable of handling the specified design flow rate and producing effluent water quality as indicated in datasheet –A & P&ID.
 - ii. Each tube settler / Lamella Clarifier shall be provided with one flash mixer and Flocculation Chamber of MSEP construction at its upstream.
 - iii. Chemical shall be added to the wastewater in the flash mixer. Flash mixer shall be circular/rectangular type. Water from the flash mixer shall flow to adjacent flocculation chamber by gravity. Suitable mechanical stirrer, driven by electric motor through speed reducing gearbox, shall be provided in each flash mixer to ensure adequate mixing of chemicals. Flash mixer shall provide minimum one-minute storage at the design flow rate of the flash mixer. The maximum speed of the agitator will be 200 RPM. Material of Construction of agitator will be SS316. Necessary reduction gear unit for agitator shall also be provided by the bidder.
 - iv. Water from flash mixer shall flow to a flocculation chamber by gravity. Adequate retention time (minimum 10 minute storage at the design flow rate) shall be provided for the incoming water to allow formation of uniform flocs. The flocculation chamber shall be of circular/rectangular type with suitable mechanical agitator driven by electric motor through speed reducing gearbox. Water from the bottom of flocculation chamber shall flow to the Tube Settler / Lamella Clarifier by gravity.
 - v. The tube settler/ Lamella Clarifiers shall be of MSEP construction and of proven design. These shall be provided with walkway (bridge) and platform to approach all the internals. Clear width of the bridge shall not be less than 1500 mm.
 - vi. All metallic parts inside the tube settler/ Lamella Clarifiers coming in contact with water shall be painted with three (3) coats of epoxy paint over one (1) coat of primer to prevent corrosion. Total thickness 500 micron. Other components shall be painted with one coat of red lead primer and three coats of suitable rust preventing paint.



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Total thickness 300 micron. The concrete parts coming in contact with water shall be painted with three (3) coats of bitumastic heavy-duty paint of 600 microns thick.

- vii. Design of the sludge removal system should be such as to reduce loss of water during sludge blow off within 5% of rated flow.
- viii. The tube settler/ Lamella Clarifiers periphery shall have sufficient width to have an easy walkway along-with hand-railing for general inspection. Access ladders (at least from two locations) with platforms and hand-railing shall be provided in the separator for good approach. However, the manual sludge valves shall be operable from the top of the sludge chamber through head stock and extended spindle arrangement.
- ix. Suitable sampling connections shall be provided for performance monitoring.
- x. The tube settler/ Lamella Clarifiers shall be circular/rectangular with distinct tube /plate separation zones, sludge thickener zone, clear water zone and oil skimming zone. The tube settler/ Lamella Clarifiers shall be counter flow or cross flow type. Co-flow type units are not acceptable.
- xi. The unit shall be designed with minimum side water depth of 4 M. The overall area of unit shall be based on an average flow velocity not more than 5 M3/hr/ M2.
- xii. The inclined tubes/plates shall be spaced so that stable flow conditions are available. The flow through the tube/plates shall be viscous/laminar. The cross sectional area of each tube shall be such that the effective hydraulic diameter is 80 mm (min). The material of tube pack shall be UV inhibited virgin PVC.
- xiii. In case of plate type separator the distance between the successive plates shall be 50 mm (min). The plates shall be made of GRP (glass reinforced plastic). The resin for the manufacturing of GRP plates shall be orthophthallic type.
- xiv. The length of the tubes/plates through which the water flow shall not be less than 1.5 M.
- xv. The tubes/plates shall be inclined by 50-80 deg. angle to the horizontal. The tubes/plates shall be arranged such that the comp Effluent treatment plante water travels through all the tubes across the cross section of separator.
- xvi. To remove settled particles from the plates/tubes suitable water jet arrangement shall be provided. Pumping and piping arrangement shall be separately provided for this purpose (though not indicated in the P&ID). The tube/ plates shall be easily accessible for the cleaning purpose. The tube pack / plates shall be placed inside the separator such that these may be individually removed for maintenance even when separator is operating.
- xvii. The entire pack shall be rigid and shall not deflect by self-weight, water load or operator movement over the pack. Special features of pack/plate support arrangement and maintenance shall be brought out in the bid.
- xviii. Treated water shall be collected in a trough provided with adjustable weir.
- xix. The unit shall be capable of delivering constant effluent water quality without any sludge/oil carryover, even at the time of rapid increase in influent water flow or change in influent water quality, or changes in raw water temperature.
- xx. The bidder shall justify the design basis of entire plate/tube type separator unit and individual components of the entire unit with backup calculations and also by means of supplying documentary evidence from their earlier installed plants in the form of drawings, certificates, etc.
- All the vertical pumps shall be considered as self-lubricating type unless specifically mentioned.
 - All the sumps, tanks, reservoirs and other water retaining structures shall be provided with access ladders/ rungs from operating platforms/ ground level as the case may be and de-watering pits one for each section. Handrailing will be provided by bidder for safety purpose in all civil structures. Supply and erection of Hand railing as desired for safety purpose will be in bidder's scope.



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- All the tanks shall be provided with vent, overflow, drain and sample connections. Effective capacity for chemical tanks & water retaining structures/ tanks/ sumps means the capacity between the bottoms of the overflow nozzle to the top of the outlet nozzle. Outlet nozzle centre line shall be kept at least 200 mm from the Invert Level of the chemical tanks/ water retaining structures/ tanks/ sumps. A minimum free board of 300 mm shall be provided in all the water retaining structures of Effluent Plant above the maximum water level/ overflow level as the case may be excluding the thickness of the slab / beam thickness if any.
- For all pumps, while calculating the pump head, 10% margin shall be considered on frictional losses.
- Max. support length in meters for MS pipe shall be as follows:-

a)	PIPE DIAMETER (MM)	1200	1000	800
b)	SPAN (METERS)	12	10	10

For pipe sizes less than 800 NB, span shall be as per ANSI B31.1.

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 subject to BHEL / Customer approval during detail engineering without any commercial & delivery implication to BHEL.

- **ENVIRONMENTAL STIPULATIONS**

The Waste Water Treatment System shall fully comply with all requirements and limits specified in Environmental (Protection) Rules, 1986, along with all latest amendments to it, requirements and stipulations of the Central Pollution Control Board (CPCB), Ministry of Environment and Forests (MOEF); Government of India and Karnataka Pollution Control Board (KPCB) for the project, and any other central or local statutory requirements regarding environmental pollution and its abatement. As regards cases for which no Indian Standard exists, internationally accepted standards like the World Bank's standard, OSHA standards etc. shall be applicable. The Purchaser will decide such applications.

- **Weighing Scales**

The effluent treatment plant shall be equipped with a weighing scale of platform & dial type suitable for chemicals being handled. Range of weighing scale shall be suitable for weighing 0-100 Kg.

- **Metering Pumps along with electric motor drive**

- a) Pumps shall be simplex displacement hydraulically operated diaphragm design, driven by squirrel cage induction motor through suitable speed reduction unit. Maximum pump stroke speed shall not exceed 100 per minute.
 - b) The stroke shall be continuously adjustable to give a capacity variation 10-100% range while the pumps along with electric motor drive are running or stopped. Adjustment of capacity shall be done by automatically from remote location and / or manually (micrometric adjusting type) locally for each of the pump as described elsewhere.
 - c) Capacity variation may be effected by changing eccentricity of the driving crank or by suitable hydraulic circuit. Pump accuracy shall be industry standard + 1% of capacity setting.
 - d) Pumps shall be provided with an integral relief valve, spring operated, to release pressure when delivery line blockage occurs.
 - e) Crank case shall be constructed of high quality cast iron which will also house the gear box and guides for cross head.
 - f) Guided, controlled travel, double-ball check valves or equivalent, shall be provided both on the suction and discharge sides. Suitable gland seal be provided to prevent leakage.
- Painting will be done on Effluent Treatment Plant equipments/ items as specified in this technical specification. However, any variation in the painting schedule as finally approved by BHEL shall be taken care by bidder without any commercial and delivery implication.
 - Wherever terminal points between BHEL and bidder indicated, bidder shall provide pipes with counter flange.



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- Wherever local instruments for measurement of Flow, Pressure, and Level is indicated in the P&ID, Bidder to provide Diaphragm seal type instrument for Chemical (all type and concentration), corrosive, viscous fluids application.

- Control Philosophy.**

The interlocks required for operation of pumps in various systems shall be implemented in Relay based Local Control Panel (LCP).

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.
- Hardwired annunciation for pump trip, level low, level high etc. with adequate number of windows.
- Push button for start / stop of pumps, etc.
- Pump stroke indicator with local/remote stroke adjustment facility (Applicable for LCP under ETP area).
- Local push button stations for all motor drives.
- LED (Seven Segment type) indicators for Analog signals.
- The signal conversion from analog to binary shall be done in the LCP and the necessary arrangement for the conversion shall be included in each LCP.

Bidder to note that following nos of LCP is in bidder's scope:

- LCP # 1- At HRSG Blow Down sump to control the HRSG Blow Down transfer pumps. The following minimum features shall be available in this LCP:
 - ❖ Start push button and Lockable type emergency stop local push button along with 'ON/OFF/TRIP' lamp indication of each pump.
 - ❖ Start/Stop command and status of each pump in the panel.
 - ❖ Main/Stand by selection of each pump through panel.
 - ❖ Alarm/annunciation in panel for running, stop, trip of each pump, low level in the sump, high level in the sump etc. In addition 5 nos spares windows for alarm/annunciation shall also be provided by the bidder.
 - ❖ Test, reset & accept push button for alarms.
 - ❖ The signal conversion from analog to binary shall be done in the LCP and the necessary arrangement for the conversion.
 - ❖ Other features of LCP as listed in the Tender technical specification.

Following Interlocks shall be provided:

Interlock Description of Equipment	Interlock Effect
At Low Level in HRSG Blow Down sump	Trip HRSG Blow Down transfer pumps



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Following Minimum annunciations shall be provided:

1. Running HRSG Blow Down transfer pumps Tripped.
2. HRSG Blow Down sump level high.
3. HRSG Blow Down sump level low.

- LCP # 2- At Burnt Oil Collection pit to control the Burnt Oil Collection pit transfer pumps. The following minimum features shall be available in this LCP:
 - ❖ Start push button and Lockable type emergency stop local push button along with 'ON/OFF/TRIP' lamp indication of each pump.
 - ❖ Start/Stop command and status of each pump in the panel.
 - ❖ Main/Stand by selection of each pump through panel.
 - ❖ Alarm/annunciation in panel for running, stop, trip of each pump, low level in the sump, high level in the sump etc. In addition 5 nos spares windows for alarm/annunciation shall also be provided by the bidder.
 - ❖ Test, reset & accept push button for alarms.
 - ❖ The signal conversion from analog to binary shall be done in the LCP and the necessary arrangement for the conversion.
 - ❖ Other features of LCP as listed in the Tender technical specification.

Following Interlocks shall be provided:

Interlock Description of Equipment	Interlock Effect
At Low Level in Burnt Oil Collection pit	Trip Burnt Oil Collection pit transfer pumps

Following Minimum annunciations shall be provided:

1. Running Burnt Oil Collection pit transfer pumps Tripped.
2. Burnt Oil Collection pit level high.
3. Burnt Oil Collection pit level low.

- LCP # 3- At GT/ST area floor wash collection pit to control the GT/ST area floor wash transfer pumps. The following minimum features shall be available in this LCP:
 - ❖ Start push button and Lockable type emergency stop local push button along with 'ON/OFF/TRIP' lamp indication of each pump.
 - ❖ Start/Stop command and status of each pump in the panel.
 - ❖ Main/Stand by selection of each pump through panel.
 - ❖ Alarm/annunciation in panel for running, stop, trip of each pump, low level in the sump, high level in the sump etc. In addition 5 nos spares windows for alarm/annunciation shall also be provided by the bidder.
 - ❖ Test, reset & accept push button for alarms.



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- ❖ The signal conversion from analog to binary shall be done in the LCP and the necessary arrangement for the conversion.
- ❖ Other features of LCP as listed in the Tender technical specification.

Following Interlocks shall be provided:

Interlock Description of Equipment	Interlock Effect
At Low Level in GT/ST area floor wash collection pit	Trip GT/ST area floor wash transfer pumps

Following Minimum annunciations shall be provided:

1. Running GT/ST area floor wash transfer pumps Tripped.
2. GT/ST area floor wash collection pit level high.
3. GT/ST area floor wash collection pit level low.

- LCP # 4- In ETP area to control the Alum dosing system, Flash mixer, agitator motors, treated Effluent transfer pumps, motorised valves etc. The following minimum features shall be available in this LCP:
 - ❖ Start push button and Lockable type emergency stop local push button along with 'ON/OFF/TRIP' lamp indication of each pump and agitator.
 - ❖ Start/Stop command and status of each pump and agitator in the panel.
 - ❖ Main/Stand by selection of pump and agitator through panel. Start permissive of agitator.
 - ❖ pH analyser interlock with motorised valves at discharge and recirculation line of effluent disposal pumps.
 - ❖ TDS analyser interlock with motorised valves at discharge and recirculation line of effluent disposal pumps.
 - ❖ Turbidity meter interlock with motorised valves at discharge and recirculation line of effluent disposal pumps.
 - ❖ Pump stroke indicator with local/remote stroke adjustment facility.
 - ❖ Alarm/annunciation in panel for running, stop, trip for each pump and agitator, low level, high level for each tank & Guard Pond compartments, temperature indication ,flow indication, TDS indication, Turbidity indication, Residual Chlorine indication, Oil indication etc. In addition 10 nos spare windows for alarm/annunciation shall also be provided by the bidder.
 - ❖ ON/ OFF/ TRIP indication of Each HRSG Blow Down Transfer Pumps, GT/ST Area Wash Collection Pit Dewatering Pumps, Burnt Oil Collection Pit Transfer Pumps.
 - ❖ Test, reset & accept push button for alarms.
 - ❖ The signal conversion from analog to binary shall be done in the LCP and the necessary arrangement for the conversion.
 - ❖ Other features of LCP as listed in the Tender technical specification.



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Following Interlocks shall be provided:

Interlock Description of Equipment	Interlock Effect
At Low Level in guard pond	Trip Treated effluent Transfer Pump
At Low Level in Alum Dosing tank	Trip Alum Dosing Pump and respective Agitator
If the pH value sensed by pH transmitter is <5.52 and > 9.0	Open Recirculation Motorized valve
If the pH value from pH transmitter is in between 5.52-9.0 i.e. Normal pH value	Motorised Valve at discharge header of treated effluent transfer pumps will open automatically and recirculation valve will close automatically.

Following Minimum annunciations shall be provided:

1. Alum Dosing pumps Tripped.
2. Alum dosing tank level high.
3. Alum dosing tank level low.
4. Alum dosing tank agitator tripped.
5. High differential pressure across the 'Y' type strainer of Alum dosing pumps.
6. Guard Pond-A level high.
7. Guard Pond-B level high.
8. pH at Low/High/Normal(pH Analyzer). Low Value pH<5.52. High Value pH>9.0. Normal Value pH= 5.52 to 9.0.
9. TDS high (TDS Analyser). TDS High Value >2100 ppm.
10. Temperature High (Temperature Transmitter). Temperature High Value >39 Degree Celsius.
11. Turbidity High (Turbidity Meter). Turbidity High Value > 100 NTU.
12. Oil Quantity High (Oil Analyser). Oil Quantity High value > 10 ppm.

Following indication shall also be provided in LCP of ETP area:

1. Temperature of water at discharge of effluent disposal pump.
2. Flow of water at discharge of effluent disposal pump.
3. TDS of water at discharge of effluent disposal pump.
4. Turbidity of water at discharge of effluent disposal pump.
5. Oil in water at discharge of effluent disposal pump.
6. Chlorine in water at discharge of effluent disposal pump.

Following ON/ OFF/ TRIP indication shall be provided in LCP of ETP area (LCP4):

1. HRSG Blow Down transfer pumps
2. GT/ST area floor wash transfer pumps
3. Burnt Oil Collection pit transfer pumps



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15.0 INSTRUCTIONS TO BIDDER

- 15.1 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 them of the responsibility of providing such facilities to complete the supply, erection and commissioning of Complete Effluent treatment Plant.
- 15.2 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high 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 judgment is not in full accordance herewith.
- 15.3 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.
- 15.4 The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification are subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- 15.5 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 BHEL/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 BHEL/ Customer as and when brought to their notice either by the bidder or by BHEL/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.
- 15.6 The bidder's offer shall not carry any sections like clarification, interpretations and /or assumptions.
- 15.7 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.
- 15.8 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- 15.9 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and Customer/Purchaser/Employer will mean BHEL and/or Customer (KPCL: Karnataka Power Corporation Ltd.) including their consultant (Fichtner Consulting Engineer (India) Pvt. Ltd.) as interpreted by BHEL in the relevant context. Bidder to refer GCC/SCC for more clarity.
- 15.10 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.
- 15.11 BHEL's/Customer's representative shall be given full access to the shop in which the equipments are being manufactured or tested and all test records shall be made available to him.



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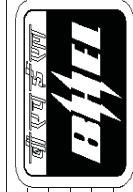
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ANNEXURE I

QUALITY PLAN FOR EFFLUENT TREATMENT PLANT



TECHNICAL SPECIFICATION FOR EFFLUENT TREATMENT PLANT
1x370 MW YELAHANKA CAPP
SPECIFICATION NO.: PE-TS-409-164-A001

QUALITY ASSURANCE PLAN FOR ATMOSPHERIC TANKS

Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Reference Document	Acceptance Standard	Format of Record	Scope of Check			Remarks
									BIDDER	BHEL	CUSTOMER	
I) Initial Procedure Qualifications :												
a	Welding Procedure Qualification Tests	Procedure Qualification	Major	Visual & Mech Checks on Test Piece	100%	ASME SEC IX	ASME SEC IX	WPS - QW 482 & PQR - QW 483	P	V	V	Note 1
b	Welder Performance Qualification Tests	Performance Qualification	Major	Visual & Mech Checks on Test Piece	100%	ASME SEC IX	ASME SEC IX	WPQ - QW 484	P	V	V	Note 1
II) Raw Material Inspection :												
a	Raw Material Identification for Shell, D/Ends, Pipes & Flanges	Verification of MTC & Chemical, Mechanical Properties	Major	Chemical & Mechanical Check	1 Per Heat / Lot	App.Drg. / Relevant code	ASME SEC II Part A for D/ends & IS 2062 for Shell	Mfr TC / Check Test Report	P	V	V	Note 2 & 3
III) Inspection of Dished Ends :												
a	Dimension & Visual Check	Dimensional Conformance, Thinning after forming & Visual	Major	Measurement & Visual	100%	App.Drg.	ASME SEC VIII / IS 4049	SIR	P	V	V	Thickness Check by De meter
b	DP Check on KR, SF & Edge	DPT	Major	Visual	100%	ASME SEC V	ASME SEC VIII Appendix 8	DP Report	P	V	V	
c	RT on Diend cordial seam	RT	Major	Visual	As per Appd. Drg	ASME SEC V	ASME SEC VIII DIV I	RT Report	V	V	V	Review of RT Films by BHEL & CUSTOMER.
IV) In Process Inspection :												
a	Shell Fabrication	Marking, Edge Preparation, rolling & Fit up	Major	Dimensional Conformance & Root Gap	100%	App.Drg.	App.Drg.	SIR	P	V	V	
b	Joint Preparation, Weld set-ups & Nozzles fittings	Alignment & Dimensions	Major	Measurement & Visual	100%	App.Drg.	App.Drg.	SIR	P	V	V	
c	Welding of shells, shell to D/ends & nozzles	Weld Parameter	Major	Visual	100%	AWPS & ASME SEC IX	AWPS & ASME SEC IX	Log Book	P	V	V	
d	DP Check on Butt Joints & Fillet Joints	DPT	Major	Visual	100% on Butt Joints & 10% on Fillet Joints	ASME SEC V	ASME SEC VIII Appendix 8	DP Report	P	V	V	
e	RT on T Joints & Butt Joints	RT	Major	Visual	As per Spec. / Drg	ASME SEC V	ASME SEC VIII DIV I	RT Report	V	V	V	Review of RT Films by BHEL & CUSTOMER.
												Contd...2

TECHNICAL SPECIFICATION FOR EFFLUENT TREATMENT PLANT											
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QUALITY ASSURANCE PLAN FOR ATMOSPHERIC TANKS											
Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Ref.Document	Acceptance Standard	Format of Record	Scope of Check		Remarks
									BIDDER	BHEL	CUSTOMER
V) Stage Inspection before Rubber Lining :											
a	Dimension Check	Dimensional	Major	Measurement	100%	App.Drg.	App.Drg.	FIR	P	W	V
b	Visual Check	Visual	Major	Visual Inspection	100%	App.Drg.	App.Drg.	FIR	P	W	V
c	Hydro Static Pressure Test / Water Fill Test (As Applicable)	With stand of Hydro Test / Water Fill Test	Critical	Visual Inspection	100%	App.Drg.	No Leakage or Seepage	FIR	P	W	W
d	Painting	DFT	Major	Visual Inspection	100%	App.Drg.	App.Drg.	FIR	P	V	V
e	Stamping / Stenciling	To identify the Equipment	Major	Visual Inspection	100%	App.Drg.	App.Drg.	FIR	P	V	V
f	Review of Testing and Measuring Instruments	To ensure the accuracy	Minor	Verification	100%	Calibration Certificate	National & International Standards	TC	V	V	V

NOTE 1: Only qualified welders & WPS to be used. In case welders are already qualified by customer / BHEL / LRIS / BVQI / DNV & doing similar jobs re-qualification is not required.

NOTE 2: Check Test shall be carried out on plates where ever correlation of TC with material is not available. Sample shall be identified & test Certificates shall be Verified by BHEL/CUSTOMER.

NOTE 3: All test reports / Inspection reports related to the tank shall be furnished for BHEL / CUSTOMER review.

NOTE 4: Hydro test duration shall be 1hr at 1.5 times of design pressure or 2 times of working pressure whichever is higher & No Leak shall be permitted.

NOTE 5: For Rubber Lining refer separate QAP. Rubber Lining shall be carried out after Hydro Test and clearance from BHEL.

NOTE 6: Hydro test will be conducted before Rubber Lining.

NOTE 7: The above mentioned quality inspection requirement are bare minimum. However any other test of any item as required by BHEL/Customer the same shall be provided by the bidder without and commercial and delivery implication to BHEL.

ABBREVIATIONS:

TC: Test Certificate
DFT: Dry Film Thickness
W: Witness

SIR: Stage Inspection Report
App.Drg. Approved Drawing
V : Verify Documents

FIR: Final Inspection Report
P: Perform

TECHNICAL SPECIFICATION FOR EFFLUENT TREATMENT PLANT

1x370 MW YELAHANKA CCPP

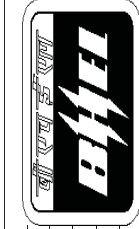
SPECIFICATION NO.:PE-TS-409-164-A001



QUALITY ASSURANCE PLAN FOR CENTRIFUGAL PUMPS

Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Ref.Document	Acceptance Standard	Format of Record	Scope of Check			Remarks
									BIDDER	BHEL	CUSTOMER	
I) Raw Material Inspection :												
a	Raw Material Identification for Casing, Impeller, Shaft, Casing Wearing ring & Shaft sleeve.	Chemical Analysis & Mechanical Tests	Major	Chemical Analysis & Mechanical Tests	1 Per Heat / Lot	App.Drg. / Relevant code	App.Drg. / Relevant code	Mfr TC / IR	P	V	V	Note 1 & 3
b	Check for Surface defects and Dimensional conformity of the Raw materials.	Dimensional & Visual	Major	Visual & Measurement	100%	App.Drg. / Relevant code	App.Drg. / Relevant code	Mfr TC / IR	P	V	V	
c	Motors	Speed, Power, IP, Mounting Type	Major	Visual	100%	As Per IS 325	Relevant code	Routine Test Report	R	V	V	
II) In Process Inspection :												
a	Machining of Casings, Impeller	Dimensions & Alignment	Major	Visual & Measurement	100%	Appd. Drg & Data Sheet	Appd. Drg	SIR	P	V	V	Note 4
b	DP Check on Machined Surface	DPT	Major	Visual	100%	ASME SEC V	ASME SEC VIII & Appendix 8	SIR	P	V	V	
c	Hydro test for casings	With stand of Hydro Static	Critical	Hydro	100%	Appd. Drg & Data Sheet / IS 5120	Appd. Drg & Data Sheet / IS 5120 & No Leakage	SIR	P	W	V	
d	Dynamic Balancing of Impeller	Dynamic / Static Balancing	Critical	Visual & Measurement	100%	ISO 1940 Gr.6.3	Relevant code	SIR	P	V	V	
e	Assembly of Pump	Alignment, Fitment	Major	Visual & Measurement	100%	Appd. Drg & Data Sheet	Appd. Drg	–	P	V	V	
III) Final Inspection :												
a	Dimension Check	Dimensions Capacity vs Head, Capacity vs Power and Capacity vs Efficiency	Major	Measurement	100%	Appd. Drg & Data Sheet	Appd. Drg	FIR	P	W	V	NOTE 5
b	Performance Test (With Job Motor)	Temperature raise in Oil & Bearing Hsg. Vibration & Noise Level	Major	Measurement	100%	Appd. Drg & Data Sheet / HIS	Appd. Drg & Data Sheet / HIS	PTR	P	W	W	
			Critical	Measurement	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet		P	W	W	
			Major	Measurement	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet		P	W	W	
c	Strip Down Test	Wear & Tear(In case of Unusual vibration)	Major	Visual / Strip test	100%	IS 5120	As per IS 5120	FIR	P	W	V	
d	Rotor Run out Test	Alignment	Major	Visual & Measurement	100%	IS 5120	As per IS 5120	FIR	P	W	V	

Contd...2



TECHNICAL SPECIFICATION FOR EFFLUENT TREATMENT PLANT

1x370 MW YELAHANKA CCPP

SPECIFICATION NO.:PE-TS-409-164-A001

QUALITY ASSURANCE PLAN FOR CENTRIFUGAL PUMPS

Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Ref.Document	Acceptance Standard	Format of Record	Scope of Check			Remarks
									BIDDER	BHEL	CUSTOMER	
IV) Painting :												
a	Surface Preparation	Roughness / Free from foreign matls.	Major	Visual	100%	Approved Drg. & Data Sheet	Approved Drg. & Data Sheet	SIR	P	V	V	
V) Stamping / Stenciling :												
a	Identification	To identify the Equipment	Major	Visual	100%	Approved Drg. & Data Sheet	Approved Drg. & Data Sheet	SIR	P	V	V	
VI) Testing and Measuring Equipment :												
a	Calibration status of equipments	To ensure the accuracy	Major	Verification	100%	National & Intl Standards	National & Intl Standards	Calibration Certificates	P	V	V	

NOTE 1: UT shall be carried out for plates thickness 20mm and above & Forgings 50mm dia and above.

NOTE 3: MTC shall be provided for metallic parts.

NOTE 4: Hydro Test on casings shall be carried out at 2 times of rated head or 1.5 times of shut off head which ever is higher and the test pressure shall be maintained for 30 minutes & No Leakage shall be permitted.

NOTE 5: The duration of performance test shall be minimum 1 hour.

NOTE 6: The above mentioned quality inspection requirement are bare minimum. However any other test of any item as required by BHEL/Customer the same shall be provided by the bidder without and commercial and delivery implication to BHEL.

ABBREVIATIONS:

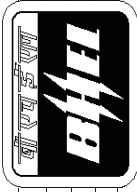
TC: Test Certificate
PTR: Performance Test Report
W: Witness

SIR: Stage Inspection Report
Apod. Drg. Approved Drawing
V: Verify Documents

FIR:
RW:
Mft's Std.

Final Inspection Report
Random Witness
Manufacturer's Standard

P: Perform
R: Review



QUALITY ASSURANCE PLAN FOR CHECK VALVES

Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Ref.Document	Acceptance Standard	Format of Record	SCOPE OF CHECK			Remarks
									BIDDER	BHEL	CUSTOMER	
I) Raw Material Inspection :												
a	Material identification for Body, Plate Castings	Material Properties	Major	Chemical & Mechanical	100%	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	FOUNDARY TC/COC	P	V	V	
			Major	Physical	100%	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	FOUNDARY TC/COC	P	V	V	
			Major	Dimension & Surface Check	100%	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	Inspection Reports	P	V	V	
b	Hinge/ Stop Pin	Material Properties	Major	Chemical Analysis	1 sampel per Heat number	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	MTC/COC	P	V	V	
			Major	Visual Inspection	100%	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	Appd. drg., Appd. Data Sheet & Relevant Mtrl.specs	Inspection Report	P	V	V	
c	Spring	Material Properties	Major	Chemical Analysis	1 sampel per Heat number	Relevant Mtrl.specs	Relevant Mtrl.specs	MTC/COC	P	V	V	
III) In Process Inspection :												
a	Body & Plate Machining	Dimensions	Major	Measurement	Sample	Manufacturing drng	Manufacturing drng	SIR	P	V	V	
		Finish	Major	Visual	100%	Manufacturing drng	Manufacturing drng	-	P	V	V	
		DPT	Major	Visual	100%	As per ASME Sec V.	As per ASME Sec V.	DPT Report	P	V	V	
b	Rubber Lining on body	Vulcanising Soundness	Major	Visual, Spark leak Test & Hardness	100%	As per Procudure for Rubber Linign	As per Procudure for Rubber Linign	Inspection Report	P	V	V	
III) Final Inspection :												
a	Assembly of Valve	Dimensions & Overall Finishing	Major	Measurement	100%	Appd.Drg./Datas sheet.	Appd.Drg./Dias sheet.	FIR	W	V	V	
b	Hydrostatic Test	Body Hydro Test	Major	Pr.Test Hydro	100%	Appd.Drg./Datas sheet/No Leakage. API 598	Appd.Drg./Datas sheet/No Leakage. API 598	FIR	W	W	W	Test pressure and duration is to be mentioned
		Seat Hydro Test	Major	Pr.Test Hydro	100%	Appd.Drg./Datas sheet/No Leakage. API 598	Appd.Drg./Datas sheet/No Leakage. API 598	FIR	W	W	W	Test pressure and duration is to be mentioned
c	Performance Test	Smooth Operation of Plates	Critical	Operational(open-close)	100%	Appd. Drg & Data Sheet, API 594 / API 598	Appd. Drg & Data Sheet, API 594 / API 598	FIR	W	W	W	
d	Surface Preparation	Painting	Major	Visual	100%	Appd.Drg./Data sheet.	Appd.Drg./Data sheet.	Test Certificate	W	V	V	

NOTE 1: The above mentioned quality inspection requirement are bare minimum. However any other test of any item as required by BHEL/Customer the same shall be provided by the bidder without and commercial and delivery implication to BHEL.

ABBREVIATIONS:

TC: Test Certificate

W: Witness

SIR: Stage Inspection Report

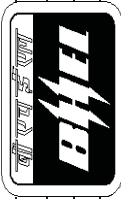
Appd. Drg. Approved Drawing

FIR: Final Inspection Report

V: Verify Documents

P: Perform

COC: Certificate of Compliance



TECHNICAL SPECIFICATION FOR EFFLUENT TREATMENT PLANT

1x370 MW YELAHANKA CCPP

SPECIFICATION NO.:PE-TS-409-164-A001

QUALITY ASSURANCE PLAN FOR BUTTERFLY VALVE / GATE VALVE/ BALL VALVE (MANUAL / ACTUATED)

Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Ref.Document	Acceptance Standard	Format of Record	SCOPE OF CHECK		Remarks	
									BIDDER	BHEL		CUSTOMER
I) Raw Material Inspection :												
a	Material Identification for Body, Disc & Wetted Parts	Mechanical & chemical Property Check	Major	Verification with respect stds	100%	Appd. drg., Appd. Data Sheet & Relevant code	Appd. drg., Appd. Data Sheet & Relevant code	Mfr. TC or Check Test Report	P	V	V	Note 1 & 2
b	Receiving Inspection of Bought outs	Visual Defects	Major	Verification with respect stds & Visual Check	100%	Appd. drg. & Relevant code	Appd. drg. & Relevant code	Receiving Inspection	P	V	V	
II) In Process Inspection :												
a	Machining of Body, Disc ,Components & Actuators.	Dimensions & Alignment	Major	Visual & Measurement	100%	App.Drg.	App.Drg.	SIR	P	V	V	
b	DP Check on Machined Surface & Actuators	Surface Defects	Major	Visual	100%	ASME SEC V	ASME SEC VIII	DP Report	P	V	V	
III B) Assembly Check :												
a	Assembly of Valves	Verification of all stages	Major	Verification with equipment drg	100%	Assy. Procedure, Equip. drg & Appd. Data Sheet	Assy. Procedure, Equip. drg & Appd. Data Sheet	--	P	V	V	
b	Assembly of Actuators	Verification of all stages	Major	Verification with Appd. Drg	100%	Assy. Procedure, Appd. drg & Appd. Data Sheet	Assy. Procedure, Appd. drg & Appd. Data Sheet	--	P	V	V	
IV) Final Inspection :												
a	Dimension Check	Dimensions	Major	Measurement	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	FIR	P	V	V	Note 3 & 4
b	Operational Check	Smooth Movement	Major	Visual	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	FIR	P	W	W	
c	Pneumatic Test for Valve Seat	Leakage Proof	Major	Visual	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	FIR	P	V	V	
d	Hydro Static Pressure Test on Seat & Body	With stand of Hydro Static & Leak Proof	Critical	Visual	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	FIR	P	W	W	
e	Actuator performance (Job Actuator)	Leak tightness,Accuracy& simulation(Air to open/close)	Major	Visual	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	FIR	P	W	W	
V) Painting :												
a	Surface Preparation	Roughness / Free from foreign matls.	Major	Visual	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	SIR	P	V	V	
VI) Stamping / Stenciling :												
a	Identification	To identify the Equipment	Major	Visual	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	SIR	P	V	V	
VII) Testing and Measuring Equipment :												
a	Calibration status of equipments	To ensure the accuracy	Major	Verification	100%	National & Intl Standards	National & Intl Standards	Calibration Certificates	P	V	V	
NOTE 1 : UT shall be carried out for plates thickness 20mm and above & Forgings 50mm dia and above (Only for Metallic).												
NOTE 2: MTC shall be provided for metallic parts.												
Note 3: Hydrostatic test for seat and body-1.1 X Maximum working pressure for seat and 1.5 X Maximum working pressure for shell& No Leakage will be permitted.												
Note 4: Seat Leakage Test should be done in both the directions												
Note 5: Proof of Design and Disc strength as per AWWAC-504 requirements needs to be conducted.												
NOTE 6: The above mentioned quality inspection requirement are bare minimum. However any other test of any item as required by BHEL/Customer the same shall be provided by the bidder without and commercial and delivery implication to BHEL												
ABBREVIATIONS:												
TC: Test Certificate				SIR: Stage Inspection Report				FIR: Final Inspection Report				
W: Witness				Appd. Drg. Approved Drawing				V: Verify Documents				
								P: Perform				
								UT: Ultrasonic Testing				

TECHNICAL SPECIFICATION FOR EFFLUENT TREATMENT PLANT

1x370 MW YELAHANKA CCPP
SPECIFICATION NO.:PE-TS-409-164-A001

QUALITY ASSURANCE PLAN FOR DIAPHRAGM VALVE

Sl.No.	Component & Operation	Characteristics	Class of check	Type of check	Quantum / Frequency of Check	Ref.Document	Acceptance Standard	Format of Record	SCOPE OF CHECK			Remarks
									BIDDER	BHEL	KPCL	
I) Raw Material Inspection :												
a	Material Identification for Body, Bonnet & Wetted Parts	Mechanical & chemical Property Check	Major	Visual & Mechanical / Chemical Analysis	100%	Appd. drg., Appd. Data Sheet & Relevant code	Appd. drg., Appd. Data Sheet & Relevant code	Mfr. TC or Check Test Report	P	V	V	Note 1 & 2
b	Receiving Inspection of Bought outs	Visual Defects	Major	Verification with respect stds & Visual Check	100%	Appd. drg. & Relevant code	Appd. drg. & Relevant code	GRIR	P	V	V	
II) In Process Inspection :												
a	Machining of Body, Bonnet, Compressor & Stem	Dimensions & Surface Defects	Major	Visual & Measurement	100%	App.Drg.	Dimension within limit & No Surface Defects	SIR	P	V	V	Note 6
b	Moulding of Diaphragm	Dimensions & Surface Defects	Major	Visual & Measurement	100%	App.Drg.	Dimension within limit & No Surface Defects	SIR	P	V	V	
		Hardness, Tensile, Elongation	Major	Physical	100%	App.Drg./DVT/S0003 as per ASTM D2000	App.Drg./DVT/S0003 as per ASTM D2000	SIR	P	V	V	
		Flex Test	Major	Physical	100%	1500 Flex Operations	No Cuts / Cracks & Punctures	SIR	P	V	V	
c	Top / Bottom Chamber of Actuator	Dimensions & Surface Defects	Major	Visual & Measurement	100%	App.Drg.	Dimension within limit & No Surface Defects	SIR	P	V	V	In case of Actuated Valves
d	For Pneumatic Actuator	Leak Tightness	Major	Pneumatic Testing at 1.2 times Design Pressure	100%	App.Drg/Documents	No Leakage	SIR	P	V	V	In case of Actuated Valves
		Accuracy	Major	Calibration	100%	App.Drg/Documents	Smooth Operation	SIR	P	V	V	
		Simulation (Operation,Air to Open/Close)	Major	Operation at rated pressure	100%	App.Drg/Documents	Smooth Operation	SIR	P	V	V	
REFER NOTE :3												
III) Assembly Check :												
a	Assembly of Valves	Verification of all stages	Major	Verification with equipment drg	100%	Assy. Procedure, Equip. drg & Appd. Data Sheet	Assy. Procedure, Equip. drg & Appd. Data Sheet	--	P	V	V	
b	Assembly of Actuators	Verification of all stages	Major	Verification with Appd. Drg	100%	Assy. Procedure, Appd. drg & Appd. Data Sheet	Assy. Procedure, Appd. drg & Appd. Data Sheet	--	P	V	V	
IV) Final inspection :												
a	Dimension & Visual Check *	Dimensions & Surface Defects	Major	Visual & Measurement	100%	App.Drg.	Dimension within limit & No Surface Defects	FIR	P	V	V	* Refer Note 3, 4
b	Operational Check *	Smooth Movement / Operation	Major	Visual	100%	App.Drg.	App.Drg.	FIR	P	V	V	
c	Pneumatic Test for Valve Seat *	Leakage Proof	Major	Visual	100%	BSEN13397 / App.Drg.	No Leakage	FIR	P	V	V	
d	Hydro Static Pressure Test on Seat & Body *	With stand of Hydro Static & Leak Proof	Critical	Visual	100%	BSEN13397 / App.Drg.	No Leakage	FIR	P	V	V	
V) Painting :												
a	Surface Preparation	Roughness / Free from foreign matts.	Major	Visual	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	SIR	P	V	V	
VI) Stamping / Stenciling :												
a	Identification	To identify the Equipment	Major	Visual	100%	Appd. Drg & Data Sheet	Appd. Drg & Data Sheet	SIR	P	V	V	
VII) Testing and Measuring Equipment :												
a	Calibration status of equipments	To ensure the accuracy	Major	Verification	100%	National & Intl Standards	National & Intl Standards	Calibration Certificates	P	V	V	
NOTE 1 : UT shall be carried out for plates thickness 20mm and above & Forgings 50mm dia and above (Only for Metallic). NOTE 2 : MTC shall be provided only for metallic parts. For Non metallic parts compliance certificate shall be provided. NOTE 3 : Body Hydro Test shall be carried out at 1.5 times of Design Pressure , prior to Rubber Lining. NOTE 4 : BHEL Inspection Report to be Reviewed by KPCL, is CHP. NOTE 5 : Diaphragm to be tested for 1500 cycles (open . Close . Open) with suitable Damper Proof Sealing.												
ABBREVIATIONS: TC: Test Certificate W: Witness GRIR: Goods Receipt & Inspection Report												
SIR: Stage Inspection Report Appd. Drg. Approved Drawing P: Final Inspection Report UT: Verify Documents Perform Ultrasonic Testing												



TITLE:
TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT
1x370 MW YELAHANKA
COMBINED CYCLE POWER PLANT

SPECIFICATION NO.: PE-TS-409-164-A001

SECTION : I

SUB-SECTION :IA

REV. NO. 00

DATE: 28/07/2016

ANNEXURE – II

INDICATIVE SUB VENDOR LIST



TITLE:
TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT
1x370 MW YELAHANKA
COMBINED CYCLE POWER PLANT

SPECIFICATION NO.: PE-TS-409-164-A001

SECTION : I

SUB-SECTION :IA

REV. NO. 00

DATE: 28/07/2016

SL NO.	ITEM	SUPPLIERS	PLACE	REMARKS
1.	CHAIN PULLEY BLOCK	BRADY & MORRIS ENGINEERING CO. LTD.	AHMEDABAD	
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		HERCULES HOISTS LTD.	RAIGAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 10 TONNE.
		TRACTEL TIRFOR INDIA PVT. LTD.	FARIDABAD	
		TECHNO INDUSTRIES	AHMEDABAD	
		UNIVERSAL HOIST-O-FABRIK	THANE	
2.	ELECTRIC HOISTS	ALPHA SERVICES	BHIWADI	
		BRADY & MORRIS ENGINEERING CO. LTD.	AHMEDABAD	
		CONSOLIDATED HOISTS PVT LTD	PUNE	
		CENTURY CRANE ENGINEERS PVT. LTD.	FARIDABAD	
		EDDY CRANES PVT. LTD.	MUMBAI	
		GRIP ENGINEERS PVT. LTD.,	FARIDABAD	
		GLOBAL TECHNOLOGIES	HYDERABAD	
		MANGLA HOISTS PVT LTD	NEW DELHI	
		MEEKA MACHINERY PVT. LTD.	AHMEDABAD	
		REVA INDUSTRIES LTD.	FARIDABAD	UPTO 25.0 T CAPACITY.
		ROCKWELL HOISTO CRANES PVT. LTD.	BAHADURGAR H	
		SAFEX ENERGY PVT. LTD.	AHMEDABAD	
		TUOBRO FURGUSON (INDIA) PVT LTD	KOLKATA	UPTO 15 TONNES.
		TECHNO INDUSTRIES	AHMEDABAD	
		UNIVERSAL HOIST-O-FABRIK	THANE	
3.	BALL VALVES	AKAY INDUSTRIES PVT.LTD.		
		FLOW CHEM INDUSTRIES		
		FISHER SANMAR LIMITED		
		KIRLOSKAR BROS. LTD.		
		LEADER VALVES LTD.		
		KSB PUMPS LTD.		
		MICROFINISH VALVES PVT LTD.		
		MICON VALVES (INDIA) PVT.LTD		
		PEC VALVES PVT.LTD.		
		VIRGO ENGINEERS LTD.		
		A.V. VALVES LIMITED		
		FLUIDLINE VALVES COMPANY PRIVATE MUMBAI		
		STEELSTRONG VALVES (I) PVT.LTD.,MUMBAI		
		B.D.K. ENGINEERING INDUSTRIES LTD.		
		SURYA VALVES &INSTRUMENTS		



TITLE:
TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT
1x370 MW YELAHANKA
COMBINED CYCLE POWER PLANT

SPECIFICATION NO.: PE-TS-409-164-A001

SECTION : I

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SL NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		MANUFACTURING COMPANY, CHENNAI		
		VAL TECH INDUSTRIES ,MUMBAI		
		FEDERAL HARDWARE ENGINEERING CO PTE LTD., SINGAPORE		
		CRESCENT VALVES MFG. CO. PVT. LTD.		
4.	CONTROL VALVE	DEZURIK -COPES VULCAN LTD., U.K		
		CONTROL COMPONENT INC., USA		
		DRESSER VALVE INDIA PVT. LTD UP TO 45KSC ONLY		
		FOURESS ENGG.INDIA LTD.UP TO 45KSC ONLY		
		FISHER SANMAR LTD		
		INSTRUMENTATION LTD. UP TO 45KSC ONLY		
		MIL. CONTROLS LTD.		
5.	STEEL GATE /GLOBE/NRV VALVES	A.V. VALVES LTD		
		NITON VALVE INDUSTRIES PRIVATE LTD		
		WEIR VALVES & CONTROLS M.E.		
		BABCOCK BORSIG ESPANA, S.A.		
		B.D.K. ENGINEERING INDUSTRIES LTD.		
		KIRLOSKAR BROTHERS LTD.		
		LEADER VALVES LTD.		
		KSB PUMPS LTD.		
		MICON VALVES (INDIA) PVT. LTD		
		OSWAL INDUSTRIES LTD.		
		PETROL VALVES S.R.L. ITALY		
		FOURESS ENGG. INDIA LTD.		
		FLUIDLINE VALVES COMPANY PRIVATE LTD., MUMBAI		
		STEEL STRONG VALVES (I) PVT. LTD., MUMBAI		
		VALTECH INDUSTRIES ,MUMBAI		
		SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY, CHENNAI		
		FEDERAL HARDWARE ENGINEERING CO PTE LTD.,SINGAPORE		
		CRESCENT VALVES MFG. CO. PVT. LTD.		
6.	CAST IRON/ GATE/GLOBE/NRV/SAFETY RELIEF VALVES	A.V. VALVES LTD		
		H.SARKER & COMPANY		
		G.M. DALUI & SONS PVT. LTD.		
		KIRLOSKAR BROS. LTD.		
		LEADER VALVES LTD.		
		MICON VALVES (INDIA) PVT. LTD		
		FLUIDLINE VALVES COMPANY PRIVATE		



TITLE:
TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT
1x370 MW YELAHANKA
COMBINED CYCLE POWER PLANT

SPECIFICATION NO.: PE-TS-409-164-A001

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REV. NO. 00

DATE: 28/07/2016

SL NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		FEDERAL HARDWARE ENGINEERING CO PTE LTD., SINGAPORE		
		CRESCENT VALVES MFG. CO. PVT. LTD.		
		SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY, CHENNAI		
7.	BF VALVES (WATER SERVICE)	ADVANCE VALVES PVT. LTD B.D.K. ENGINEERING INDUSTRIES LTD. INTER VALVE (INDIA) LTD. FOURESS ENGG. INDIA LTD. INSTRUMENTATION LTD. LARSEN & TOUBRO LTD. KIRLOSKAR BROS. LTD. MICON VALVES (INDIA) PVT. LTD R&D MULTIPLES (METAL CAST) PVT. LTD. SURYA VALVES AND INSTRUMENTS MANUFACTURING COMPANY, CHENNAI STAFFORD CONTROLS LIMITED, PUNE FLUIDLINE VALVES COMPANY PRIVATE LTD., MUMBAI TYCO VALVES & CONTROLS INDIA PVT.LTD.,HALOL		
8.	FLOW ELEMENT	ENGINEERING SPECIALTIES PRIVATE LTD INSTRUMENTATION LTD. MICRO PRECISION PRODUCTS STAR-MECH CONTROLS (I) PVT.LTD		
9.	PUMPS (HORIZONTAL)	BEST & CROMPTON ENGG. LTD. FLOWMORE LTD. JYOTI LTD. KIRLOSKAR BROS. LTD. MATHER & PLAN PUMPS LTD. KSB PUMPS LTD. SULZER PUMPS INDIA LTD. WPIL LIMITED SAM TURBO INDUSTRY LTD.		
10.	PUMPS (VERTICAL)	FLOWMORE LTD. JYOTI LTD. KIRLOSKAR BROS. LTD. MATHER & PLAN PUMPS LTD. SULZER PUMPS INDIA LTD. WPIL LIMITED		
11.	LOCAL CONTROL	C & S ELECTRIC LTD.		



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1x370 MW YELAHANKA
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SL NO.	ITEM	SUPPLIERS	PLACE	REMARKS
	PANEL	PROCON INSTRUMENTATION PVT LTD.		
		INDUSTRIAL CONTROLS & APPLIANCES PVT LTD.		
12.	ROTAMETER	FLOWSTAR		
		CHEMTROLS SAMIL (INDIA) PVT. LTD., MUMBAI		
		EUREKA		
13.	DIAPHRAGM VALVE	BDK VALVES –HUBLI		
		CRANE FLOW PROCESS-SATARA		
14.	CHECK VALVES (FLAT TYPE SIZE UPTO 50 NB)	B BDK VALVES –HUBLI		
		H SARKAR-HOWRAH		
		LEADER-JALANDHAR		
		MAJESTIC WORKS, MUMBAI		
15.	DUAL PLATE NON RETURN VALVES (SS & CI UPTO 100 NB CLASS 150)	ADVANCE VALVES-NOIDA		
		R&D MULTIPLES-VALSAD		
		B BDK VALVES –HUBLI		
16.	SOLENOID VALVES	ROTEX AUTOMATION-BARODA		
		ASCO - CHENNAI		
17.	Y-TYPE STRAINER	OTOKLIN-MUMBAI		
		GRAND PRIX-NEW DELHI		
		JAYPEE-NEW DELHI		
		GREAVES COTTON-MUMBAI		
		MULTITEX- NEW DELHI		
18.	MS PIPES (IS: 1239 & 3589)	SAIL-ROUR KELA		
		JINDAL (UPTO 350 NB)-GHAZIABAD		
		TISCO (UPTO 150 NB)-JAMSHEDPUR		
		MSL (FOR IS 3589-200 NB TO 500 NB)-RAIGAD		
19.	MS PLATES	SAIL		
20.	LEVEL GAUGES	SIGMA INSTRUMENTS	MUMBAI	
		LEVCON	KOLKATA	
		SBEM	PUNE	
		V. AUTOMAT	NEW DELHI	
21.	LEVEL TRANSMITTER (FOR ULTRA SONIC TYPE)	EMERSON PROCESS MANAGEMENT (I) LTD		
		SIEMENS		
22.	ANALYSERS	POLYTRON	FRANCE	
		HACH ULTRA	FRANCE	
		ABB	UK	
		ORION	USA	
		SWAN	USA	



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		EMERSON PROCESS MANAGEMENT	CHENNAI	
23.	PRESSURE / DP TRANSMITTER	EMERSON PROCESS MANAGEMENT	USA/DAMAN	
		FUJI ELECTRIC	JAPAN	
		HONEYWELL	USA	
		YOKOGAWA	JAPAN	
		ABB	ITALY/FARIDA BAD/BANGAL ORE	
24.	PRESSURE AND DIFFERENTIAL PRESSURE GAUGE	A.N.INST	KOLKATTA	
		WAREE	MUMBAI	
		SWITZER INSTRUMENTS	CHENNAI	
		GENERAL INSTRUMENTS CONSORTIUM	GOA / MUMBAI	
		MANOMETER	MUMBAI	
25.	TEMPERATURE GUAGE	A.N.INST	KOLKATTA	
		H.GURU (SI) P LTD	BANGALORE	
		GIC	GOA/MUMBAI	
		PYRO ELECTRIC INSTRUMENTS P LTD	GOA	
26.	TEMPERATURE ELEMENT	GENERAL INST CONSORTIUM	NEW DELHI	
		PYRO ELECTRIC	GOA	
		TOSHINWAL BROS	NEW DELHI	
27.	TEMPERATURE TRANSMITTER	SOR INC	USA	
		DELTA CONTROLS LIMITED	USA	
		ABB	CHENNAI	
28.	LT MOTORS	BBL	MUMBAI	
		CGL	MUMBAI/ AHMEDABAD	
		ALSTOM	KOLKATTA	
		KEC	BANGALORE/ HUBLI	
		SEIMENS	MUMBAI	
		ABB	FARIDABAD	
29.	AGITATOR/STIRRER	FIBRE & FIBRE	MUMBAI	
30.	FITTINGS	BHARAT FORGE	PUNE	
		RELIANCE FORGE	PUNE	
31.	FLANGES	BHARAT FORGE	PUNE	
		RELIANCE FORGE	PUNE	
		HBL NIFE POWER SYSTEMS LTD.		
32.	INSTRUMENT FITTINGS	AURA INCORPORATED	NEW DELHI	
		ASTEC VALVES & FITTINGS PVT. LTD.,	MUMBAI	
		ARYA CRAFTS & ENGINEERING	MUMBAI	



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SL NO.	ITEM	SUPPLIERS	PLACE	REMARKS
		PVT. LTD.		
		COMFIT & VALVE PVT. LTD.	GUJARAT	
		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 INSTRUMENTATION CONTROL (INDIA) PVT. LTD.	MUMBAI	
		VIKAS INDUSTRIAL PRODUCTS	NOIDA	
33.	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	MUMBAI	
		FLEXPRO ELECTRICALS PVT. LTD.		(METAL TYPE JUNCTION BOX ONLY)
			GUJARAT	
		K.S.INSTRUMENTS PVT.LTD.	BANGALORE	
		SUCHITRA INDUSTRIES	BANGALORE	
		SHRENIK & COMPANY,	AHMEDABAD	
34.	CABLE GLAND	COMET		
		DOWELL		
		CHETNA		
35.	CABLE LUGS	ELECTRO BILLETS		
		COMET		
		DOWELL		
		CHETNA		
36.	PAINT	ASIAN PAINTS (I) LTD.		
		BERGER PAINTS INDIA LTD		
		GOODLASS NEROLAC		
		JENSON & NICHOLSON (I) LTD		
		CDC CARBOLINE (I) LTD.		
		SHALIMAR PAINTS LTD.		
37.	OILSKIMMER	JEET ENGENEERING		
38.	TURBIDITY METER	HACH		
		ROSE MOUNT		
		YOGOKAWA		
39.	TDS Analyser	Emerson		
		Hach		

NOTES-

- All the finally selected sub vendors shall be subject to customer approval during detailed engineering without any delivery/ commercial implications to BHEL/ Customer (KPCL).
- The sub vendor list enclosed is indicative only and is subject to approval / acceptance by customer (KPCL).



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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).



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ANNEXURE – III

FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES



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Performance Guarantee Test Procedure for Effluent Treatment plant.

The bidder for workmanship, materials and satisfactory performance shall guarantee all equipment. The guarantee for performance shall cover individual items and systems including electrical for their ratings / outputs as well as for the integrated operation of the equipment and its auxiliaries as a whole. On completion of satisfactory commissioning, the supplier shall conduct performance / acceptance tests on the equipment and system as a whole for demonstrating the guaranteed performance parameters specified. All instruments, gauges installed for the normal operation of equipment shall be made use of during the acceptance test as far as practicable. If additional instruments are required for the tests, these shall be calibrated and brought by supplier free of cost and shall be taken back after performance test. The guarantee tests shall cover but not be limited to the following rated parameters for smooth operation of complete Effluent Treatment plant:

The outlet water from lamella clarifier/ Tube Settlers shall meet the below requirements:

Sl. No.	Constituent	Units	OUTLET (Maximum)
1.	Total suspended solids	ppm	10
2.	Oil content	ppm	10

The treated effluents shall also meet quality requirements indicated in Gazette requirements of Ministry of Environment and Forests Notifications and state pollution Control Board.

The measured noise level produced by any rotating equipment shall not exceed 85 dBA at a distance of 1.0 m from the equipment surfaces and at a height of 1.5 m from floor level.

Each equipment such as lamella clarifier or tube settlers shall be tested for its design capacity & effluent quality at site. Each pumps shall be tested at shop for capacity, head & power consumption at shop along with parallel operation, vibration & noise level.

Quality of output from the plant, consumption of chemicals shall also be demonstrated and guaranteed.



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ANNEXURE IV

DRAWING DOCUMENTS DISTRIBUTION SCHEDULE



TITLE:
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- 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.

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.



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DRAWING / DOCUMENT DISTRIBUTION SCHEDULE

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	2	11	2	S	2
	B)RETURN OF SUBMISSION WITH COMMENTS/APPROVAL BY KPCL	1	S	1	2	0
	C) RFC ISSUE	2	11	2	S	4
	D) AS BUILT	2	11	2	S	4
	E)ERECTION DRAWINGS	2	11	3	S	5
C	PROGRESS REPORT (MONTHLY)					
	EPC CONTRACTOR'S REPORT	2	11	5	S	4
D	INSTRUCTION MANUALS					
	ERECTION &COMMISSIONING	2	11	3	S	3
	O & M MANUAL	2	1 + 8CD	5 + 11CD	S	2 + 5CD

KPCL- KARNATAKA POWER CORPORATION LIMITED

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 Thirteen (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.
- 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.
 - Cable tray lay out.
 - Civil scope drawings.
 - Piping lay out drawing.
- Cable schedule in BHEL format (shall be provided during detailed engineering stage).



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ANNEXURE-V
PAINTING SPECIFICATION



TITLE:
TECHNICAL SPECIFICATION FOR
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1.0 SCOPE

1.1 This section covers the painting requirements for the Ozone generation plant as applicable.

2.0 CODES AND STANDARDS

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

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

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

3.0 PREPARATION OF SURFACES

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

4.0 PRIMER PAINT

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



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5.0 FINISH PAINT

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

6.0 PAINTING AND CORROSION PROTECTION FOR PIPES & FITTINGS

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

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

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

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

7.0 PAINTING AND CORROSION PROTECTION FOR VALVES & SPECIALTIES

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

8.0 Suggested Colour Codes for Painting

Suggested colour codes has been enclosed for adherence. Colour codes for piping shall be as per IS 2379 with necessary modifications. Where band colour is specified for piping, same shall be provided at 30 metre intervals on long uninterrupted lines and also adjacent to valves and junctions.

9 PAINTING SCHEDULES

9.1 Painting schedules for various systems/ items are furnished as per enclosed Annexures-A . Vendors will furnish detailed painting schedule for customer approval during detail engineering stage as per specification.



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ANNEXURE - A

Paint Reference Scheme	Surface Preparation Grade / Surface Profile	Primer Coat			Intermediate Coat			Finish Coat			Total DFT in microns
		Premier Paint	No. of Coats	DFT in Microns	Intermediate Paint	No. of Coats	DFT in Microns	Finish Paint (See Note)	No. of Coats	DFT in Microns	
Various type of equipment /valve, etc. (Temp. upto 90°C)	Degreasing and Mech. Cleaning with wire brushing/hand tool (Sa1/St2/St3 as applicable)	HB Zinc Phosphate (alkyd Medium) as per IS:2074	2	35-45 per coat	- NA	-	-	Synthetic enamel (alkyd med.) as per IS:2932	2	20 – 25 per coat	110 - 140
LP Piping/structural Vessels, etc. (Temp. upto 90°)	- do -	HB Zinc Phosphate as per IS:2074 (alkyd medium)	2	35 – 45 per coat	- NA	-	-	Synthetic enamel (alkyd med.) as per IS:2932	2	20 – 25 per coat	110-140
Equipment with (Temp. upto 250°)	- do -	Heat resistant Al – paint	2	20 per coat	- NA	-	-	NA	Insulated	NA	40
Equipment in corrosive areas.	Blast clean to Sa 2½	HB Epoxy resin based zinc phosphate primer	1	50 per coat	Epoxy based MIO pigmented paint	1	50 per coat	Polyamide cured Epoxy finish coat	2	25 – 35 per coat	150 - 170
Elect. / Control Panels, etc.	Seven tank process	HB Zinc phosphate (alkyd Medium) as per IS:2074	2	35 – 45 per coat	-NA	-	-	Synthetic enamel (alkyd med.) as per IS:2932	2	20 – 25 per coat	110 - 140

Notes:

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



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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	Crane				
2.1	Crane structure	Golden Yellow	356	-	-
2.2	Trolley and hook	Crimson	540	-	-
3.0	Fans, pumps, motors, compressors	Light Grey	631	-	-
4.0	Tanks (without insulation and cladding)				
4.1	Outdoor	Aluminium	-	-	-
4.2	Indoor	Light grey	631	-	-
5.0	Vessels & all other proprietary equipment (without insulation & cladding)	Light grey	631	-	-
6.0	Control & relay panels	Light grey	631/7078 of IS 1650	-	-
7.0	Transformers	Aluminium	-	-	-
8.0	Machinery guards	Signal red	537	-	-
9.0	Piping				
9.1	Potable, Service water , Effluent piping	Sea green	217	French blue	166
9.2	Compressed air	Sky blue	101	White	-
9.3	Vacuum pipes	Sky blue	101	Black	-
9.4	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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ANNEXURE-VI

MANDATORY SPARES LIST



TITLE:
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S. No	Spares	Units	Quantity
1.0	Horizontal Centrifugal Pumps (The following spares shall be supplied for each type of pump)		
1.1	Impeller	No.	One (1)
1.2	Shaft	No.	One (1)
1.3	Shaft sleeve	No.	One (1)
1.4	Wearings rings (Impeller & Casing)	No.	One (1)
1.5	Bearings	Set	One (1)
1.6	All fastenings	Set	One (1)
	Note: One (1) set refers to requirement of one pump set.		
1.7	Motor	No.	1 No. of each type, rating & frame size
1.7.1	Bearings of each type and each rating	No.	Two (2)
1.7.2	Cooling fan of each rating	No.	One (1)
2.0	For each size, type and category of pump covered in the contract (for which list is not specifically brought above)		
2.1	Impeller with its nuts and other associated parts of one pump	Set	One
2.2	Bushes and wear rings for one pump	Set	One
2.3	Shaft, Shaft sleeves and shaft seals of one pump	Set	One
2.4	Gaskets of one pump	Set	One
2.5	Glands and mechanical seals as applicable of one pump	Set	One
2.6	Complete set of bearings for one pump	Set	One
2.7	Coupling complete with all nuts, bolts, etc. for one pump	Set	One



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ANNEXURE VII

DRAWING/DOCUMENTS SUBMISSION SCHEDULE



TITLE:
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DRAWING/DOCUMENTS SUBMISSION SCHEDULE

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

For the Drawings/Documents Submission Procedure, please refer following Annexure-A. 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. The number of drawing/documents to be submitted by the bidder shall be as per Annexure-IV in Section IA.

Every revised submission incorporating comments shall be resubmitted within 7 days.

BHEL shall provide observation / approval within 15 days from the date of document submission by bidder.

Bidder to note 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. Engineering meeting shall be held fortnightly, for which the bidder shall depute his concerned engineers along with project manager to PEM office or at customer office without fail.

ANNEXURE – A

SL. NO.	BHEL DRAWING/ DOCUMENT NUMBER	DRAWING/ DOCUMENT TITLE	NO. OF WEEKS FOR DRAWING/ DOCUMENT SUBMISSION AFTER PLACING LOI/LOA	APPROVAL CATEGORY	SIZE OF DRAWING/ DOCUMENT
1	PE-V0-409-164-A001	P&I DIAGRAM FOR EFFLUENT TREATMENT PLANT	4	A	A1
2	PE-V0-409-164-A002	LAYOUT PLAN FOR EFFLUENT TREATMENT PLANT INCLUDING SUMPS	4	A	A1
3	PE-V0-409-164-A003	PROCESS & UNIT SIZING & HYDRAULIC LEVEL CALCULATIONS FOR EFFLUENT TREATMENT PLANT	4	A	A4
4	PE-V0-409-164-A004	SUB VENDOR LIST FOR EFFLUENT TREATMENT PLANT	4	A	A4
5	PE-V0-409-164-A005	CONTROL PHILOSOPHY FOR EFFLUENT TREATMENT PLANT	4	A	A4
6	PE-V0-409-164-A006	QAP FOR VALVES OF EFFLUENT TREATMENT PLANT	6	A	A4
7	PE-V0-409-164-A007	QAP FOR HORIZONTAL / VERTICAL CENTRIFUGAL/SCREW PUMPS WITH MOTOR OF EFFLUENT TREATMENT PLANT	6	A	A4
8	PE-V0-409-164-A008	QAP FOR METERING PUMPS WITH MOTOR OF EFFLUENT TREATMENT PLANT	6	A	A4
9	PE-V0-409-164-A009	QAP FOR ATMOSPHERIC TANKS OF EFFLUENT TREATMENT PLANT	6	A	A4
10	PE-V0-409-164-A010	QAP / ICL OF EFFLUENT TREATMENT PLANT (FOR BALANCE OF ITEMS)	6	A	A4
11	PE-V0-409-164-A011	ELECTRICAL LOAD LIST FOR EFFLUENT TREATMENT PLANT	8	A	A4
12	PE-V0-409-164-A012	GA DRAWINGS FOR TANKS FOR EFFLUENT TREATMENT PLANT	6	A	A4
13	PE-V0-409-164-A013	TECHNICAL DATASHEET OF VALVES FOR EFFLUENT TREATMENT PLANT	8	A	A4
14	PE-V0-409-	TECHNICAL DATASHEET FOR INSTRUMENTS	8	A	A4



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	164-A014	FOR EFFLUENT TREATMENT PLANT			
15	PE-V0-409-164-A015	TECHNICAL DATA SHEET OF HORIZONTAL / VERTICAL CENTRIFUGAL/SCREW PUMPS FOR EFFLUENT TREATMENT PLANT	8	A	A4
16	PE-V0-409-164-A016	TECHNICAL DATA SHEET FOR METERING PUMPS FOR EFFLUENT TREATMENT PLANT	8	A	A4
17	PE-V0-409-164-A017	TECHNICAL DATASHEET FOR MOTORS FOR EFFLUENT TREATMENT PLANT	8	A	A4
18	PE-V0-409-164-A018	TECHNICAL DATASHEET FOR STRAINERS, AGITATORS, ISOLATION GATES FOR EFFLUENT TREATMENT PLANT	8	A	A4
19	PE-V0-409-164-A019	TECHNICAL DATASHEET FOR HOIST FOR EFFLUENT TREATMENT PLANT	8	A	A4
20	PE-V0-409-164-A020	MECH. GA OF SUMPS AND CENTRAL MONITORING BASIN	8	A	A1
21	PE-V0-409-164-A021	MECH. GA OF LAMELLA CLARIFIER/ TUBE SETTLERS	10	A	A1
22	PE-V0-409-164-A022	PIPING LAYOUT FOR EFFLUENT TREATMENT PLANT	10	A	A1
23	PE-V0-409-164-A023	YARD PIPING LAYOUT FOR EFFLUENT TREATMENT PLANT	16	A	A1
24	PE-V0-409-164-A024	INSTRUMENT SCHEDULE FOR EFFLUENT TREATMENT PLANT	12	I	A3
25	PE-V0-409-164-A025	VALVE SCHEDULE FOR EFFLUENT TREATMENT PLANT	12	I	A3
26	PE-V0-409-164-A026	INSTRUMENT INSTALLATION/ HOOK UP DIAGRAMS	12	A	A2
27	PE-V0-409-164-A027	FIELD JB TERMINATIONS /GROUPING DOCUMENT	12	A	A3
28	PE-V0-409-164-A028	LCP PANEL DATASHEET, GA (INTERNAL & EXTERNAL) DRAWING	12	A	A1
29	PE-V0-409-164-A029	QAP FOR LOCAL CONTROL PANEL	12	A	A4
30	PE-V0-409-164-A030	CABLE SCHEDULE (IN BHEL EXCEL FORMAT) & CABLE INTERCONNECTION DETAILS	12	A	A3
31	PE-V0-409-164-A031	CABLE TRAY/TRENCH & CONDUIT ROUTING DIAGRAM AND EARTHING LAYOUT OF EFFLUENT TREATMENT PLANT	12	A	A2
32	PE-V0-409-164-A032	CABLE INTERCONNECTION DRAWING FOR EFFLUENT TREATMENT PLANT	12	A	A3
33	PE-V0-409-164-A033	PG TEST PROCEDURE FOR EFFLUENT TREATMENT PLANT	12	A	A4
34	PE-V0-409-164-A034	ENGINEERING BOQ FOR EFFLUENT TREATMENT PLANT	12	A	A3
35	PE-V0-409-164-A035	O&M MANUAL FOR EFFLUENT TREATMENT PLANT	24	A	A4/A3/A2/A1 AS APPLICABLE

Notes:

1. A= APPROVAL. I = INFORMATION.
2. Any additional drawings-documents required during detailed engineering stage shall be provided by bidder without any commercial, technical and delivery implication to BHEL and customer.
3. Non-submission of the document as per attached schedule will attract LD.
4. Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System in addition to hard copies to be submitted as per the Annexure IV



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of this specification. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end

- 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
(<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>



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ANNEXURE VIII
WATER ANALYSIS



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TERTIARY TREATED WATER ANALYSIS (RAW WATER ANALYSIS)

SL NO	PARAMETERS	UNIT	RESULTS
A	QUANTITY	CUM/HR	NIL
1	Colour	Hazen Units	<5
2	Odour		Unobjectionable
3	Turbidity	NTU	<0.6
4	pH Value		7.1-7.3
5	BOD	ppm	1.2
6	COD	ppm	4.9
7	Total Suspended Solids	ppm	4
8	Total dissolved solids	ppm	800
9	Alkalinity	ppm	24.7
10	Chloride as Cl	ppm	41.45
11	Sulphate as SO ₄	ppm	129
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	234
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	0.1
25	Total phosphorus	ppm	0.56
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



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39	Coliform Organisms/100 ml	ppm	15X10 ⁶
40	Faecal Coliform Organisms/100 ml	ppm	15X10 ⁶
41	MPN count/100	ppm	2
42	E-coil	ppm	Present
43	Temperature	Deg C	28



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COOLING TOWER BLOW DOWN WATER ANALYSIS COMING TO GUARD POND

SL NO	PARAMETERS	UNIT	RESULTS
A	QUANTITY	CUM/HR	211.8
1	Colour	Hazen Units	5
2	Odour		0
3	Turbidity	NTU	15
4	pH Value		7.3
5	BOD	ppm	1.2
6	COD	ppm	12.25
7	Total Suspended Solids	ppm	10
8	Total dissolved solids	ppm	2000
9	Alkalinity	ppm	61.75
10	Chloride as Cl	ppm	103.625
11	Sulphate as SO ₄	ppm	322.5
12	Silica-Dissolved as SiO ₂	ppm	58.75
13	Silica-Colloidal as SiO ₂	ppm	7.5
14	Ca Hardness as CaCO ₃	ppm	350
15	Mg Hardness as CaCO ₃	ppm	235
16	Total Hardness as CaCO ₃	ppm	585
17	% sodium	ppm	30.35
18	Ammonical Nitrogen	ppm	16.425
19	Iron as Fe	ppm	0.775
20	Manganese as Mn	ppm	0.125
21	Total Kjeldhal Nitrogen	ppm	8.5
22	Total Residual Chlorine	ppm	1.25
23	Phosphate as PO ₄	ppm	3.25
24	Free Ammonia	ppm	0.25
25	Total phosphorus	ppm	1.4
26	Oil and Grease	ppm	2.5
27	Nitrate Nitrogen	ppm	3.25
28	Sulphide	ppm	0.125
29	Fluoride as F	ppm	0.975
30	Copper as Cu	ppm	0.125
31	Zinc as Zn	ppm	0.125
32	Lead as Pb	ppm	0.05
33	Total Chromium as Cr	ppm	0.125
34	Mercury as Hg	ppm	0.0025
35	Cyanide as CN	ppm	0.125
36	Phenolic components as C ₆ H ₅ OH	ppm	0.125
37	Nickel as Ni	ppm	0.125



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38	Arsenic as AS	ppm	0.0025
39	Coliform Organisms/100 ml	ppm	0
40	Faecal Coliform Organisms/100 ml	ppm	0
41	MPN count/100	ppm	0
42	E-coil	ppm	Present
43	Temperature	Deg C	28



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RO-1 REJECT WATER ANALYSIS COMING TO GUARD POND

SL NO	PARAMETERS	UNIT	RESULTS
A	QUANTITY	CUM/HR	12
1	Colour	Hazen Units	0
2	Odour		0
3	Turbidity	NTU	0
4	pH Value		7.46
5	BOD	ppm	0
6	COD	ppm	0
7	Total Suspended Solids	ppm	100
8	Total dissolved solids	ppm	3100
9	Alkalinity	ppm	95.7125
10	Chloride as Cl	ppm	160.61875
11	Sulphate as SO4	ppm	499.875
12	Silica-Dissolved as SiO2	ppm	91.0625
13	Silica-Colloidal as SiO2	ppm	11.625
14	Ca Hardness as CaCO3	ppm	542.5
15	Mg Hardness as CaCO3	ppm	364.25
16	Total Hardness as CaCO3	ppm	906.75
17	% sodium	ppm	47.0425
18	Ammonical Nitrogen	ppm	25.45875
19	Iron as Fe	ppm	1.20125
20	Manganese as Mn	ppm	0.19375
21	Total Kjeldhal Nitrogen	ppm	13.175
22	Total Residual Chlorine	ppm	1.9375
23	Phosphate as PO4	ppm	5.0375
24	Free Ammonia	ppm	0.3875
25	Total phosphorus	ppm	2.17
26	Oil and Grease	ppm	3.875
27	Nitrate Nitrogen	ppm	5.0375
28	Sulphide	ppm	0.19375
29	Fluoride as F	ppm	1.51125
30	Copper as Cu	ppm	0.19375
31	Zinc as Zn	ppm	0.19375
32	Lead as Pb	ppm	0.0775
33	Total Chromium as Cr	ppm	0.19375
34	Mercury as Hg	ppm	0.003875
35	Cyanide as CN	ppm	0.19375
36	Phenolic components as C6H5OH	ppm	0.19375
37	Nickel as Ni	ppm	0.19375
38	Arsenic as AS	ppm	0.003875



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39	Coliform Organisms/100 ml	ppm	0
40	Faecal Coliform Organisms/100 ml	ppm	0
41	MPN count/100	ppm	0
42	E-coil	ppm	0
43	Temperature	Deg C	28



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N-PIT REJECT (DM+UF) WATER ANALYSIS COMING TO GUARD POND

SL NO	PARAMETERS	UNIT	RESULTS
A	QUANTITY	CUM/HR	6
1	Colour	Hazen Units	0
2	Odour		0
3	Turbidity	NTU	0
4	pH Value		7
5	BOD	ppm	0
6	COD	ppm	0
7	Total Suspended Solids	ppm	0
8	Total dissolved solids	ppm	3000
9	Alkalinity	ppm	10.2916667
10	Chloride as Cl	ppm	2000
11	Sulphate as SO4	ppm	53.75
12	Silica-Dissolved as SiO2	ppm	9.79166667
13	Silica-Colloidal as SiO2	ppm	1.25
14	Ca Hardness as CaCO3	ppm	58.3333333
15	Mg Hardness as CaCO3	ppm	39.1666667
16	Total Hardness as CaCO3	ppm	97.5
17	% sodium	ppm	1500
18	Ammonical Nitrogen	ppm	2.7375
19	Iron as Fe	ppm	0.12916667
20	Manganese as Mn	ppm	0.02083333
21	Total Kjeldhal Nitrogen	ppm	1.41666667
22	Total Residual Chlorine	ppm	0.20833333
23	Phosphate as PO4	ppm	0.54166667
24	Free Ammonia	ppm	0.04166667
25	Total phosphorus	ppm	0.23333333
26	Oil and Grease	ppm	0.41666667
27	Nitrate Nitrogen	ppm	0.54166667
28	Sulphide	ppm	0.02083333
29	Fluoride as F	ppm	0.1625
30	Copper as Cu	ppm	0.02083333
31	Zinc as Zn	ppm	0.02083333
32	Lead as Pb	ppm	0.00833333



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33	Total Chromium as Cr	ppm	0.02083333
34	Mercury as Hg	ppm	0.00041667
35	Cyanide as CN	ppm	0.02083333
36	Phenolic components as C ₆ H ₅ OH	ppm	0.02083333
37	Nickel as Ni	ppm	0.02083333
38	Arsenic as AS	ppm	0.00041667
39	Coliform Organisms/100 ml	ppm	122500000
40	Faecal Coliform Organisms/100 ml	ppm	122500000
41	MPN count/100	ppm	16.3333333
42	E-coil	ppm	0
43	Temperature	Deg C	28



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ANNEXURE – IX

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.



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ANNEXURE –X

Format for Operation & 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	
1.0	Cover page				
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	Index				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	Description of Plant/System				
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				



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4.0	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				
4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/user/operator				
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.				
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	Maintenance guidelines for plant personal				
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.				



TITLE:
**TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

**1x370 MW YELAHANKA
COMBINED CYCLE POWER PLANT**

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	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				



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ANNEXURE-XI

SITE STORAGE AND PRESERVATION

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.

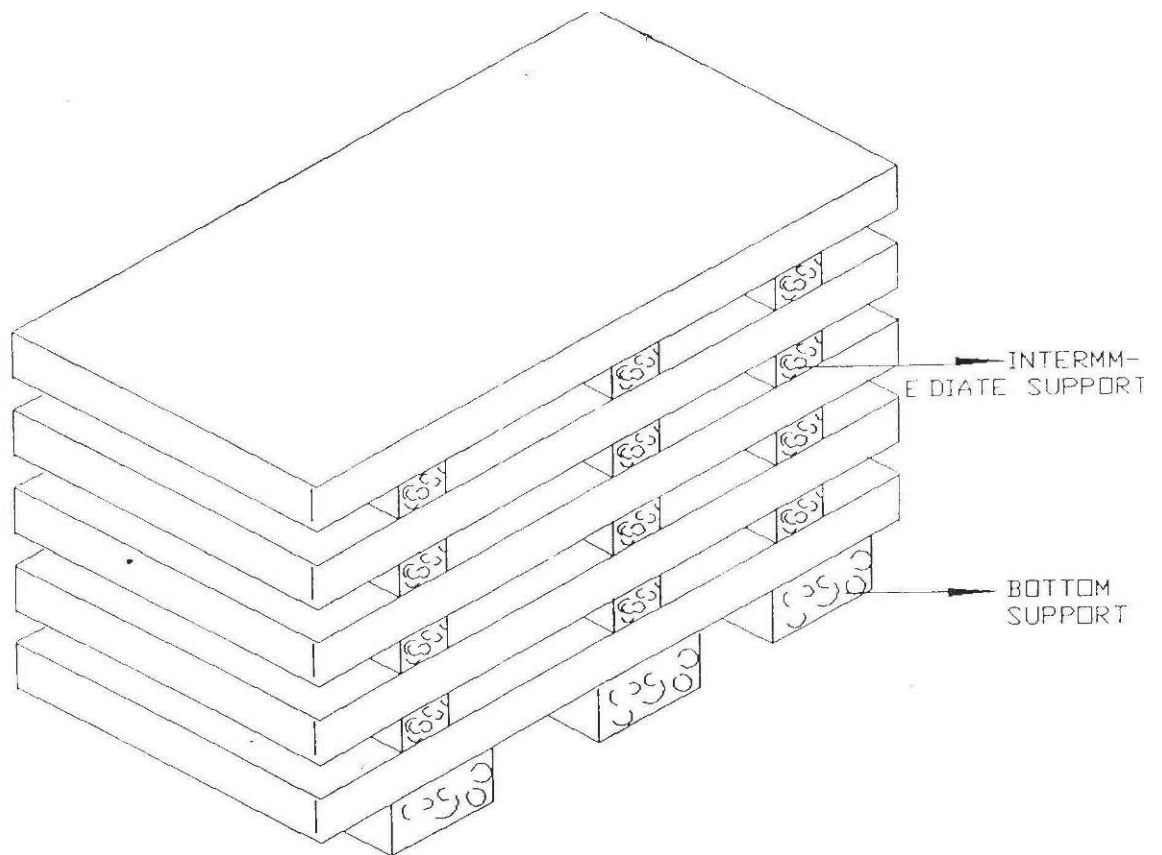


Figure – 1 – PLATE STACKING ARRANGEMENT

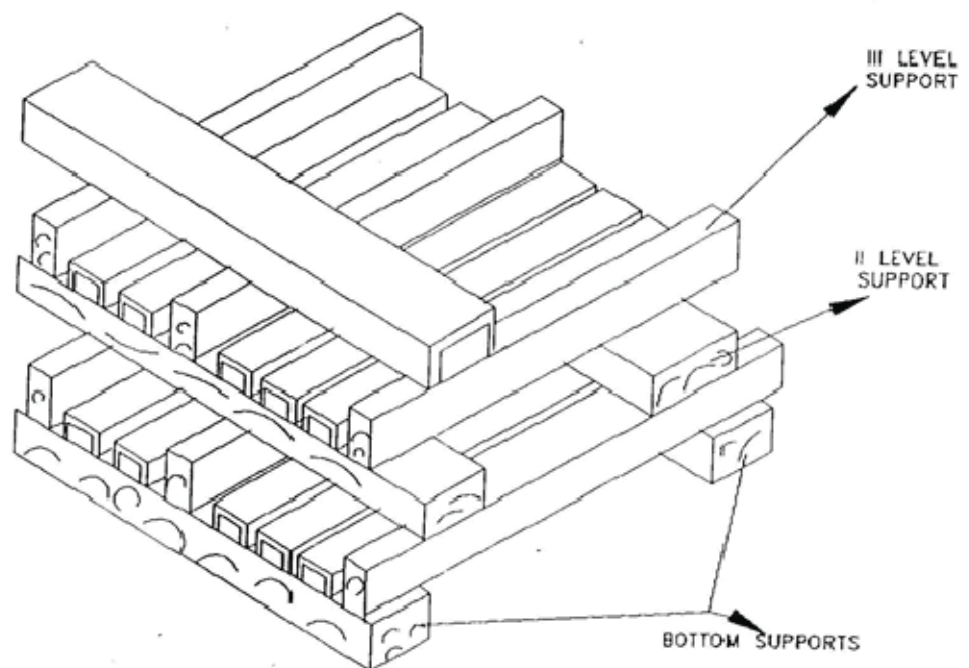


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

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		SUB-SECTION :IA	
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ANNEXURE –XII

POLLUTION CONTROL MEASURES

	TITLE: TECHNICAL SPECIFICATION FOR EFFLUENT TREATMENT PLANT 1x370 MW YELAHANKA COMBINED CYCLE POWER PLANT	SPECIFICATION NO.: PE-TS-409-164-A001	
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1.0 GENERAL

The Contractor shall offer a plant so as to meet the pollution control requirements of statutory authorities. Emissions and discharges of solid, liquid and gaseous effluents from the Power Plant shall fully comply with all requirements and limits specified in Environmental (Protection) Act, 1986, Minimum National Standards (MINAS), along with all latest amendments to all of the above requirements, stipulations of the Central Pollution Control Board (CPCB), Ministry of Environment and Forests (MOEF) and State Pollution Control Board (SPCB) for the project, and any other central or local statutory requirements regarding environmental pollution and its abatement.

The Contractor shall be responsible for obtaining all necessary approvals, licenses and permissions which are related to design, construction, installation and operation of the plant. These shall be obtained at appropriate time to ensure that the construction and commissioning programme can be realised.

2.0 GASEOUS AND PARTICULATE EMISSIONS

For the fuel specified (Regasified LNG), the gaseous and particulate emission from the stack shall comply with the requirements stipulated by statutory authorities.

The Contractor shall provide continuous monitoring equipment to measure particulate matter (e.g. cross-stack optical density or equivalent), carbon monoxide, sulphur dioxide, nitrogen oxides, temperature and oxygen content of the stack gases. The monitoring instruments must be carefully located to ensure that representative sampling is obtained and sampling should be to a recognised standard.

The monitoring systems should incorporate the means to record various time averaged values as required by the performance requirements. Monitoring data should be displayed in the control room, with provision of alarms to notify the operator of any deviation from the specified values. The Contractor shall furnish a list of monitoring equipment he intends to provide with their location in the plant.

3.0 NOISE CONTROL

3.1 An integrated approach shall be taken by the Contractor to control noise emission which shall include but not be limited to:

- (a) Design and layout of building to minimise transmission of noise, segregation of particular items of plant and to avoid reverberant areas.
- (b) Specification of permissible noise levels for bought-out items.
- (c) Choice of materials for civil construction
- (d) Acoustic design of building
- (e) Use of lagging with attenuation properties on plant components / installation of sound attenuation panels around the equipment.

3.2 Where the requirements stated above are not met within the basic design of the plant they shall be achieved by the supply under the Contract of suitable means of noise control, which shall conform to the following requirements:

- (a) The noise control system shall, as far as possible, be designed to form an integral part of the plant.
- (b) The abatement system shall, wherever practicable, be applied to the source of excessive noise rather than to the entire item or component.

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- (c) If above means are not adequate and enclosures are used for noise abatement, close fitting enclosures shall be provided.

3.3 NOISE IN CONTROL AREAS

(a) Control Rooms

The noise levels in control rooms must be such that intelligible speech communication is always possible and mental concentration is not hindered.

(b) Other Control Areas

The noise levels in other control areas must be such that intelligible conversation (telephone and person-to-person) is possible and operator fatigue is minimised.

(c) Station Noise Criterion

The criterion for environmental noise is that the design of the station and its components shall not exceed, in any continuous mode of operation, the level stipulated by MOEF and/or Pollution Control Board at any point on the site boundary.

4.0 LIQUID EFFLUENT DISPOSAL

The cooling tower blow down, HRSG blowdown/ drains, reject from the RO plant and effluent after plant washing, cleaning etc., will be led to the guards pond. Back wash from filters and regeneration effluent from the mixed bed units will be led to the neutralising pit, treated and led to the guard pond.

Plant drains from SG / TG areas will be led to a sump, which will also collect oil water from transformer area. The oily effluent has to be treated in an oil water separator for removal of oil traces. The clear water will be led to the guard pond while dirty oil will be disposed off in drums separately.

Network of sewage pipe lines of stoneware construction would be provided to carry sewage from the building toilets and other drains to septic tanks. Outflow from septic tank is passed through soak. Treated water may be utilised for gardening.

The water collected in the guard pond will be diluted with water from the tertiary water storage tank if necessary and treated properly to meet the tolerance limits stipulated by the pollution control board before pumping it to plant boundary.

5.0 MONITORING REQUIREMENTS

The Contractor shall include continuous monitoring equipment for the following as minimum.

- Continuous ambient air quality monitoring system for suspended particulate matter, respirable particulate matter, SO₂, NO_x and CO minimum one (1) set.
- For manual monitoring of ambient air quality–High Volume Sampler with attachment for gaseous sampling and respirable particulate matter sampler – four (4) sets (minimum)
- Stack monitoring kit complete with all accessories as well as NO_x sampling assembly for manual monitoring of stack gases conforming to the requirements laid down by CPCB.
- One completely automatic micro-meteorological data collection and recording station comprising wind-vane, anemometer, thermometer, hygrometer, sunshine recorder, evaporimeter, rain-fall recorder etc. The stations shall be equipped with arrangement for measurement of ground based inversions

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using techno-commercially acceptable methods. Alternative means can be proposed for the method of measurement of inversions on hourly basis. The entire station shall be of automatic recording type connected with logic controller and programmable microprocessor. Continuous recording system with provision for instantaneous display of different parameters including the wind rose shall be provided.

- (e) On line monitoring equipment for continuous monitoring of temperature and other salient parameters like TSS, free chlorine, pH, oil and grease, etc., of treated effluent before reuse shall be provided.
- (f) A full fledged and well equipped modern laboratory with all necessary instrument and facilities shall be provided. The Contractor shall furnish the list of laboratory equipment and appliances including specification and make. The laboratory shall be adequately equipped to test and analyse all parameters laid down in the Standards of discharge of liquid effluents, air emissions, ambient air quality as well as solid wastes applicable in India. All chemicals and consumables shall be supplied by the Contractor for one year's plant operation from the date of commercial operation (COD) of the plant in totality, as would be necessary for the various tests and analysis.



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P&ID FOR EFFLUENT TREATMENT PLANT



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DATA SHEET-A

1.0	HRSG BLOW DOWN SUMP	
1.1	Number	One (1) number.
1.2	Capacity	70 Cu.M.+ 300 MM free board.
1.3	Material	RCC
1.4	Type	Under Ground.
1.5	Size (minimum)	5.0 meters X 5.0 meters X 3.5 meters (Depth)
1.6	Hand railing	Shall be provided by the bidder
1.7	Level transmitter (One number)	Shall be provided by the bidder
1.8	Level Gauge(One number)	Shall be provided by the bidder
2.0	HRSG BLOW DOWN TRANSFER PUMPS	
2.1	Number	Two (2) [1Working + 1 standby].
2.2	Capacity	40 CuM/Hr (each).
2.3	Head	As per system requirement.
2.4	Type	Vertical Centrifugal.
2.5	Duty	Intermittent
2.6	Location	Outdoor
2.7	Material	
	a) Impeller (Semi open non clog Type)	SS 316
	b) Discharge Elbow/Head/Casing/Column pipe	2% Ni: IS 210 Gr FG. 260
	c) Shaft and Shaft Coupling	SS 410.
	d) Base plate	IS 2062 Gr. B with epoxy coating.
3.0	GT/ST AREA FLOOR WASH COLLECTION PIT	
3.1	Number	One (1)
3.2	Capacity	10 cum+300 MM free board.
3.3	Material of construction	RCC.
3.4	Type	Under Ground.
3.5	Size (minimum)	3.0 meters X 2.0 meters X 2.5 meters (Depth)
3.6	Hand railing	Shall be provided by the bidder
3.7	Level transmitter (One number)	Shall be provided by the bidder
3.8	Level Gauge(One number)	Shall be provided by the bidder
4.0	GT/ST AREA FLOOR WASH COLLECTION PIT DEWATERING PUMPS	
4.1	Number	Two (2) [1Working + 1 standby].
4.2	Capacity	5 CuM/Hr (each).
4.3	Head	As per system requirement.
4.4	Type	Vertical Centrifugal.
4.5	Duty	Intermittent
4.6	Location	Outdoor
4.7	Material	
	a) Impeller (Closed/Semi open Type)	ASTM A 351 CF 8M.
	b) Discharge Elbow/Head/Casing/Column pipe	2% Ni: IS 210 Gr FG. 260
	c) Shaft and Shaft Coupling	SS 410
	d) Base plate	IS 2062 Gr. B with epoxy coating
5.0	BURNT OIL COLLECTION PIT	
5.1	Number	One (1)
5.2	Capacity	100 cum+300 MM free board.
5.3	Material of construction	RCC.
5.4	Type	Under Ground.
5.5	Size (minimum)	7.0 meters X 3.5 meters X 4.5 meters (Depth)
5.6	Hand railing	Shall be provided by the bidder
5.7	Level transmitter (One number)	Shall be provided by the bidder
5.8	Level Gauge(One number)	Shall be provided by the bidder



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6.0	BURNT OIL COLLECTION TRANSFER PUMPS			
6.1	Number	Two (2) [1Working + 1 standby].		
6.2	Capacity	10 CuM/Hr (each).		
6.3	Head	As per system requirement.		
6.4	Type	Screw type (vertical)		
6.5	Duty	Intermittent		
6.6	Location	Outdoor		
6.7	Material			
	a) Casing	2 % Ni Cl to IS 210 FG 260		
	b) Rotor	SS 316		
	c) Stator	Nitrile /EPDM		
	d) Shaft	SS ASTM A 276 Gr 410.		
7.0	LAMELLA CLARIFIER/TUBE SETTLERS			
7.1	Numbers	One (1X100 %)		
7.2	Capacity	10 M3/Hr		
7.3	Type	As per manufacturer's design		
7.4	Distance between successive plates/tubes	As per manufacturer's design		
7.5	MOC of plates	PVC		
7.6	Oil skimmer	One number		
7.7	Angle of inclination	50 – 80 degree.		
7.8	Flash mixer and clariflocculator	• Part of Lamella Clarifier/Tube Settlers • Rectangular. • Material of Construction : MSEP • Slow speed agitator with reduction gear unit. Material of Construction of agitator is SS316.		
7.9	Oil Separation Pack	Shall be provided by the bidder.		
7.10	Design Parameter	CONSTITUENT	INLET (Minimum)	OUTLET (Maximum)
		Total suspended solids	500 PPM	10 PPM
		Oil content	50 PPM	10 PPM
8.0	GUARD POND/CENTRAL MONITORING BASIN			
8.1	Number	1 no.		
8.2	Type	Above ground.		
8.3	No. of Sections/Compartments.	Two		
8.4	Material of construction	RCC		
8.5	Capacity of each Compartment	2800 Cu.M+300 MM free board.		
8.6	Size of each Compartment (minimum)	33.0 meters X 22.0 meters X 4.0 meters (Height)		
8.7	Hand railing	Shall be provided by the bidder		
8.8	Level transmitter-One number in each Compartment and One number in common collection pit. Total three number level Transmitter.	Shall be provided by the bidder		
8.9	Level Gauge(One number) in each Compartment	Shall be provided by the bidder		
8.10	ISOLATION GATES (SLUICE GATE) (Bidder's scope)	i. Numbers- Four (4) Numbers ii. Design standard for each gate shall be IS:3042 or Eqv. iii. The gates shall be rectangular or square sluice, rising spindle type conforming to class-1 of IS:3042. iv. Material of Construction of each gate: • GATE FRAME & SHUTTER: MILD STEEL IS:2062 Gr 'B'.		



TITLE:
**TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

**1x370 MW YELAHANKA
COMBINED CYCLE POWER PLANT**

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		- BOTTOM RUBBER SEAL: EPDM RUBBER - STEM/SPINDLE: MILD STEEL IS:2062 Gr 'A'. - HEADSTOCK: CAST IRON IS :210 FG 200 - STEM BLOCK/THRUST NUT: CF8 - ASSEMBLY FASTNERS: ASTM A276 TYPE 304 - YOKE: MILD STEEL IS:2062 Gr 'A' v. All the parts of each gates shall be applied with the coats of heavy duty bitumastic paint. vi. Each of the gates shall be provided by the Bidder with hand wheel, and a position indicator. vii. Each gate shall be FRP coated on both sides.
9.0	TREATED EFFLUENT DISPOSAL PUMPS	
9.1	Number	Two (2) [1Working + 1 standby].
9.2	Capacity	230 CuM/Hr (each)
9.3	Head	As per system requirement.
9.4	Type	Horizontal Centrifugal
9.5	Duty	Continuous
9.6	Maximum speed	1500 RPM
9.7	Materials of construction	
9.8	Casing	SS 316
	a) Impeller (Closed/Semi openType)	SS 316
	c) Shaft and Shaft Coupling	SS 410.
	b) Discharge Elbow/Head/Casing/Column pipe	2% Ni: IS 210 Gr FG. 260
	d) Base plate	Mild steel to IS : 2062 with 5 mil epoxy paint coat
9.9	Drive details	415V, 3-phase, 50Hz supply, AC Electrical Motor with output rating equal to 1.25 times the pump power requirement at duty point.
10.0	SLOP OIL STORAGE TANK	
10.1	Number required	One (1).
10.2	Type	Vertical Cylindrical.
10.3	Type of fluid to be handled	Slop Oil.
10.4	Effective capacity, cum	10
10.5	Material of Construction	Carbon Steel
10.6	Design Standard	IS 803
10.7	Oil collection drum	2 Nos with wheel (MOC: HDPE), each capacity=150 Ltrs.
11.0	ALUM DOSING SYSTEM FOR LAMELLA CLARIFIER/ TUBE SETTLERS	
11.1	ALUM DOSING TANKS	
11.1.1	Number	One number
11.1.2	Capacity	24 Hrs storage capacity
11.1.3	Material, thickness	SS304, 6 MM (minimum)
11.1.4	Type	Vertical with dished end
11.1.5	Stirrer per tank	- Slow speed stirrer driven by motor drive and reduction gear. Speed of stirrer = 200 RPM Max. - Material of Construction of each stirrer and agitator = Stainless Steel – 316.
11.1.6	Free board	Minimum 300 mm freeboard shall be provided over the over flow level for each tank
11.1.7	Accessories	Vent, drain, sample connection, level transmitter, Level Gauge, operating platform, ladders , lifting lugs (4 nos minimum) etc.
11.2	ALUM DOSING PUMPS	
11.2.1	Number	Two (2) [1Working + 1 standby].



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11.2.2	Type	Positive displacement
11.2.3	Displacer	Plunger/diaphragm
11.2.4	Capacity and pressure	As per system requirements
11.2.5	Capacity variation	0-100%
11.2.6	Materials of construction	SS 316
11.2.7	Pressure gauge	One per pump
11.2.8	Pressure Dampener	One per pump
11.2.9	Accessories required for each pump	Coupling guard, drain plug, vent valve, suction hoses, isolation valves, Y- type strainers (SS316), pressure gauges, pulsation dampener etc.
11.2.10	External safety relief valve (in addition to inbuilt safety valve) for each pump	One number. Material of construction of each safety relief valve shall be SS316
12.0	WEIGHING SCALE FOR CHEMICAL	
12.1	Type	Platform, dial type.
12.2	Number	One (1)
12.3	Capacity	0-100 Kgs
13.0	PIPING	
		- Alum handling pipe shall be of SS 304 SCH 40. - Pipe carrying sludge shall be of MS. - Pipe carrying boiler Blowdown, oily waste and floor wash waste shall be Carbon Steel to IS-1239 Heavy Grade. - Pipe carrying treated water at outlet of guard pond shall be Carbon Steel to IS-3589 for sizes above 150 mm with minimum pipe thickness as indicated in the P&ID.
14.0	VALVES	Material of Construction (Refer Note-1).
i.	Gate (All gate valves shall have flanged end connections, it shall be outside screw rising stem type with hand wheel). [Design Std-API 602 and Testing Std-API 598 for <50 NB size and Design Std-API 600 and Testing Std-API 598 for >=50 NB size].	Rating: PN 10 (min). Body/Bonnet – Cast Iron. Stem – stainless steel 410. Disc – Cast iron. Seat & seat rings – 13% Chromium steel. Hand wheel- Cast iron.
ii.	NRV (All NRV shall have flanged end connection. For bore greater than 50 mm valves shall be swing check type. For bore smaller than or equal to 50 mm it shall be piston type). [Design Std-BS 5352 and Testing Std-BS 6755 for <50 NB size and Design BS 1868 and Testing Std-BS 6755 for >=50 NB size].	<u>Swing Check type</u> Body – Cast Iron Disc/door – Cast Iron Hinged pin – SS 316 <u>Piston type</u> Body – Cast Iron Hinge pin – SS316 Piston – SS Disc- Cast Iron
iii	Ball valve	Type :Full bore Rating: PN 10 (min). Body: cast Iron/carbon steel Ball: stainless steel Seat ring: PTFE Stem: Stainless steel Seat: Nitrile rubber, PTFE
iv	Globe valve [Design Std-BS 5352 and Testing Std-BS 6755 for <50 NB size and Design BS 1873 and Testing Std-BS 6755 for >=50 NB size].	Type: Double flanged. Rating: PN 10 (min). Body: Cast iron:IS 210 Gr FG260 Stem: stainless steel.
v	Plug Valve	Type :Full bore Rating: PN 10 (min).



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		Body: cast Iron/carbon steel Plug: Stainless steel Seat: Nitrile rubber, PTFE
vi	Butterfly valve	Butterfly valves shall be of Lugged wafer type of low leakage rate confirming to AWWA-C-504 class 150 (min.) or BS:5155 PN 10 (min.) Body: cast Iron IS:210 Gr. FG 260 Disc: SS 316. Shaft:ASTM.A296 Gr. CF8M Seat rings: Nitrilerubber, EPDM,Hypalon All the butterfly valves shall be provided with Hand wheel or lever as per the requirements. All the butterfly valves shall be provided with an indicator to show the position of the disc. Flanges shall conform to ANSI B 16.5 Cl.150 (min).
vii	Diaphragm valve	The Diaphragm shall conform to following requirement i) Design standard: BS:5156 or equivalent of required rating/class. (minimum rating of valves shall be PN 10). ii) Type: Flanged and lined body ends, sealed bonnet, weir pattern, tight shut off type iii) Material of Construction a. Body , Bonnet: Cast iron IS 210 Gr. FG 260 or equivalent or Cast steel ASTM A-216 Gr. WCB b. Body lining : Soft natural rubber, ebonite , Polypropelene c. Handwheel : Cast Iron d. Compressor : Stainless Steel e. Stem and Bush : Stainless Steel
viii	Needle valve	Rating: PN 10 (min). Body– Cast Iron. Stem – stainless steel AISI 410/ 13% chrome steel. Handel- Cast iron.
ix	Valves for chemical application	All parts of valve shall be of SS 316



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PUMPS AND PIPE SELECTION CRITERIA.

Pump and Pipeline carrying water and chemicals etc. shall generally be sized on the following velocities. However wherever minimum pipe sizes are defined in the drawing/datasheets, the selected size shall not be less than the specified size.

	VELOCITY IN m/sec.		
	BELOW 50 MM.	50-150 MM	200 MM AND ABOVE
Pump Suction for water	-----	1.2-1.5	1.2-1.8
Pump discharge for water	1.2-1.8	1.8-2.4	2.1-2.5
Header for water	-----	1.5-2.4	1.8-2.4
Pump Suction for chemical solution	1.0-1.2	1.1-1.3	-----
Pump discharge for chemical solution	1.2-1.4	1.3-1.5	-----
Gravity flows	Pipe-1.0 (maximum) and Channel-0.6 (maximum).		

Note 1- All piping system shall be capable of withstanding the maximum pressure in the corresponding line.

Note 2- TDH of all pumps shall be decided by the supplier assuming the following 'C' values in Hazen & Williams equation for calculation of friction loss. Friction losses of all the pumps shall be calculated using H&W equation following "C" values to be adopted.

- Carbon steel pipes – 100
- C. I pipes –100
- Rubber lined steel pipe – 120
- PVC/HDPE pipes – 140

Note-1: Pumps head shall be calculated with a margin of 10% on pump flow and 10% margin on frictional head shall be provided over the designed requirement



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KEY PLAN FOR EFFLUENT TREATMENT PLANT

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



NOTES:

1. ALL THE DIMENSIONS ARE IN MM.
2. BIDDER TO ACCOMMODATE ALL THEIR EQUIPMENTS IN THE SPACE SHOWN.

	OWNER	KARNATAKA POWER CORPORATION LIMITED 12370 MAIN YELAHANNA COMBINED CYCLE POWER PLANT				
	OWNER'S CONSULTANT	POHNNER Consulting Engineers (India) Private Limited, Chemical, Bangalore				
	FIGHTNER	BHARAT HEAVY ELECTRICALS LTD POWER GROUP PROJECTS ENGINEERING MANAGEMENT INDIA				
		DOPT	NAME	SSN	DATE	
		DESIGN	SSN			
		APPROV	SSN			
		DATE	SSN			
		APPROV	SSN			
		DATE	SSN			

KEY PLAN FOR EFFLUENT TREATMENT PLANT

DEPT.	SCALE	DRAWING NO.
		DT 20 100 101 1000

SIGN DATE		FE-DG-408-104-A002	
		SHEET 1 OF 1	REV 00

DATE	T	THICK 1	S	T	THICK 2	W
SIZE-A						

SIDE 4

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT



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SECTION – IB

SPECIFIC TECHNICAL REQUIREMENTS ELECTRICAL



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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 **EFFLUENT 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.
- 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) BASIC TECHNICAL FEATURES FOR LT MOTORS
- c) Datasheets-A for motors
- d) Datasheets-C for motors
- e) Quality plan for motors.
- f) Electrical Load data format (Annexure –II)
- g) BHEL cable listing format (Annexure –III)
- h) STANDARD SPECIFICATION - LV MOTORS



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**ELECTRICAL SCOPE BETWEEN BHEL & VENDOR
(ANNEXURE-I)**

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGES: EFFLUENT TREATMENT PLANT

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT: 1 X 370 MW YELAHANKA CCPP

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
11	Below grade grounding	BHEL	BHEL	

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGES: EFFLUENT TREATMENT PLANT

SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT

PROJECT: 1 X 370 MW YELAHANKA CCPP

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
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.



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**ELECTRICAL LOAD DATA FORMAT
(ANNEXURE- II)**

LOAD TITLE		RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (γ)	CONT.(C)/ INTT.(ι)	STARTING TIME ≥5 SEC (γ)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONT ROL CODE	REMA RKS	LOAD No.	VERIFICATI ON FROM MOTOR DATASHEE T (Y/N)	KKS NO
		NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	Nos						
1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
ANNEXURE-II																					
NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER																					
2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V																					
: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTOR CONTROLLED)																					
LOAD DATA (ELECTRICAL)	JOB NO.	409										ORIGINATING AGENCY		PEM (ELECTRICAL)							
	PROJECT TITLE	1X370MW YELAHANKA TPS										NAME	DATA FILLED UP ON								
	SYSTEM	EFFLUENT TREATMENT PLANT										SIGN.	DATA ENTERED ON								
	DEPTT. / SECTION	MAUX										SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE							
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CABLE SCHEDULE FORMAT

ANNEXURE- III

[illegible]



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SECTION – IC

SPECIFIC TECHNICAL REQUIREMENTS C&I



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IMPORTANT NOTES:-

1. The controls for ETP shall be Relay based Control cum Annunciation panel with solid state annunciation windows.
2. The requirements given below are to be read in conjunction with detailed Technical specification & data sheets-A&B (applicable for Local panels and motorized valve actuator), enclosed elsewhere in the specification. Further in case of any discrepancy in the requirement within the specification noted by the bidder, the same shall be brought to the notice of BHEL in the form of pre-bid clarification. In absence of any pre-bid clarification, the more stringent requirement as per interpretation of customer and Customer contractual specification shall prevail without any commercial implication.
3. The scope of cable shall be referred in Electrical scope split in Electrical specification whereas cable schedule, cable interconnections and wiring diagram for the same shall be in bidders' scope.
4. The bidder to furnish the list of instruments and BOQ of drives/loads along with their bids.
5. PG/DPG/PS/PT shall have chemical/diaphragm seal as per requirement.
6. Vendor to include Field instrumentation and Field Junction Box (JB's) in his scope of supply. Field instrument specification, Data Sheet and Quality plans are given elsewhere in the C&I Technical specification.
7. Instrument installation drawings are to be provided by Vendor during detailed Engineering. All instrument fitting and erection hardware as per instrument installation diagram shall be in vendor's scope.
8. 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.
9. Provision for separate Terminal block/ wiring diagram for Power & control blocks of control panel to be ensured.
10. Vendor to furnish Signal interface between panel & MCC during detailed engineering.
11. The make of the panel, make and the type of relays, selector switches, timers, push buttons, MCBs, lamps, Alarm facia should be in line with customer approved



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/BHEL approved vendor list. Make of all C&I equipment/ items supplied shall be of reputed make & shall be subject to approval of BHEL/ Customer after award of contract.

12. Layout & space requirement of panel to be specified during detailed engineering. Vendor to specify whether the panel shall be wall/skid mounted. If the panel is very small, wall mounting of panel can be ensured, if applicable.

13. Provision for earthing of the panel to be provided by vendor.

14. Illumination and ventilation requirement of each panel to be furnished. Vendor to ensure that power requirement for illumination is derived from available input power supply only.

15. Electrical load & heat load of each panel to be furnished during detailed engineering.

16. 20% spare relays of each type, fully wired upto TBs and one number of MCBs of each type to be provided as engineering spares. Commissioning spares to be covered as per Contract specification.

17. All Vendor QPs (if applicable) shall be subject to approval of BHEL/ Customer after award of contract.

18. Vendor shall be responsible for the completeness of the system in all respect. Any requirement not mentioned here and required during detailed engineering shall be supplied by vendor without any commercial / time implication.



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SECTION – II

GENERAL TECHNICAL REQUIREMENTS

SUB-SECTION IIA - GENERAL TECHNICAL REQUIREMENTS (MECH.)

SUB-SECTION IIB - GENERAL TECHNICAL REQUIREMENTS (ELECTRICAL)

SUB-SECTION IIC - GENERAL TECHNICAL REQUIREMENTS (C & I)

SUB-SECTION IID - GENERAL TECHNICAL REQUIREMENTS (CIVIL)



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MECHANICAL



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1.0 **EFFLUENT TREATMENT PLANT**

- 1.1 The CW blowdown, blowdown from the HRSGs, reject water from Reverse Osmosis plant, DM plant waste from neutralising pit and all plant drains shall be disposed to the guard pond. The regenerant effluent from the DM plant and filter backwash from RO pretreatment plant will be first led to neutralising pit and after neutralisation will be led to the guard pond by the neutralising system pumps.
- 1.2 The oily sewers collect water from areas where there are possibilities of contamination with oil (as in the transformer yard, fuel oil storage area, turbine building and HRSG areas, etc.) and the drains from such areas shall be connected to the oil separator. The clear water from the oil separator shall be led to the guard pond while the oily waste sludge shall be collected in a waste oil tank of around 10.0 cu.m capacity.
- 1.3 The guard pond shall be sized to have a storage capacity of one day's inflow. The effluents collected in the guard pond shall be diluted with water from raw water storage tank/ treated for pH correction if required and this treated water shall be partly utilised in the plant for gardening while the remaining water shall be disposed using two 2x100% effluent disposal pumps to plant drains.



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TECHNICAL REQUIREMENTS FOR ELECTRIC/MANUAL HOIST



TITLE:

**TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

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1.0 GENERAL

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

Capacity of hoists shall be selected considering a minimum margin of 20% over the maximum weight of the heaviest equipment / component to be handled by the Hoist.

2.0 GENERAL DESIGN FEATURES

- For the items weighing 500 kg and above, hoists and trolleys and accessories along with monorails shall be provided throughout the plant where cranes cannot be utilised. For items weighing less than 1000 kg manual hoists with all accessories shall be provided by the Bidder. For items weighing more than 1000 kg electric hoists with all accessories shall be provided by the Bidder. The speed for Hoists shall be generally 2-3 m / min.
- Bidder shall provide Electric/Manual hoists to facilitate the lifting and transporting of various pieces of equipment during construction, maintenance, or replacement of the Effluent Treatmnet plant components.
- The electric hoist shall be complete with its accessories, supporting structure, power supply, safety devices, and controls and shall conform to local statutory rules and regulation.
- Equipment offered shall be conforming to specification requirements as per IS: 3938 class II duty.
- Parts requiring replacement or lubrication shall be easily accessible & without dismounting type.
- Equipment shall include the devices as required and comply with applicable standards/specification requirements.
- Defects in material not acceptable/allowed. Rectification of any flaw is permissible only with the approval of BHEL.
- Design shall provide for easy maintenance of all parts, particularly the wheel bearings.
- Both hoists and trolleys are driven electrically as specified
- Wheels shall be single flanged type and to suit different monorail beam sizes
- Hook shall be swiveling type and fitted with a safety latch.
- Hoists shall be designed for minimum headroom above the highest position of hook and for closest hook approaches.
- All material, castings and forgings will be of tested quality & certificates shall be made available for approval as per approved QAP.
- Creep speed shall be provided for hoisting motion only and shall be through VVVF drive.

MANUAL HOIST

1.0	Type	Chain pulley block with/without trolley
2.0	General Design	IS: 3832
3.0	Duty Class as per IS:3832	Class –II
4.0	Hoisting Mechanism	
a)	Type	Hand operated gear transmission
b)	Type of gear	Spur / Helical
c)	Load Chain	
i)	Type	Link type
ii)	Material	T (8) as per IS: 6216
d)	Hand Chain	
i)	Type	Link type



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ii)	Material	Mild steel Grade 30
iii)	Conform to Std.	IS:2429 (Part I)
e)	Load Hook & Hook Block	
i)	Type of load hook	Plain shank- Trapezoidal section/ 'C' type
ii)	Load hooks conforms to	IS: 15560
iii)	Type of hook suspension	Swivelling type with lock
iv)	Type of make of bearing	Thrust ball bearing of hook suspension
v)	Type & Material of hook	Material: Mild steel / Cast Iron / Malleable CI / High tensile steel and heat treated as per clause 7.1 (b) IS 3815 block enclosures
f)	Gears	
i)	Type	Spur
ii)	Material	Alloy steel / carbon steel
iii)	Type of Bearing	Antifriction ball bearing / Roller
g)	Pinions	
i)	Type of bearing used	Antifriction ball bearing / Roller
h)	Sprockets :	
	Type of bearings used	Antifriction ball bearing / Roller
i)	Method of lubrication	
	Bearings	Grease
	Gearing & Pinions	Grease
	Sprocket	Grease
j)	Brakes	
	Type	Screw and friction disc type
5.0	Trolley and Bridge drive	
a)	Trolley	
i)	Type	Geared (Manually operated)
ii)	Material of frame	Mild steel (IS:2062 Grade A or B)
b)	Drive Chain	
i)	Type	Link type
ii)	Material	Steel Gr.30
iii)	Design of drive chain	IS : 2429 part 1 :1870
c)	Wheel	
i)	Number of pairs of wheel	Two in each trolley/bridge
ii)	Flange	Single flanged
iii)	Type of bearings need	Antifriction
iv)	Wheel material	Load chain wheel: Malleable / S.G. iron casting Hand chain wheel: SG iron (IS: 1865)
d)	Gears	
i)	Type	Spur / helical
ii)	Material	Cast iron/EN8
iii)	Type of bearings used	Antifriction



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e)	Method of lubrication for	
i)	Bearings	Grease
ii)	General	Grease
iii)	Sprockets	Grease
6.0	Painting	As per manufacturer's standard

Electric Hoist

S.No.	DESCRIPTION	TECHNICAL PARTICULARS	
1.0	Type	Steel wire electric hoist with electrically operated trolley	
2.0	Overload test	125% of SWL	
3.0	Design Ambient temperature	50 ° C	
4.0	General Design	As per IS: 3938 / 1983, class-II	
5.0	Operating speed	Full speed (m/min)	Creep speed (m/min)
5.1	Hoisting speed	3.0 M / min.	10% of main speed (thro' VVVF drive)
5.2	Trolley speed	10.0 M / min.	NA
6.0	Type of transmission	Through Electric motor and gearbox	
7.0	Wire Rope	Min ultimate tensile strength = 180 kg/mm ²	
7.1	Construction / core	6 x36 Steel core	
7.2	Code	IS:2266	
7.3	Factor of safety	Not less than 5	
7.4	No. of full laps on the drum at extreme low position of hook	Rope shall be of sufficient length so that 3 (three) full laps remain on the drum at extreme low position of the hook not taking into consideration the turns covered by the wore rope anchorage and one spare groove for each lead of the wire rope on the drum when hook is at its highest position.	
8.0	Load Hook and block		
8.1	Type of load hook	Plain shank type swiveling with safety latch (section: circular/ trapezoidal/'c' type)	
8.2	Load hook Code	IS:15560	
8.3	Load hook Material	As per IS: 1875, min. C 20 forged	
8.4	Hook suspension	Thrust bearing	
9.0	Gear (Hoisting)		
9.1	Type	Spur / Helical	
9.2	Material	Gear: 16 Mn Cr 5 / 20 Mn Cr 5 / C40 / C50 / EN19 / EN24 / SAE 8620 / 16 Cr Ni 4 / 18 Ni Cr Mo5 / 39 Ni Cr. MO3 / 42 Cr MO4	



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9.3	Bearing type	Antifriction Ball
10.0	Trolley drive	
10.1	Wheel	Single flange taper thread
10.2	Wheel conform to (Std. / code)	IS: 3938
10.3	Wheel material	As per IS 3938
10.4	Bearing type	Antifriction Ball
11.0	SHEAVE	
11.1	Material	Cast / forged steel. IS: 2062 Gr. B / as per IS: 3938
11.2	Bearing type	Antifriction Ball
12.0	BRAKE (Hoist)	
12.1	Type	ACEM / DC EM brakes
12.2	Capacity	150 % of FLT
12.3	Number	One number for each motor
13.0	BRAKE (Trolley)	
13.1	Type	ACEM / DC EM brakes
13.2	Capacity	125 % of FLT or 100% of motor torque (Which ever is higher)
13.3	Number	One number for each motor
14.0	ROPE DRUM	
14.1	Material	As per IS 3938. Seamless steel pipe. ASTM A106 /A53 grade B
14.2	Type of groove	Right hand groove or Right hand and left hand groove
14.3	Spare groove on drum	One (1) spare groove when the hook is at its highest position
15.0	TYPE OF DSL	
15.1	Travel	PVC shrouded bus bar conductor type
16.0	MOTORS (for hoisting and trolley)	(As per IS: 325 & IS : 3938)
16.1	Type	Sq. Cage induction, TEFC, S4 duty, 40% CDF
16.2	Number of start	150 starts / hr
16.3	Voltage, Phase and Frequency	415V + 10%, 3 phase, 4 wire, 50 Hz, $\pm 5\%$, combined variation of $\pm 10\%$
16.4	Class of insulation	Class "F" and temperature rise limited to class "B".
16.5	Type of enclosure	TEFC



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16.6	Degree of protection provided for enclosure	IP-55
16.7	Margin	Margin for motor rating shall be 15% over maximum power requirement at the rated speed.
16.8	RPM	Shall not exceed 1500RPM
16.9	Starting torque	The starting torque of the main motor shall be minimum 225% of FLT
16.10	Pull out torque	275% of FLT
17.0	LIMIT SWITCHES	Hoisting / loweringTrolley
17.1	Type	Snap action, self actuating type / two way lever
18.0	Operation from	Pendant push button for all motions of hoist
19.0	Power cable	FRLS / EPR flexible Cu cable / Aluminum cable
20.0	Control cable	FRLS / EPR flexible Cu cable / Aluminum cable
21.0	Control Voltage	110 V
22.0	Buffer stop/wheel stop	Buffer shall be provide at the end of monorail beam



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GENERAL TECHNICAL REQUIREMENTS
ELECTRICAL



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**BASIC TECHNICAL FEATURES FOR
LT MOTOR**

	1 X 370 MW YELAHANKA COMBINED CYCLE POWER PLANT BASIC TECHNICAL FEATURES FOR LT MOTOR	Doc. No.	PE-DC-409-565-E003
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- 1.0 This document covers the basic technical features of low tension (LT) squirrel cage induction AC motors employed for driving auxiliaries of BHEL-PEM scope packages in 1 X 370 MW YELAHANKA COMBINED CYCLE POWER PLANT.

2.0 CODES AND STANDARDS

All motors shall conform to the latest applicable standards as listed below;

IS: 325, IEC: 60034: Three phase induction motors:
 IS: 996, IEC: 60034: Single phase AC motors:
 IS: 3177, IEC: 60034: Crane duty motors:
 IS 12615 or IEC: 60034-30: Energy Efficient motors with Efficiency class IE3
 IS: 900 Code of practice for installation and maintenance of induction motors
 IS: 996 Single phase small AC and universal motors
 IS: 4722 Rotating Electrical machines
 IS: 4691 Degree of Protection provided by enclosures for rotating electrical machines
 IS: 4728 Terminal marking and direction of rotation rotating electrical machines
 IS: 1231 Dimensions of three phase foot mounted induction motors
 IS: 8789 Values of performance characteristics for three phase induction motors
 IS: 13555 Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
 IS: 2148 Flame proof enclosures for electrical appliance
 IS: 5571 Guide for selection of electrical equipment for hazardous areas
 IS: 12824 Type of duty and classes of rating assigned
 IS: 12802 Temperature rise measurement for rotating electrical machines
 IS: 12065 Permissible limits of noise level for rotating electrical machines
 IS: 12075 Mechanical vibration of rotating electrical machines

3.0 DESIGN REQUIREMENTS

3.1 General Requirements

The design ambient temperature shall be 50 deg C.

3.2 Supply system and rated voltage of motors

KW rating	Supply system	Rated voltage of motor
Upto & including 200 kW	415 V	415 V

3.2.1 Supply voltage & variations shall be as follows:-

Voltage variation (+/-) 10%
 Frequency variation (+) 3% to (-) 5%
 Combined V & F variation 10% (sum of absolute values)

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

3.3 Motor Rating

Motor ratings shall be adequate to meet the requirements of the drive equipment. Motors shall be continuously rated at the design ambient temperature of 50 deg C. Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment at duty point or 10% margin over the continuous maximum demand of the driven equipment under entire operating range, whichever is higher.

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3.4 Starting Requirements

3.4.1 Motor shall start smoothly and rapidly. 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.

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

The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value of 85 (eighty five) percent rated voltage.

3.4.3 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 and the locked rotor current of motors shall as per IS 12615.

3.4.4 The following frequency of starts shall apply

- i) Three cold starts in succession with the motor being initially at a temperature not exceeding the ambient temperature.
- ii) Two hot starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- iii) 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)

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

- a) For motors with starting time upto 20 sec.
 - at least 3 sec. more than starting time.
- b) For motor with starting time above 20 secs but not exceeding 45 secs.
 - at least 5.0 sec. more than starting time.
- c) For motors with starting time above 45 secs.
 - at least 10%. more than starting time.

The starting time of the motor referred above is at minimum permissible voltage. Wherever the above requirements are not complied with, speed switches of approved make & type shall be provided to bypass the locked rotor protection for a pre-selected time during starting of motors. The speed switches shall have one NO & one NC contacts having maximum interrupting capacity of 5 Amps at 240V AC and 0.25 amps at 220 V DC.

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3.5 Running Requirements

- 3.5.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.
- 3.5.2 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 1 secs. The pull-out torque of the motor shall be at least 205% of full load torque to meet this requirement.

3.6 Stress during bus Transfer

- 3.6.1 Motors shall withstand the voltage 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.
- 3.6.2 Motor windings shall be adequately braced to satisfactorily withstand the mech. Stresses during above condition.
- 3.6.3 Motors shall be capable of withstanding heavy in-rush transient current caused by bus transfer without damage.
- 3.6.4 Motor and driven eqpt. Shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.7 Noise level

Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed 85 db (A) in line with IS 12065.

3.8 Vibration

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 Degree of Protection

- 4.1.1 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. The degree of protection for terminal boxes shall be IP 55 as per IS 4691. Outdoor motors shall be installed under a suitable canopy.
- 4.1.2 The stator laminations shall made from suitable silicon steel/magnetic steel sheet varnished on both sides and pressed to form a rigid core.
- 4.1.3 The rotor shall be of rigid cage construction with die cast aluminium / copper alloy / copper bars firmly wedged in bar slots and brazed to the end rings. The rotor cage shall be designed to operate satisfactorily under respective starting and load duty cycle.

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4.2 Enclosure and Cooling

- 4.2.1 Motors shall generally have totally enclosed fan cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.
- 4.2.2 Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.
- 4.2.3 Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.
- 4.2.4 Motor weighing 25 Kg. or more shall be provided with removable type eyebolt or other adequate provision of lifting.

4.3 Class of Insulation

Tropicalised insulation material of Class 'F' shall be used .The temperature rise shall be limited to the limits applicable to Class 'B' insulation. In case of continuous operation at extreme voltage limits, 10deg C rise above the temperature limits specified in IS: 325 shall be permissible.

4.4 Bearings

- 4.4.1 In general all LV motors, bearings can be either sealed life lubricated type or regreasable type as per manufacturer's standard. However horizontally mounted motors shall have grease lubricated ball/roller or sleeve bearings.
- 4.4.2 The vertical motors shall have a combined thrust and guide bearing on top and guide bearing at bottom. If the ball or roller bearings can take vertical thrust, thrust and guide bearing need not be provided.
- 4.4.3 After taking all motor driven eqpt. loads and thrust (if any) into account, the bearings shall be suitable for min. 20,000 working hours . Re-greasable bearings shall be provided with grease nipples and relief holes for on-line re-greasing and shall be suitable for 8000 working hours without changing of the grease.
- 4.4.4 The bearings of solidly coupled motors shall be of the same type as those of the driven equipment.
- 4.4.5 For motors upto 2 kW, double sealed type bearings shall be provided.

4.5 Terminals and Terminal Boxes

- 4.5.1 Motors of rating 100 kW & above shall be controlled by circuit breaker, motors below 100 kW shall be controlled by Switch Fuse-contactor. The terminal box ,terminal leads, winding tails and associated equipment of LT motors shall be designed for the fault current of 50 kA, 0.2 secs for motors 100 kW & above (Breaker controlled), for motors below 100 kW (Contactor controlled) shall be 50 KA protected by fuse.
- 4.5.2 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.
- 4.5.3 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

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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 V, W & U respectively.

- 4.5.4 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.
- 4.5.5 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.
- 4.5.6 Separate terminal boxes shall be provided for space heaters and temp. Indicators. If this is not possible in case of LT motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression tinned brass glands shall be provided in terminal boxes.
- 4.5.7 Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LT motors.
- 4.5.8 Cable glands and cable lugs as per selected cable sizes shall be provided in line with cable erection philosophy. For single core cable termination, gland plates shall be of non-magnetic material.

4.6 Grounding

Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

4.7 General

- 4.7.1** Motors provided for similar drives shall be interchangeable. Suitable foundation bolts are to be supplied along with the motors. Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.
Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.
- 4.7.2 An arrow block shall be screwed on the body of the motors on the non-driving end to indicate the direction of rotation of the motors.
- 4.7.3 Motors for hazardous areas shall be with flame-proof enclosures in accordance with IS 2148 / IEC 60079. Classification of Hazardous area shall be as per IS: 5572 part-I.

5.0 ACCESSORIES

5.1 SPACE HEATERS

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

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

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6.0 NAME PLATE

Motors shall have stainless steel name plate with all particulars as per IS: 325. In addition bearing identification number and type of lubricant is to be indicated.

7.0 PAINTING

The paint shall be epoxy based. The colour of finish shall be as per IS: 5 for motors. Shade shall be decided during detailed engineering.

8.0 TESTING

8.1 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 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.

8.2 Routine Tests

All motors shall be subjected to routine tests as per IS: 325/ IS: 12615.

8.3 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

- a) OGA drawing showing the position of terminal boxes, earthing connections etc.
- b) Arrangement drawing of terminal boxes.
- c) Characteristic curves:

(To be given for motor above 55 kW unless otherwise specified in Data Sheet).

- i) Current vs. time at rated voltage and minimum starting voltage.
- ii) Speed vs. time at rated voltage and minimum starting voltage.
- iii) Torque vs. speed at rated voltage and minimum voltage.

For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.

- iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.



TITLE:

TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT
1x370 MW YELAHANKA
COMBINED CYCLE POWER PLANT

SPECIFICATION NO.: PE-TS-409-164-A001

SECTION : II

SUB-SECTION: IIB

REV. NO. 00

DATE: 28/07/2016

DATA SHEET A – MOTORS



TITLE

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

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. 00 DATE 19.01.2016

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 100 kW and above (Breaker : 50 KA for 0.2 sec. Controlled)
 - o Below 100 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 Earth Conductor Size & Material : Shall be given during detailed engg
- 9.0 Space heater supply : 240 V, 1 ϕ , 50 Hz
- 10.0 Rating up to which Single phase motor : Acceptable below 0.20 kW
- 11.0 Locked rotor current
- a) Limit as percentage of FLC : As per IS 12615*
- 12.0 Flame-proof motor
- a) Enclosure suitable (As per IS: 2148) : As per requirement
 - b) Classification of Hazardous area : As per requirement
(As per IS: 5572 part-I)
- 13.0 Paint shade : Shall be given during detailed engg.
- 14.0 Degree Of protection for motor : IP 54 for indoor as per IS 4691
IP 55 for semi indoor/outdoor as per IS 4691
- Degree Of protection for terminal box : IP 55 as per IS 4691

15.0 * 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 TPP**

SPECIFICATION NO.

VOLUME

II B

SECTION

D

REV NO.

00

DATE

19.01.2016

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 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:

TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT
1x370 MW YELAHANKA
COMBINED CYCLE POWER PLANT

SPECIFICATION NO.: PE-TS-409-164-A001

SECTION : II

SUB-SECTION: IIB

REV. NO. 00

DATE: 28/07/2016

DATA SHEET C– MOTORS

	TITLE MOTOR DATA SHEET – C 1 X 370 MW YELAHANKA CCPP	SPECIFICATION NO. PE-TS-409-164-A001
		VOLUME II B
		REV NO. 00
		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. PE-TS-409-164-A001
		VOLUME II B
		REV NO. 00
		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			



TITLE:

TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT
1x370 MW YELAHANKA
COMBINED CYCLE POWER PLANT

SPECIFICATION NO.: PE-TS-409-164-A001

SECTION : II

SUB-SECTION: IIB

REV. NO. 00

DATE: 28/07/2016

QUALITY PLAN (MOTOR)

THIS IS A PART OF TECHNICAL SPECIFICATION NO.- PE-TS-409-164-A001

		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :			
				BIDDER/ VENDOR		TITLE		NUMBER :			
				SYSTEM		QUALITY PLAN		TITLE			
				CAT.		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		VOLUME III			
				TYPE/ METHOD OF CHECK		REFERENCE DOCUMENT		SECTION		REMARKS	
				EXTENT OF CHECK		ACCEPTANCE NORM		AGENCY			
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THIS IS A PART OF TECHNICAL SPECIFICATION NO.- PE-TS-409-164-A001

		CUSTOMER :			PROJECT		SPECIFICATION :										
QUALITY PLAN		BIDDER/ VENDOR		TITLE		NUMBER :											
		SYSTEM		QUALITY PLAN		TITLE											
SHEET 2 OF 9		CAT.		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD		SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	4	5	6	7	8	9	10	P	W	V	REMARKS				
1	2	3	4	5	6	7	8	9	10	11							
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED				
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2						
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUF'R'S DRG.	LOG BOOK	3	-	2						
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUF'R'S SPEC. BHEL SPEC.	-DO-	3	2	1		FOR DIA OF 55 MM & ABOVE				
1.6	SPACE HEATERS, CONNECTIONS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUF'R'S DRG. SPEC.	MANUF'R'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	MANUF'R'S DRG./ SPEC.	MANUF'R'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												

THIS IS A PART OF TECHNICAL SPECIFICATION NO.- PE-TS-409-164-A001

		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :											
SL. NO.		COMPONENT/OPERATION		BIDDER/ :		TITLE		NUMBER :											
				VENDOR		QUALITY PLAN		TITLE											
SHEET 3 OF 9		CHARACTERISTIC CHECK		SYSTEM CAT.		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD		SECTION AGENCY		VOLUME III REMARKS	

THIS IS A PART OF TECHNICAL SPECIFICATION NO.- PE-TS-409-164-A001

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

THIS IS A PART OF TECHNICAL SPECIFICATION NO.- PE-TS-409-164-A001

		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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THIS IS A PART OF TECHNICAL SPECIFICATION NO.- PE-TS-409-164-A001

		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :				
				BIDDER/ VENDOR SYSTEM		TITLE		NUMBER :		TITLE		
SHEET 6 OF 9		QUALITY PLAN		NUMBER PED-506-00-Q-007, REV-03		TITLE		SPECIFICATION :				
CHARACTERISTIC CHECK		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		FORMAT OF RECORD		VOLUME III		REMARKS				
SL. NO.	COMPONENT/OPERATION	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY	P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUF'R'S SPEC.	MANUF'R'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%	MANUF'R'S SPEC./BHEL SPEC.	MANUF'R'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 VACCUUM	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										

THIS IS A PART OF TECHNICAL SPECIFICATION NO.- PE-TS-409-164-A001

		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :					
								QUALITY PLAN		SPECIFICATION : TITLE	
SHEET 7 OF 9		BIDDER/ VENDOR		NUMBER PED-506-00-Q-007, REV-03		TITLE					
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION AGENCY	VOLUME III REMARKS	
	2	3	4	5	6	7	8	9	P	W	V
1										10	11
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1
		1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2	1	1
2.9	COMPLETE ROTOR ASSEMBLY	3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	1	1
		1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2	1	VERIFICATION FOR MV MOTOR ONLY
2.10	ASSEMBLY	2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2	1	1
		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									
					BIDDERS/VENDORS COMPANY SEAL						

THIS IS A PART OF TECHNICAL SPECIFICATION NO.- PE-IS-409-164-A001													
CUSTOMER :			PROJECT			TITLE			SPECIFICATION :				
QUALITY PLAN			BIDDER/ VENDOR			QUALITY PLAN			SPECIFICATION :				
SHEET 8 OF 9			VENDOR SYSTEM			NUMBER PED-506-00-Q-007, REV-03			TITLE				
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	SECTION			VOLUME III REMARKS	
									AGENCY	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. 2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC. 3.VIBRATION & NOISE LEVEL 4.OVERALL DIMENSIONS AND ORIENTATION 5.DEGREE OF PROTECTION 6. MEASUREMENT OF RESISTANCE OF RTD & RTD 7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER 8. NAMEPLATE DETAILS 9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED) 10. PAINT SHADE, THICKNESS & FINISH	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	
			MA	-DO-	100%	-DO-	-DO-	-DO-	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
			MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
			MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-		
			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
			MA	-DO-	100%	-DO-	-DO-	-DO-	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
			MA	-DO-	100%	-DO-	-DO-	-DO-	-DO-	2	1 ^{\$}	1	^{\$} NOTE - 2
			MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1 ^{\$}	1	^{\$} NOTE - 2	
			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
			MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1 ^{\$}	1		SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY ^{\$} NOTE - 2
BHEL													
PARTICULARS													
NAME													
SIGNATURE													
DATE													
BIDDER'S/VENDORS COMPANY SEAL													

THIS IS A PART OF TECHNICAL SPECIFICATION NO.- PE-TS-409-164-A001

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE		SPECIFICATION : NUMBER :													
SHEET 9 OF 9		BIDDER/ VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03		SPECIFICATION : TITLE															
COMPONENT/OPERATION		CHARACTERISTIC CHECK		SYSTEM CAT.		TYPE/ METHOD OF CHECK		EXTENT OF CHECK		REFERENCE DOCUMENT		ACCEPTANCE NORM		FORMAT OF RECORD		SECTION AGENCY		VOLUME III REMARKS			
1		2		3		4		5		6		7		8		9		10		11	
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																			

CUSTOMER :			PROJECT		SPECIFICATION :			
TITLE			NUMBER :					
BIDDER/ VENDOR			SPECIFICATION					
TITLE			TITLE					
SHEET 1 OF 2			NUMBER PED-506-00-Q-006, REV-01					
QUALITY PLAN			VOLUME III					
SL. NO.			REMARKS					
COMPONENT/OPERATION			SECTION					
CHARACTERISTICS			AGENCY					
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TITLE:

**TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

**1x370 MW YELAHANKA
COMBINED CYCLE POWER PLANT**

SPECIFICATION NO.: PE-TS-409-164-A001

SECTION : II

SUB-SECTION:IIC

REV. NO. 00

DATE: 28/07/2016

**SUB SECTION – IIC
GENERAL TECHNICAL REQUIREMENTS
C&I**



TITLE:

**TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

**1x370 MW YELAHANKA
COMBINED CYCLE POWER PLANT**

SPECIFICATION NO.: PE-TS-409-164-A001

SECTION : II

SUB-SECTION: IIC

REV. NO. 00

DATE: 28/07/2016

LCP SPECIFICATION



SPECIFICATION FOR LOCAL PANELS

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

VOLUME II B

SECTION D

REV. NO. 03

DATE : 16-09-2013

SHEET 1 OF 6

1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site, **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.



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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



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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 or as per Approved vendor/sub vendor list.

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, corrosion, incidental damage due to vermin, sunlight, high temperature, rain moisture, humidity, dust, sea-water spray (where applicable) as well as rough handling and delays in Transit and storage in open.

8.0 APPLICABLE DATA SHEET FORMS

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

- | | | |
|-----------------------------------|---|-------------------------------|
| - Data sheet A&B for Local Panels | : | Data sheet no. PES-145A-DS1-0 |
| - Data sheet C for Local Panels | : | Data sheet no. PES-145A-DS2-0 |

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LCP DATA SHEET

	DATA SHEET FOR LOCAL PANELS			SPECIFICATION NO.:	
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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 (As per requirement)		
TECHNICAL	INPUT POWER SUPPLY		☐ 240V 50 Hz AC ☐ 220V DC ☐ 415V 3 PHASE (4 wires)		
	NO. OF FEEDERS		☐ ONE ☒ TWO		
	CONTROL SUPPLY		☐ 110V AC ☐ 220V AC ☐ 220V DC ☐ (As per requirement)		
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		_____ NOS. (AS REQUIRED)		
	PAINT TYPE		☐ EPOXY ☐ SYNTHETIC ENAMEL ☐ POWER COATED		
	PANEL COLOUR (EXTERNAL)		☐ LIGHT GREY (Shade 631 IS-5) ☐ OPALINE GREEN (Shade 275) ☐		
	FINISH		☐ SEMI MAT ☐ MATT ☐ GLOSSY ☒ SEMI GLOSSY		
	PANEL COLOUR (INTERNAL)		☒ WHITE ☐ CREAM ☐ OFF WHITE		
	FINISH		☐ SEMI MAT ☐ MATT ☐ GLOSSY ☒ SEMI GLOSSY		
	CLASS OF PROTECTION		☒ IP-54 ☐ _____		
	CONTROL HARDWARE		☒ RELAY BASED ☐ PLC As per Requirement		
	FOUNDATION ARRANGEMENT		☒ FOUNDATION BOLTS ☐ ANCHOR FASTENERS		
	WEIGHT OF PANEL (Kg.)				
	PANEL TYPE		☐ PRESSURISED ☐ UNPRESSURISED As per Requirement		
	CABLE GLAND		☐ SINGLE COMPRESSION ☒ DOUBLE COMPRESSION		
NAME SIGNATURE DATE	PREPARED BY		CHECKED BY		COMPANY SEAL NAME SIGNATURE DATE

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

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INSTRUMENTATION DATA SHEET

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General Guidelines for Provision of Instruments

- 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

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/ haste alloy/ other suitable sensing element. Accessories like snubbers for pump discharge applications and chemical diaphragm with 15 m PVC covered SS armoured capillary for corrosive and oil services, etc. Material for accessories will be SS. HART protocol output shall be available in each transmitter. In case it becomes necessary to use a DP transmitter for pressure measurement then a 3-valve manifold should be used in place of 2-valve manifold. LVDT type is not acceptable.
- 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: $\pm 0.1\%$ of calibrated span for 6 months up to 70 KSC & $\pm 0.25\%$ for range more than 70 KSC(g).
- 6) Zero and Span Drift: $\pm 0.015\%$ 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)

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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

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.

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.

Differential Pressure Switches shall be provided

(a) Across filters / strainers for remote monitoring

Differential pressure indicators shall be provided

(a) Across filters / strainers for local monitoring.

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.

Differential pressure transmitters shall be provided for

(a) all the requirements of differential pressure, flow and level measurements.

(b) control applications.

Temperature indicators (Thermometers) shall be provided.

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

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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.

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.

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.

Transmitter racks

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

Junction boxes shall be provided for :

- Termination of all sensors and transmitters located area-wise.
- Termination of transmitters mounted on the transmitter racks.

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.

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Specifications for Instruments

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 +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).

Pressure Switches

Non indicating type, field mounted Pressure Switches of aluminium casing (epoxy coated), and 316 SS element and accuracy of +1% of span, including accessories like syphons for steam services, snubbers for pump discharge applications and chemical diaphragm for corrosive and oil services, 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 + 0.5% of full scale range.

Pressure Transmitters

Micro-processor based **Smart Electronic Transmitters**, rack mounted with accuracy of +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.

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 +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.

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Differential Pressure Switches

Bellows or diaphragm operated non-indicating field mounted type; aluminium casing (epoxy coated); 316 SS pressure element nylon movement; accuracy of +1% of span with an adjustable contact including accessories like snubbers for pump discharge applications, chemical diaphragm with 15 m capillary for each limb for all corrosive and oil services and 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 +0.5% FSR.

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 +/- 0.1% of span, Repeatability :+0.05% of FSR or better, Linearity :+0.1% of FSR or better. Hysteresis: +0.1% of FSR or better external zero and span adjustment, self diagnostics, temperature sensor for compensation. Power supply 24 V DC; output signal of 4- 20 mA DC. IP 65 or equivalent degree of protection with epoxy coating, 316 SS/ haste alloy/ other suitable sensing element. Accessories like snubbers for pump discharge applications and chemical diaphragm with 15 m PVC covered SS armoured capillary for corrosive and oil services, etc.

Material for accessories will be SS. HART protocol output shall be available in each transmitter. 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.

Level Gauges

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

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.

	Technical specification for CONTROL & INSTRUMENTATION 1X370 MW YELAHANKA CCPP	SPEC NO.: PE-TS-409-145-I	
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Displacement Type Level TransmittersSmart Electronic Transmitters:

Displacement type level transmitters of float length of 14 inches or 32 inches with an accuracy of +0.5% of span, 4-20 mA DC output (2 wire system), +24 V DC supply, isolated and ungrounded electrical circuits, zero adjustment (100% of sensing element) for control application and measurement purposes. IP 54 or equivalent degree of protection for enclosure. Displacer / float material of 316SS. The material of accessories will be SS.

ULTRASONIC LEVEL TRANSMITTER

1. Type: Microprocessor based, 2-wire, Smart (HART Compatible)
2. Operating Principle: Detection of reflected ultrasonic pulse
3. Output Signal: 4-20 mA DC along with superimposed digital signal
4. Operating frequency: 10 KHz to 50 KHz (typical)
5. Display: LCD
6. Temperature Compensation: Built in –Programmable
7. Power supply: 24 V DC
8. Enclosure: SS, IP-65 (Explosion proof for NEC Class-1, Division 1 area)
9. Zero & Span: Continuous, tamper proof, remote as well locally adjustable. It shall be possible to calibrate the instrument without any level in the sump/ tank
10. Accuracy & Repeatability: 0.15 % of span or better
11. Resolution: 0.1 % of span
12. Operating temp. : Transmitter- 500 C and Sensor - 800 C
13. MOC Sensor: SS-316/Body- PVC and Face – Polyurethane
14. Mounting: 4" Flanged/ 2" NPT for sensor and Transmitter on panel
15. Accessories:
 - a) Handheld calibrator
 - b) Weather canopy for protection from direct sunlight and direct rain
 - c) ½"NPT cable gland
 - d) All mounting hardware (SS- 316), Prefab cable
 - e) SS Nameplate
16. Diagnosis: On-line
17. Status Indication: Power On, HI, HI-HI, Lo, LO-LO, Fault
18. Output Contacts: 2 SPDT, 230V, 5A
19. Adjustment/Calibration/Maintenance: From handheld calibrator/ HART management system

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 +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.

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.

Temperature Switch

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

Thermocouple Assembly

Duplex type with accuracy of +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.

Resistance Temperature Detectors (RTD)

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

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 +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.

PH Analyser

1. TYPE	CELL - FLOW THROUGH
2. ACCURACY	< $\pm 1\%$ OF SPAN
3. RANGE	0 - 14 PH, PROGRAMMABLE
4. NO. OF STEAMS	SINGLE
5. STABILITY	< 0.001 PH / WEEK
6. TEMP. COEFFICIENT / TEMP. ERROR	0.001 PH / DEG. C
7. TYPE OF ELECTRONICS	MICROPROCESSOR BASED WITH SELFDIAGNOSTIC FACILITY.
8. INDICATION	DIGITAL
9. ENCLOSURE	WEATHER DUST PROOF (IP55) DIE CAST ALUMINUM with IP-65.

	Technical specification for ETP 1X370 MW YELAHANKA CCPP	SPEC NO.: PE-TS-409-145-I	
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		SECTION	
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		SHEET	OF

MOTOR OPERATED VALVE ACTUATOR DATASHEET

MOTOR OPERATED VALVE ACTUATOR DATA SHEET

JOB NO. 409				OWNER: KARNATAKA POWER CORPORATION LIMITED 1x370 MW YELAHANKA COMBINED CYCLE POWER PLANT																
STATUS CONTRACT				OWNER'S CONSULTANT: FICHTNER Consulting Engineers (India) Private Limited, Chennai, Bengaluru.																
PRINT SCALE 				EPC CONTRACTOR: BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NEW DELHI																
REV.	DATED.	ALTD	CHKD	APPD	<table border="1"> <tr> <td>DEPT. CODE</td> <td>DESIGN</td> <td>NAME</td> <td>SIGN</td> <td>DATE</td> </tr> <tr> <td>I</td> <td>CHD</td> <td>RKR</td> <td></td> <td>07.04.16</td> </tr> <tr> <td></td> <td>APPD</td> <td>SSB</td> <td></td> <td>08.04.16</td> </tr> </table>	DEPT. CODE	DESIGN	NAME	SIGN	DATE	I	CHD	RKR		07.04.16		APPD	SSB		08.04.16
DEPT. CODE	DESIGN	NAME	SIGN	DATE																
I	CHD	RKR		07.04.16																
	APPD	SSB		08.04.16																
TITLE MOTOR OPERATED VALVE ACTUATOR DATA SHEET																				
				DEPT. SCALE 1:3000	DRAWING NO.															
				SIGN 	PE-ID-409-145-1902															
				DATE:	SHEET 1 OF 5 REV. 00															

FORM NO. PEM-8868-0

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		DOCUMENT NO.: PE-ID-409-145-1902	
			VOLUME	
			SECTION	
			REV. NO.	00
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 3. 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 (Ref. 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		
	@ ENCLOSURE CLASS OF MOTOR	☒ IP 67 ☐ FLAME PROOF		
	@ INSULATION CLASS	CLASS F TEMP. RISE LIMITED TO CLASS-B		
	@ WINDING TEMP PROTECTION	☒ THERMOSTAT (3 Nos. 1 IN EACH PHASE) ☐		

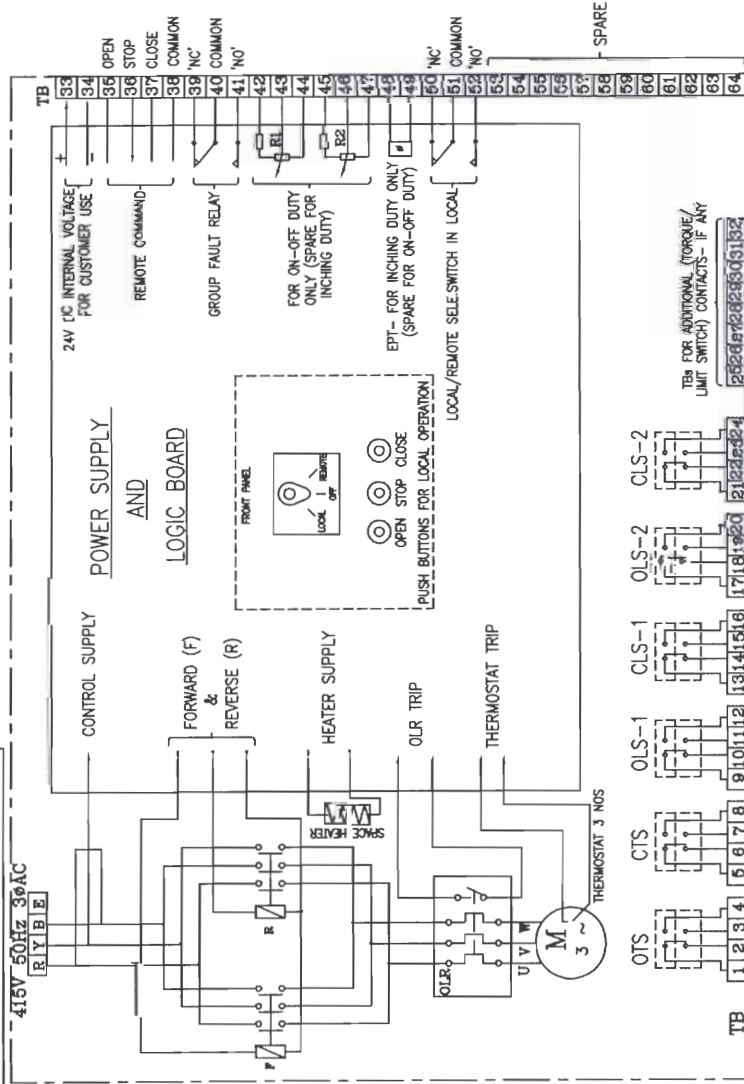
FORM NO. PEM-6655-0

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		DOCUMENT NO.: PE-ID-409-145-1902	
			VOLUME	
			SECTION	
			REV. NO. 00	DATE: 28.03.16
			SHEET 2	OF 3
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
INTEGRAL STARTER	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION		REQUIRED	
	INTEGRAL STARTER		☒ 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 ☐ DEVICENET ☐	
	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 INTERFACE WITH DC5		☐ 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. (ADJ.) ☒ 1 No. ☐ 2Nos.	
	CONTACT TYPE		2 NO + 2 NC	
	RATING (AC / DC)		5A 240V AC AND 0.5A 220V DC	
POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)		☐ REQUIRED ☐ NOT REQUIRED	
	MFR & MODEL NO.		BIDDER TO SPECIFY	
	TYPE		☐ ELECTRONIC (2 WIRE) R/I CONVERTER ☒ ELECTRONIC (2 WIRE) CONTACTLESS	
	SUPPLY		☒ 24V DC ☐	
	OUTPUT		☒ 4-20mA	
	ACCURACY		± 1% FS	

FORM NO. PEM-6665-C

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		DOCUMENT NO.: PE-ID-409-145-1902		
			VOLUME		
			SECTION		
	REV. NO.	00	DATE:	28.03.16	
		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)		
SPACE HEATER	@SPACE HEATER	REQUIRED			
	@ POWER SUPPLY (NON INTEGRAL)	240V 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	Cable shall be determined later			
	@ SPACE HEATER CABLE GLAND	Cable shall be determined later			
	OTHER CONTROL CABLE GLANDS-1	1) INSTRUMENT CABLE SIZE FOR ON/OFF DUTY VALVES SHALL BE 8PX0.5 SQMM - ONE CABLE GLAND OF OD SIZE 20 MM. 2) INSTRUMENT CABLE SIZE FOR INCHING DUTY TYPE VALVES SHALL HAVE TWO NO. CABLES (ONE NO. 8PX0.5 SQMM AND 2ND 2PX0.5 SQMM) - TWO NO. GLANDS OF OD SIZES 20 MM & 15 MM.			
	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 LUGS & GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PART OF ACTUATOR. 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	R.K.RAINA	S.S.BANSALA	NAME	
	28.03.2016	28.03.2016	28.03.2016	SIGNATURE	
				DATE	
NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @ = TO BE FILLED BY ES					

DRAFTING NO. 3-V-MISC-24227



1. ALL TORQUE AND LIMIT SWITCHES (OTS,CTS,OLS1&2, CLS1&2) ARE WITH 2N0+2N0 CONTACTS '1N0+1N0' IS TERMINATED IN TBS 1-24, REMAINING CONTACTS ARE FOR INTERNAL USE.
ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25-32
2. CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE)
3. OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN)
4. OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN
5. CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE
6. EPT - ELECTRONIC POSITION TRANSMITTER
(CONTACTLESS TYPE, FOR INTCHING DUTY)
7. R1-R2-POTENTIOMETER 2 x 100 OHMS (FOR ON-OFF DUTY)
8. FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
9. M - MOTOR 3Ø 415V 50 HZ AC SUPPLY

OTS	1-2	OPEN AT OVER TORQUE DURING OPENING TRAVEL
	3-4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL
OTS	5-6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL
	7-8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL
OLS-1	9-10	
	11-12	
OLS-1	13-14	
	15-16	
OLS-2	17-18	
	19-20	
OLS-2	21-22	
	23-24	
OPER. SWITCH	TERMINAL NO.	FULL OPEN
		INTERMEDIATE
		FULL CLOSE
		VALVE POSITION

— INDICATES CONTACT CLOSED
- - - INDICATES CONTACT OPEN

CONTACT RATING: 5A AT 250V AC $\frac{1}{2}$ 0.5A AT 220V DC

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

- OLS NOT TO BE CONNECTED IN TRIP CIRCUIT
 * - BYPASS OTS FOR MIN. 5% OF TRAVEL (FOR GATE VALVES ONLY)

TYPE OF PRODUCT
OR NAME OF

	DEPT	VL	SCALE	WEIGHT (KG.)	DEN	SIGN	DATE	NO OF VLS
365-121					N.P. ESWAR	N.P.	07.10.04	
Bharat Heavy Electricals Ltd., UNIT: HIGH PRESSURE MOTOR PLANT, TRUCKPALAI-692014.					D.DINAKARAN	D.D	07.10.04	
					K.A.RUNACHALAM	K.A	07.10.04	
				REFERENCE INFORMATION(S)				
TITLE				CARD CODE	REV			
WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER				U 01	3-V-MISC-24227 0			

Size A3

	Technical specification for ETP 1X370 MW YELAHANKA CCPP	SPEC NO.: PE-TS-409-145-I	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE : 04.08.2016
		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)

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.

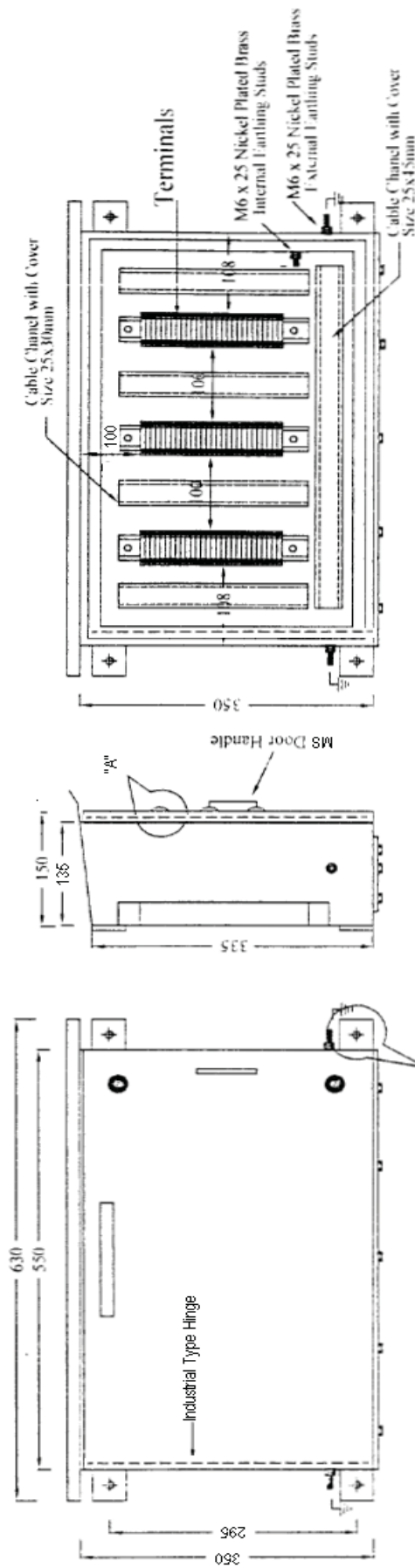
g) The Supplier shall furnish general arrangement, cross section details of junction boxes and the same shall be subject to BHEL/CUSTOMER's approval during detailed engineering stage.

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 CIRCA

2) Protection IP65

3) Paint :

a) Hot Dip Galvanizing.

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 throughing 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 to be provided with number markers

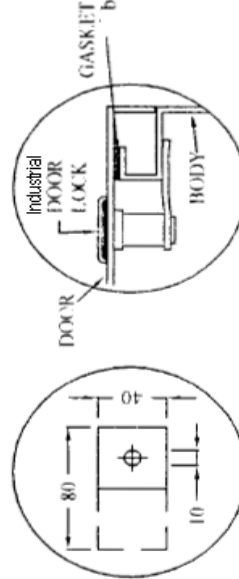
Continuously from top to Bottom

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.



VIEW "B"

VIEW "A"

BILL OF MATERIAL.

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

Rev	Drw	Name	Date	Sign	Customer	Project	Title	G/A FOR 72 WAY JUNCTION BOX	Rev	Scale	Sheet No.
01									01	N.T.S.	01/01

	Technical specification for CONTROL & INSTRUMENTATION 1X370 MW YELAHANKA CCPP	SPEC NO.: PE-TS-409-145-I	
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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

	Technical specification for ETP 1X370 MW YELAHANKA CCPP	SPEC NO.: PE-TS-409-145-I	
		VOLUME	
		SECTION	
		REV. NO. 00	DATE : 04.08.2016
		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

KKS PHILOSOPHY



DOCUMENT TITLE

KKS NUMBERING PHILOSOPHY

1 X 370 MW YELAHANKA CCPP

KKS NUMBERING PHILOSOPHY

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

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

X	X	X	A	A	Y	Y	B	B	B
---	---	---	---	---	---	---	---	---	---

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

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

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

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

	DOCUMENT TITLE
	KKS NUMBERING PHILOSOPHY
	1 X 370 MW YELAHANKA CCPP

ANNEXURE-1**List of System / Sub-System Codes used in Power Plant:**

- 1) Ozone Generation Plant: PBB

ANNEXURE-2**Standard Equipment Codes:**

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

Standard Apparatus Codes:

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

Standard Measuring Circuits Codes:

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

	DOCUMENT TITLE	
	KKS NUMBERING PHILOSOPHY	
	1 X 370 MW YELAHANKA CCPP	

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

ANNEXURE-3

Numerical Keys

A) Numerical Keys at System Code Level

i)

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

a)

Main Steam (Left) and Main Steam (Right)

b)

BFP – A/B/C

c)

ID Fan – A/B, FD Fan A/B, AH – A/B

ii)

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

iii)

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

B) Numerical keys at Equipment Code level:

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

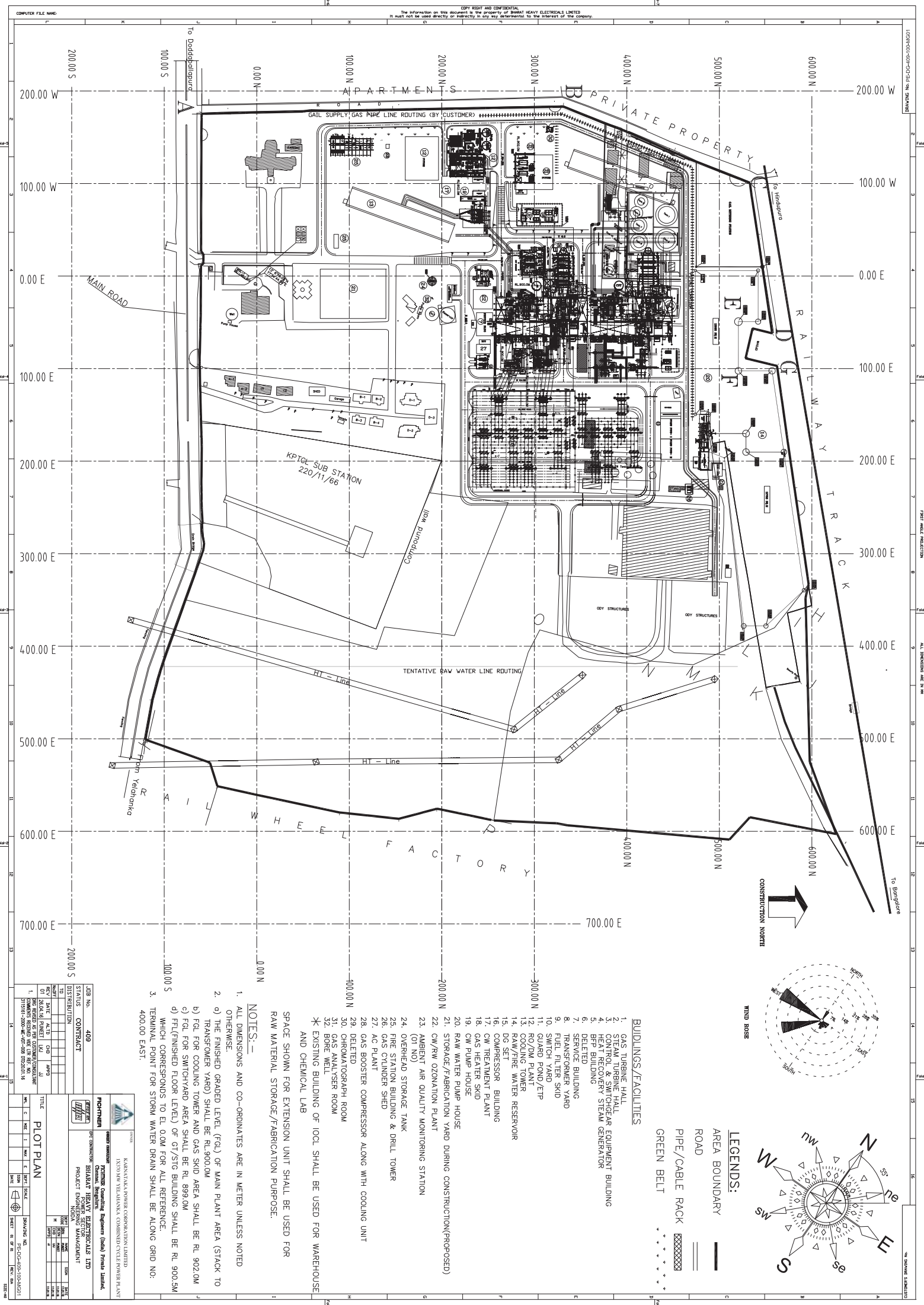
i)

Valves and Dampers

--- Equipment Code – AA

		<u>N1</u>	<u>N2 N3</u>
Motorised (on/off duty)	-	0	01 to 50
Motorised (inching duty)	-	0	51 to 99
Pneumatic (Control)	-	1	01 to 50
Motorised (thyrestor Control)	-	1	51 to 99
Sol. Operated	-	2	01 to 99
(Open / Close duty (Valves, NRVs, Gate)			
Hydraulic	-	3	01 to 99
NRV (Without actuation)	-	4	01 to 99
Manual	-	5	01 to 99

	DOCUMENT TITLE		
	KKS NUMBERING PHILOSOPHY		
	1 X 370 MW YELAHANKA CCPP		
	-	6	01 to 99
Relief & Safety Valves	-	7	01 to 99
Reserve	-	8	01 to 99
Reserve	-	9	01 to 99
ii) Field Instruments			
Field Transmitters & Analog Signals	-	0	01 to 99
Field Switches & Binary Signals	-	1	00 to 99
PG Test Point	-	4	00 to 99
Gauges	-	5	00 to 99
Automatic Turbine Tester (ATT)-HWR	-	2	00 to 99
(Reserved for protection Signals used by Hardwar)			
Example of Numerical Key Usage:			
In line with the philosophy adopted for Valves / Dampers /instruments etc. pumps and fans in the main systems (having different system code) can be numbered as AP/N100 and as AP/N101, 102, Where system code is same.			



KARNATAKA POWER CORPORATION LIMITED 13/29/100 VELAHANKA, COMBINED CYCLE POWER PLANT			
PROJECT ORGANIZATION DESIGNING: Swasthik Engineers (India) Private Limited, POWER SECTION PROJECT: BHARAT HEAVY ELECTRICALS LTD PROJECT: POWER SECTOR MANAGEMENT INDIA		FOURNIER 	
JOB NO. 409 STATUS CONTRACT DISTRIBUTION		TO: _____ FROM: _____ DATE: _____ BY: _____ 01 06/04/16 POWER I&E J PREPARED BY: R.R. GOWDARAO 1. 07/10/01-07/04/08-07/08/03/16 14 15	
TITLE PLOT PLAN		SHEET NO. 1 OF 1 DATE: _____ BY: _____ CHECKED BY: _____ APPROVED BY: _____ SCALE: _____ DRAWING NO. CS-25-104/05/1 SHEET 11 OF 11 REV. NO. _____ DATE: _____	



TITLE:
**TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

**1x370 MW YELAHANKA
COMBINED CYCLE POWER PLANT**

SPECIFICATION NO.: PE-TS-409-164-A001

SECTION : III

REV. NO. 00

DATE: 28/07/2016

SECTION III

DOCUMENTS TO BE SUBMITTED BY BIDDER



TITLE:
**TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

**1x370 MW YELAHANKA
COMBINED CYCLE POWER PLANT**

SPECIFICATION NO.: PE-TS-409-164-A001

SECTION : III

REV. NO. 00

DATE: 28/07/2016

SCHEDULE OF PRE-BID CLARIFICATION

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

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

Note: Bidder to furnish all the pre bid in the above indicated pre bid clarification format only. General pre bid clarification will not be considered.



TITLE:
**TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT**

**1x370 MW YELAHANKA
COMBINED CYCLE POWER PLANT**

SPECIFICATION NO.: PE-TS-409-164-A001

SECTION : III

REV. NO. 00

DATE: 28/07/2016

COMPLIANCE CUM CONFIRMATION SCHEDULE

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

- a.) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.
- b.) QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder.
- c.) All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.
- d.) There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'.
- e.) The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.
- f.) The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).
- g.) All sub vendors shall be subject to BHEL/CUSTOMER approval.
- h.) Any special tools & tackles, if required, shall be in bidder's scope.
- i.) Demonstration parameters shall stand valid till the satisfactory completion of demonstration test and its acceptance by BHEL/Customer.



TITLE:
TECHNICAL SPECIFICATION FOR
EFFLUENT TREATMENT PLANT

1x370 MW YELAHANKA
COMBINED CYCLE POWER PLANT

SPECIFICATION NO.: PE-TS-409-164-A001

SECTION : III

REV. NO. 00

DATE: 28/07/2016

DECLARATIONS

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

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

Bidders Company Name

Authorized representative's
Signature

Name

Bidder's Name	The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated
---------------	---