**BHEL-PEM-MAUX**
**PRE-QUALIFICATION CRITERIA**

| | | | |
|---|---|---|---|
| | **PACKAGE: PRETREATMENT PLANT** | PE-PQ-999-158-A001 | |
| | | DATE | 29/04/2016 |
| | **PRE-QUALIFICATION REQUIREMENT** | REV NO | 00 |

| | |
|---|---|
| 1.0 | Supplier should have capabilities for design/ manufacture and having in-house/ out-sourced facility for testing of Pre-treatment Plant.<br><br>Pre-treatment Plant minimum output capacity of each clarifier / clarifloculator of 750 m3/hr with associated mechanical & dosing system capable of producing outlet quality with suspended solid / turbidity less than equal to 15 PPM/NTU. |
| 2.0 | The supplier has to submit either of following supporting documents meeting above mentioned pre-qualifying requirement<br><br>a. Copy of minimum one (1) performance certificate in English from end user along with copy of related Purchase Order (PO) or letter of intent (LOI) or letter of award (LOA) or work order (WO) specifying that the system/package is running successfully for one (1) year from date of commissioning meeting the minimum pre-qualifying requirement.<br>OR<br><br>b. Minimum two PO/ LOI /LOA/ WO placed with a minimum gap of one (1) year from same purchaser meeting the minimum pre-qualifying requirement.<br>OR<br><br>c. Minimum one PO/ LOI /LOA/ WO after commissioning of first order from same purchaser meeting the minimum pre-qualifying requirement.<br>OR<br><br>d. In case, vendor has executed contract (s) for BHEL-PEM, internal assessment by BHEL-PEM shall be followed for evaluation for satisfactory performance. For this, vendor to submit the request along-with relevant documents.<br>OR<br><br>e. Minimum three customer's/ third party's inspection reports/ test certificates/commissioning certificates meeting the minimum pre-qualifying requirement. |
| 3.0 | Minimum two (2) nos. Purchase orders, shall be submitted which should not be more than twenty (20) years old as on date of bid submission, for establishing continuity in business. |

In case supplier is not OEM the offer shall be evaluated as per point no 1 of general PQR enclosed as Annexure-A

ANNEXURE-A

## General Points of PQR

1. Offers of the JV companies/ Joint Bidders/ bidders having collaboration/ licensing agreement/ MOU/ Indian subsidiaries shall be evaluated as follows:

    a. If bidder happens to be an Indian subsidiaries of foreign OEM, then the credentials of the foreign OEM can also be considered for meeting PQR.
    b. If bidder happens to be the Joint Venture Company, then the credentials of any of JV partners can be also considered for meeting PQR.
    c. If bidder happens to bid jointly with their partner, then credentials of both the partners will be considered for meeting PQR as per distribution of the work. In all such cases, lead bidder as specified in bid documents shall be responsible for overall execution of the contract and all guarantee/ warranty.
    d. If bidder happens to be the having valid collaboration agreement/ MOU/ licensing agreement with some other company, then the credentials of collaborator/ MOU partner/ licensing company can also be considered for meeting PQR.

    Note: If bidder(s) qualifies on the basis of credentials of his principal/ JV partner/ Collaborator/ joint bidder etc., then the principal/ JV partner/ Collaborator/ MOU partner/ joint bidder shall be responsible for overall design vetting and warranty/ guarantee of the package. The scope matrix clearly defining their respective roles including design vetting, manufacturing of critical component, E&C etc. etc. and warranty/ guarantee shall be submitted along with the offer.

2. Bidder to note that the arrangement of bidding (joint bid partners/ collaborator/ MOU partner/ licensing company etc.) once offered to BHEL as a part of bidding documents cannot be changed till the execution of the project.

3. Consideration of offer shall be subject to customer's approval of bidders, if applicable.

4. Bidder to submit all supporting documents in English. If documents submitted by bidder are in language other than English, a self-attested English translated document should also be submitted.

5. Any other project specific requirement shall be as per Annexure-I and bidder shall submit relevant supporting documents.

6. Notwithstanding anything stated above, BHEL reserves the right to assess the capabilities and capacity of the bidder/collaborators to perform the contract, should the circumstances warrant such assessment in the overall interest of BHEL.

7. After satisfactory fulfillment of all the above criteria/ requirement, offer shall be considered for further evaluation as per NIT and all the other terms of the tender.

# 2X660 MW ENNORE SEZ STPP, CHENNAI.

## VOLUME: IIB & III.

**TECHNICAL SPECIFICATIONS**
**FOR**
**PRE-TREATMENT PLANT.**

**SPECIFICATION NO.: PE-TS-412-158-A002**


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

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# SECTION – A

# SCOPE OF ENQUIRY

**1. SCOPE OF INQUIRY/ INTENT OF SPECIFICATION**

**1.1** The specification is intended to cover design, engineering, manufacture, supply, fabrication, assembly, inspection/testing at vendor's & sub-vendor's works, painting, maintenance/special tools & tackles, mandatory spares along with spares for erection as required, startup and commissioning spares as required, forwarding, proper packing, shipment and delivery at site, **Supervision of erection and commissioning including assembly at Site**, preparation and submission of drawing/documents including "As built" drawings and carrying out Trial Run and Performance Guarantee test (PG Test) at site & equipment/system guarantee, etc., handover in flawless condition of the **PRETREATMENT PLANT** for **2X660 MW ENNORE SEZ STPP, CHENNAI** to the end customer complete with all accessories for the total scope defined as per BHEL NIT and tender technical specification number as specified above, amendment & agreement till placement of order.

**Bidders to please note that originally the plant was Designed and Engineered by M/s Otoklin Global Business Ltd (M/s OGBL), Mumbai, however, the Supply and further Erection work was not completed. The Civil front has already prepared at site based on the Detailed Engineering Documents submitted by M/s OGBL and approved by M/s BHEL/Customer/Consultant. Bidder to visit site for readiness of Civil Fronts in totality. The items to be supplied by Bidder should be able to integrate/hook with the existing Civil Work/Foundation. Bidder shall carryout rectification in existing civil work if any, before erection & commissioning of the plant.**

**1.2** 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 as **"PRE BID CLARIFICATION SCHEDULE"**. 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.

**1.3** Deviations, if any, should be very clearly brought out clause by clause in the enclosed schedule; otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification.

**1.4** 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 (**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO))** including their consultant **(CONSULTANT: DESEIN PVT LTD, NEW DELHI**) as interpreted by BHEL in the relevant context. Bidder to refer GCC/SCC for more clarity.

**SECTION - B**

**(PROJECT INFORMATION)**

**Project Title : 2 x 660 MW Ennore SEZ Coal Based Supercritical Thermal Power Project at Ash Dyke of NCTPS.**

**OWNER : TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO).**

**LOCATION :** The site is located near Vayalur Village, Ennore
Latitude : 13°17' N to 13°18' N
Longitude : 80°18' E to 80°19' E
Distance from Chennai City : 35 km
Nearest Airport is at Chennai at a Distance of : 60 km

**Meteorological Condition**

**Climate :** Tropical ,very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompanied with strong wind.

| | | |
|---|---|---|
| Climatological data | : | Ambient temp. (°C) |
| Annual Maximum Mean Temp | : | 41.5(°C) |
| Annual Minimum Mean Temp | : | 24(°C) |
| Design Ambient temperature | : | 35(°C) |
| Relative Humidity | : | In Percentage |
| Maximum | : | 100% |
| Minimum | : | 36% |
| Design | : | 75% |
| Annual Rainfall | : | In MM |
| Maximum | : | 2540 mm |
| Average | : | 1600 mm |
| Minimum | : | 1175 mm |

Seismic Zone III as per IS:1893-2002

# SECTION – C

# (SPECIFIC TECHNICAL REQUIREMENTS)

# SECTION – C1

# (SPECIFIC TECHNICAL REQUIREMENTS FOR MECHANICAL)

## 1.0 GENERAL:

### 1.1 PRE TREATMENT PLANT (PT PLANT)

**1.1** The specification is intended to cover design, engineering, manufacture, supply, fabrication, assembly, inspection/testing at vendor's & sub-vendor's works, painting, maintenance/special tools & tackles, mandatory spares along with spares for erection as required, startup and commissioning spares as required, forwarding, proper packing, shipment and delivery at site, **Supervision of Erection and Commissioning including assembly at Site**, preparation and submission of drawing/documents including "As built" drawings and carrying out Trial Run and Performance Guarantee test (PG Test) at site & equipment/system guarantee, etc., handover in flawless condition of the **PRETREATMENT PLANT** for **2X660 MW ENNORE SEZ STPP, CHENNAI** to the end customer complete with all accessories for the total scope defined as per BHEL NIT and tender technical specification number as specified above, amendment & agreement till placement of order.

The bidder's scope shall also include any other services, etc. if called for in the succeeding sections of the specification.

## 2.0 BROAD SCOPE OF SUPPLY

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

i. Entire Pre-treatment plant as per P&ID (**PE-V0-412-158-A001: P & ID FOR PRE TREATMENT PLANT**), Data Sheet-A and technical specification requirements.
ii. Raw water inlet piping to aerator complete with piping, fitting and valves. The inlet piping is to include two number motorized butterfly type control valves with necessary manual isolation/control valve and necessary instrumentation.
iii. Piping along with valves from raw water supply pumps to aerator as per flow diagram enclosed for pre-treatment plant.
iv. One number Bypass line to clarified water storage tank with Motorised Valve as per P & ID enclosed .
v. Mechanical, Electrical, Instrumentation etc. as required for one no (1). Aerator of RCC construction as per P & ID enclosed for pre-treatment plant with accessories as required.
vi. Mechanical, Electrical, Instrumentation etc. as required for one no (1). Stilling chamber as per P & ID enclosed for pre-treatment plant with accessories as required.
vii. Mechanical, Electrical, Instrumentation etc. as required for one no (1). Parshall flume as per P & ID enclosed for pre-treatment plant with accessories as required.
viii. Mechanical, Electrical, Instrumentation etc. as required for one no (1). Flash Mixer with motorized stirrer as per P & ID enclosed for pre-treatment plant with accessories as required.
ix. Mechanical, Electrical, Instrumentation etc. as required for two (2) nos. 2X50 % calrifloculators with sampling points at different elevation of clarifiers as per P & ID enclosed for pre-treatment plant with accessories as required.
x. Clarifier bridge (half bridge mechanism) assemblies, hand railings, required motors, valves, piping, instrumentation etc as per P & ID enclosed for pre-treatment plant.
xi. Sludge disposal system from clarifier with piping, valves and instrumentation up to sludge collection pit as per P & ID enclosed for pre-treatment plant with accessories as required.
xii. Mechanical, Electrical, Instrumentation etc. as required for one (1) no. RCC Sludge Pit (in twin section) interconnected through gate as per P & ID enclosed for pre-treatment plant with accessories as required.
xiii. Three (3) nos. sludge transfer pump with electric motor drive, piping, valves, fittings and instrumentation upto guard pond. The distance between Guard pond and PT plant is 350m.
xiv. Two nos. polyelectrolyte dosing tanks along with motorised stirrer, flushing arrangement, instrumentation, valves, fittings, ladders, platforms, lifting lugs and piping etc. as indicated in P & ID enclosed for Pre-treatment plant.
xv. Two (2) nos. (1w+1s) polyelectrolyte dosing pumps with electric motor drive, piping, valves, fittings and instrumentation as indicated in P & ID enclosed for Pre-treatment plant
xvi. Three (3) nos. FeCl3 dosing tanks along with motorised stirrer, flushing arrangement, instrumentation, valves, fittings, ladders, platforms, lifting lugs and piping etc. as indicated in P & ID enclosed for Pre-treatment plant.
xvii. Two (2) nos. (1w+1s) FeCl3 dosing pumps with electric motor drive, piping, valves, fittings and instrumentation as indicated in P & ID enclosed for Pre-treatment plant.
xviii. Two nos. lime dosing tanks along with motorised stirrer, flushing arrangement, instrumentation, valves, fittings, ladders, platforms, lifting lugs and piping etc. as indicated in P & ID enclosed for Pre-treatment plant.
xix. Two (2) nos. (1w+1s) lime dosing pumps with electric motor drive, piping, valves, fittings and instrumentation as indicated in P & ID enclosed for Pre-treatment plant.
xx. One no. Hypo dosing tank along with motorised stirrer, flushing arrangement, instrumentation, valves, fittings, ladders, platforms, lifting lugs and piping etc. as indicated in P & ID enclosed for Pre-treatment plant.
xxi. Two (2) nos. (1w+1s) Hypo dosing pumps with electric motor drive, piping, valves, fittings and instrumentation as indicated in P & ID enclosed for Pre-treatment plant.
xxii. Clarified water overhead storage tank (civil work by BHEL) with float type valve, overflow arrangement, level indicator, level transmitter etc.
xxiii. Piping along with valves and fittings as required from clarified overhead tank to dosing systems as per P & ID enclosed for Pre-treatment plant.

xxiv. All pipes, fittings etc. required for hand railing, platforms, and ladders shall be in the scope of bidder of supply and erection of complete PT plant. Hand railing shall be provided by bidder wherever required for safety point.

xxv. Entire piping inside ETP area are in Bidder's scope.

xxvi. The following piping also are part of bidders's scope.

- Raw water: 35m from Aerator central shaft at 0.5m above FGL.
- Service Water: 5m at 0.5m above FGL from PTP chemical House. Line Size shall be 50 NB.
- Potable Water: - Pipe length from Hypo dosing pump to outlet of potable water pump shall be 350 m.
- All the necessary fitting and flanges needed for connection at outlet header of potable water pump discharge shall be in scope of bidder.
- Instrument Air/Service Air: At Terminal Point 10 meter from PT Plant Boundary at 5-7 kg/cm2 (g) pressure.
- From discharge of sludge transfer pumps to guard pond shall be 350m.

xxvii. All insert plates, puddle pipes, nuts and bolts, counter flanges, grouting material wherever applicable shall be in the scope of bidder.

xxviii. All sluice gates shall be in the scope of bidder.

xxix. **Bidder to be note that the outlet Total Suspended solid guarantee for PT clarifier shall be <10 ppm.**

xxx. Centrifugal type blower (2 Nos) with acoustic enclosures along with piping valves fitting and instrument as per flow diagram of PT Plant for clarifier sludge sump.

xxxi. Pipe racks shall be provided by BHEL wherever available. However where pipe racks are not available the pipe shall run on pipe pedestals. All auxiliary steel structures (U-clamps, nuts, bolts, channels etc.) for fixing the pipe on the pedestal or trestles shall be in the scope of bidder.

xxxii. All grout material in BHEL civil works and to support/ hold the equipment being supplied under this specification shall be in bidder's scope.

xxxiii. All motorized valves shall be provided with integral starter.

xxxiv. Instrument hook up material shall be in bidder's scope.

xxxv. All necessary drains, vents and sampling points with valves as specified and as required are in bidder's scope.

xxxvi. Monitoring gadgets, instruments and equipments required for maintenance (till PG test & plant handover) shall be in bidder's scope.

xxxvii. Wherever terminal points between BHEL and bidder indicated, bidder shall provide pipes with counter flange.

xxxviii. All motorized valves shall be provided with integral starter.

xxxix. Wherever terminal points between BHEL and bidder indicated, blank flanges/counter flanges, isolations valves, tees etc. to interconnect the pipes at all terminal points.

xl. Hume Pipe 4 Nos (200 NB Size) each of 6 meter length.

xli. One (1) number Electrically Operated Monorail Hoist of 1.0 Ton (minimum) safe working capacity and complete with all accessories for handling of Sludge Transfer Pumps within Sludge Sump cum Pump House.

xlii. Two (2) numbers Electrically Operated Monorail Hoists, each of 1.0 Ton safe working capacity and complete with all accessories for handling of chemicals at ground floor and first floor of Chemical House.

xliii. The chemical house shall be equipped with two weighing scales of platform & dial type suitable for chemicals being handled. Range of weighing scales shall be suitable for weighing 0-1000 Kg. Technical requirements of weighing scale shall be as specified in Datasheet – A.

xliv. All handrails shall be of 32 mm nominal bore MS pipes (medium class) as per IS: 1161 galvanized 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 centre to centre 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 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. Hand rail supply shall and erection at site on structures is also in Bidder's scope.

xlv. Finish paints for touch up painting of equipment 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.

xlvi. Monitoring gadgets, instruments and equipment required for commissioning & maintenance (till PG test and plant handover).

xlvii. Instrument hook up material shall be in bidder's scope.

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

xlix. Wrapping, coating and protection of the entire buried pipe shall be as per IS 10221 or AWWA C 203-93.

l. Hydraulics of the Complete Pre-treatment Plant shall be designed to take an occasional over loading of 20% over the design flow.

li. Bidder to note that the equipment, valves, instruments indicated in the P&ID (**PE-V0-412-158-A001**) 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.

lii. All channels & brackets, mounting plates as required for mounting of motors, pumps, stirrers, tank etc shall be in bidder's scope.

liii. 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 Pre Treatment Plant.

liv. Instrument hook up material shall be in bidder's scope.

lv. 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. Efforts should be made to limit the variety of lubricants to minimum.

lvi. All Chemical for Trial Run (Minimum 15 Days) and for PG Test+First fill of all chemical tanks.

lvii. All items shall be properly packed considering Costal Environment to avoid any corrosion during storage and also all small quantities of items to be supplied in containers to ensure proper storage.

## 3.0 SCOPE OF SERVICE

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

1) **Supervision of Erection and Commissioning at Site including assembly at site,** Bidder shall be required to depute his qualified/capable personnel at any stage for **Three (3)** visits each of **Fifty (50)** days to supervise in Erection and Commissioning including assembly in totality [Total **One Fifty (150)** days in **Three (3)** visits excluding the travel time]. Bidder to indicate the prices (in price format) for the same. The prices for Visit shall be inclusive of charges of Air-Fair/Rail-Fair, Boarding/Lodging, local conveyance, medical, Insurance etc.

   - Bidder to ensure that the erection and commissioning work meets the technical specification requirement which are necessary to meet the performance guarantee of complete Effluent Treatment Plant.
   - The scope of Bidder shall include to carry out trouble shooting during supervision of erection and commissioning and intimate any minor modification in erection drawings/sequence/ procedure to BHEL.
   - The scope of Bidder shall include to carry out trouble shooting during trial test/ demonstration test/ functional performance guarantee test and to implement the same to meet the performance guarantee of complete Effluent Treatment Plant.
   - Before erection, Bidder shall visit site for checking and ensuring Civil Front correctness and readiness for erection. In case of any discrepancy find out, Bidder shall intimate to BHEL and propose any minor modification in erection drawings/sequence/ procedure.

2) Arrangement of all instruments and lab facilities to carry out trial run/commissioning and PG test.
3) All personnel required during Trial Run and PG Test.
4) Trial Run and PG (Performance and Guarantee) testing.
5) Painting as per enclosed painting schedule. However, any variation in the painting schedule as finally approved by customer shall be taken care by the bidder without any commercial and delivery implication. Color-coding scheme shall be intimated to vendor during detailed engineering.

## 4.0 CIVIL SCOPE

Total Civil construction work along with material (RCC and Reinforcement Steel) at site is in BHEL's Scope of work, however complete grouting for equipment, pumps, blowers etc. fixing of equipment, pumps, blowers etc. as required shall be in bidder's scope.

Detailed Civil assignment drawing and Civil Design/Drawing as applicable shall be provided by bidder.

**Note: The Civil Input Documents/Drawings already approved as per ANNEXURE-B to be followed by bidder and for that no drawing/documents to be submitted by Bidder. In addition to above the engineering documents which are not approved as per ANNEXURE-B shall be part of Bidder scope.**

## 5.0 ELECTRICAL SCOPE

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

**Note-1: The Electrical Documents/Drawings already approved as per ANNEXURE-B to be followed by bidder and for that no drawing/documents to be submitted by Bidder. In addition to above the engineering documents which are not approved as per ANNEXURE-B shall be part of Bidder scope.**

**Note-2: Please note that MCC/Switchgear already supplied by BHEL based on the already approved data sheet. In case any minor changes is needed, the same shall be part of bidder scope.**

**6.0 C&I SCOPE**

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

**Note: The C&I Documents/Drawings already approved as per ANNEXURE-B to be followed by bidder and for that no drawing/documents to be submitted by Bidder. In addition to above the engineering documents which are not approved as per ANNEXURE-B shall be part of Bidder scope.**

**5.0 TERMINAL POINT**

- Raw water: 35m from Aerator central shaft at 0.5m above FGL.
- Service Water: 5m at 0.5m above FGL from PTP chemical House. Line Size shall be 50 NB.
- Potable Water: - Pipe length from Hypo dosing pump to outlet of potable water pump shall be 350 m.
- All the necessary fitting and flanges needed for connection at outlet header of potable water pump discharge shall be in scope of bidder.
- Instrument Air/Service Air: At Terminal Point 10 meter from PT Plant Boundary at 5-7 kg/cm2 (g) pressure.
- From discharge of sludge transfer pumps to guard pond shall be 350m.

**Note: The Pump head shall be as per PE-V0-412-158-A004 (PROCESS SIZING CALCULATION).**

**6.0 EXCLUSIONS**

a) Service air, Instrument air, upto the terminal point.
**b)** Fire fighting facilities. However, bidder to furnish the requirement of same after award of contract.
**c)** Drinking water and service water.
d) All Civil works at site including Acid/Alkali resistant tiling/lining, excavation, backfilling, cement and steel.
e) Laying of pipes under road crossing and railway track.
**f)** M.C.C. / Switch fuse feeder panels for the power plant and control cabling up to & beyond the battery limit (Refer electrical section for scope).
**g)** DCS/DDCMIS.
**h) Erection and Commissioning including assembly at site.**
**i) Painting at Site.**

**7.0 QP AND SUBVENDOR APPROVAL**

a) QP requirements part of section-C shall be as per the enclosed QP subject to BHEL/Customer approval. However, any additional comments as given by BHEL/Customer shall be adhered by the bidder without any implication to BHEL.
b) Approved subvendor list is enclosed elsewhere of this specification. However, any additional sub-vendor shall be subject to BHEL and Customer approval.

**Note: The QAP already approved as per ANNEXURE-B to be followed by bidder and for that no documents to be submitted by Bidder. In addition to above the engineering documents which are not approved as per ANNEXURE-B shall be part of Bidder scope.**

**8.0 FUNCTIONAL GUARANTEES (REFER APPROVED PG TEST PROCEDURE ENCLOSED, REF. PE-V0-412-158-A094).**

**9.0 DESIGN/CONSTRUCTION**

In addition to the requirements of Section-C & D the following shall also be complied under scope of this specification:
The P&ID is enclosed herein in this section for bidders compliance.
The material of construction specified in Data Sheet-A are minimum requirements and material of construction for other components not specified shall be similarly selected by the bidder for intended duty which shall be subjects to customer approval during detailed engineering.

## 10.0 DRAWING/DOCUEMNTS REQUIREMENT (FOR MECHANICAL/ELECTRICAL/C&I/ETC)

**The Documents/Drawings already approved as per ANNEXURE-B to be followed by bidder and for that no drawing/documents to be submitted by Bidder. In addition to above the engineering documents which are not approved as per ANNEXURE-B shall be part of Bidder scope.**

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

- Compliance certificate.(Stamped & Signed)
- Un Price Schedule duly filled in. (Stamped & Signed)

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

**Note-2:** Bidder to note that BHEL reserve the right for drg/doc submission through web based Document Management System. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

• 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)

**Note-3:** The above Note-1 and 2 shall be applicable for Electrical and C&I also.

**TABLE - A**

**SEA WATER ANALYSIS:**

| S.No. | Parameter | Unit | Value (Range) |
|---|---|---|---|
| **1** | **General** | | |
| a | pH | | 7.94-8 |
| b | Conductivity | millisiemens/cm | 43.8-44.1 |
| c | Temperature | Deg C | 25-32 |
| d | Turbidity (Total Suspended Solids) | PPM | 500 |
| e | Total Organic carbon (total/ dissolved) | PPM of C | 2.4-2.84 |
| f | CO2 | Mg/l | <2 |
| g | TDS | Mg/l | 39600-39740 |
| h | BOD | Mg/l | 10-12 |
| i | COD | Mg/l | 88-96 |
| j | Oil & Grease | Mg/l | <10 |
| k | Phenols | Mg/l | 0.08-0.09 |
| l | Free Residual Chlorine | Mg/l | <0.2 |
| **2** | **Cations** | | |
| a | Cacium | Mg/l | 459-478 |
| b | Magnesium | Mg/l | 1510-1516 |
| c | Sodium | Mg/l | 10100-12000 |
| d | Potassium | Mg/l | 358-450 |

| | | | |
|---|---|---|---|
| e | Ammonia | Mg/l | 4.43-5.42 |
| f | Stontium | Mg/l | 12.9-12.4 |
| g | Barium | Mg/l | 1.55-1.58 |
| h | Aluminum Total | Mg/l | 1-1.8 |
| i | Aluminum Dossolved | Mg/l | 0.8-1.0 |
| j | Manganese Total | Micro g/l | 0.2-0.6 |
| k | Manganese Dissolved | Micro g/l | 0.1-0.2 |
| l | Iron total | Micro g/l | 220-260 |
| m | Iron Dissolved | Micro g/l | Below detectable limit (detectable Limit : 10) |
| **3** | **Anions** | | |
| a | Chloride | Mg/l | 18994-19194 |
| b | Sulphate | Mg/l | 3710-3949 |
| c | Nitrate | Mg/l | 136-152 |
| d | Nitrite | Mg/l | 0.46-0.62 |
| e | Bicarbonate | Mg/l | 144-148 |
| f | Carbonate | Mg/l | Nil |
| g | Fluoride | Mg/l | 2.64-2.8 |
| h | Boron | Mg/l | 0.14-0.17 |
| i | Phosphate | Micro g/l | 240-380 |
| j | Sulphide | Micro g/l | Below detectable limit (detectable Limit : 100) |
| k | Silica Dissolved | Micro g/l as SiO2 | 200-250 |
| **4** | **Heavy Metals** | | |
| A | Arsenic | Micro g/l | Below detectable limit (detectable Limit : 2) |
| B | Mercury | Micro g/l | Below detectable limit (detectable Limit : 1) |
| C | Cadmium | Micro g/l | 120-130 |
| D | Copper | Micro g/l | 200-220 |
| E | Nickel | Micro g/l | 470-490 |
| F | Molybdenum | Micro g/l | Below detectable limit (detectable Limit : 100) |
| **5** | **Suspended Particle Size Range** | | |
| A | 10 micron & above | Mg/l | Below detectable limit(detectable Limit : 10) |
| B | 5 micron to 10 micron | Mg/l | Below detectable limit(detectable Limit : 10) |
| C | 1 micron to 5 micron | Mg/l | Below detectable limit(detectable Limit : 10) |
| D | 0.1 micron to 1 micron | Mg/l | 20-26 |
| **6** | **Colloidal Particle Size Range** | | |
| A | SDI (10 Minutes) | - | 10-20 |
| B | SDI (5 Minutes) | - | 20-40 |
| 7 | Density of sea water | Kg/ cum | 1030 |

## MANDATORY SPARES

**TABLE-B**

| SI. NO. | PARTICULARS | QUANTITY |
|---|---|---|
| **1.0** | **CIRL DIAPHRAGM VALVE** | |
| 1.1 | Complete valve | Two (2) Nos. each of different size of valve in the system |
| 1.2 | Diaphragm | Five (5) Nos. each of different sizes valves |
| 1.3 | Valve spindle | Two (2) Nos. each of different sizes valves |
| **2.0** | **Other type valve (except Control Valve )** | |
| 2.1 | Complete valve | One (1) No. each of different size of valve in the system |
| 2.2 | Sampling & needle valve | Four (4) Nos. each type & size |
| **3.0** | **Pressure Gauge** | Two (2) Nos. for each Range/Type |
| **4.0** | **Level Gauge** | |
| 4.1 | Glass Tube | Five (5) Nos. for each size |
| 4.2 | Off-set value | Two (2) Nos. for each size |
| **5.0** | **Level Switch (conductivity type)** | |
| 5.1 | Float & Rod Float & Rod | One (1) No. for each size |
| 5.2 | Switch Assembly | One (1) No. for each size |
| **6.0** | **Clariflocculator Bridge** | |
| 6.1 | Worm gearbox | One (1) No. |
| 6.2 | Shaft for trailing wheel | One (1) No. |
| 6.3 | Flocc. Drive head complete with bevel & pinion set. | One (1) No. |
| 6.4 | Central bearing housing complete. | Two (2) Sets |
| 6.5 | Current collectors. | One (1) Set |
| 6.6 | Weir with stuffing box. | One (1) No. |
| 6.7 | Bearing; Impeller with shaft & gear unit for each type and size of air blowers. | Two (2) Sets |
| 6.8 | Floats for each size and type with links & levers | Two (2) Sets |
| 6.9 | Bearings & brake linings for each type & rating of hoists. | Two (2) Sets |
| 6.10 | Rope grid & complete length of wire rope for each type of hoists rating | One (1) No. |

| | | |
|---|---|---|
| 6.11 | Bearings; shaft sleeve; impeller; and mechanical seal for each type & duty parameters of pump sets. | One (1) set each |
| 6.12 | Controller valve assembly complete. | Two (2) No. |
| 6.13 | Periphery drive worm gearbox coupling. | Two (2) No. |
| **7.0** | **415 V Motors** | |
| 7.1 | Terminal plates | 10 Nos. each for small motors upto 30 kW & 4 Nos. each for more than 30 kW |
| 7.2 | Heaters | 2 sets |
| 7.3 | Greasing arrangements | 4 sets each type of motor |
| 7.4 | Motor of each type and rating | 10% of the installed quantity or minimum 1 number whichever be higher |
| 7.5 | Bearings (DE and NDE) for each type and rating of motor | 4 sets |
| **8.0** | **BATTERY** | |
| 8.1 | Battery cell | 10 nos. |
| 8.2 | MT cell container of each type | 10 nos. |
| 8.3 | Level indicator | 6 nos. |
| 8.4 | Vent plugs | 12 nos. |
| 8.5 | Inter-cell connector | 10 nos. |
| 8.6 | Set of nuts, bolts and washer | 12 nos. |
| **11.0** | Each type of lamps, PBs, ILPBs, fuse, MCB, MCCB used in the equipment/system. | 20% of Installed of each type. |
| **12.0** | **Measuring Instruments** | |
| 12.1 | **Indicators, Recorders, Electrical Metering and Skid Mounted Instruments** | |
| 12.1.1 | Indicators, recorders and meters offered from each model for the project. These instruments shall be supplied with three sets of blank scales. | 10 % of Installed of each type/Model or a minimum of one number for each model and type, whichever is more. |
| 12.1.2 | For skid mounted instruments (As applicable) | 10% of total number of instruments for each Type and model or a minimum of one number for each model and type, whichever is more. |
| 12.1.3 | Temperature Transmitters and Electronic Transmitters (For Pressure, DP, Temp, Flow, Level), Temperature, Pressure, Flow & Level Switch, safety switches, Gauges, meters, Transducer or any other instrument etc. | 10% of total number of Instruments/transducers offered for each model and type for the project or a minimum of one number, whichever is more. |
| **13.0** | **Erection hardware** | |
| 13.1 | Instrument valves | Ten (10) percent of each type & Size installed |
| 13.2 | Condensate pots of each type & Size installed | Ten (10) percent of total number of Installed or four numbers whichever is higher . |

| | | |
|---|---|---|
| 13.3 | Manifold | Ten (10) percent of each type & Size installed |
| 13.4 | Fittings | Ten (10) percent of each type & Size installed |
| **14.0** | **Control valves, Power Cylinder, Control Dampers, Actuators and Accessories** | |
| 14.1 | Following spares shall be provided for control valves, Power Cylinder, Control Dampers as applicable. | |
| 4.1.1 | One set of spare control valve stem packing for each control valve. | |
| 4.1.2 | Two moulded rubber diaphragms for each control valve. | |
| 4.1.3 | One sets of each of O-rings and rubber gaskets for each control valve. | |
| 4.1.4 | 100 percent qty. of lubricants for gaskets for each control valve on one year consumption basis. | |
| 4.1.5 | 2 sets of limit switches and 1 set of valve positioner for each control valve. | |
| 4.1.6 | 20% of position transmitter (4-20mA) for total qty. of control valve. | |
| 4.1.7 | One (1) set of valve trims (such as plug, stem, seat ring /cage, guide bushing, stem lock pin, packing retaining ring, etc) for each control valve. | |
| 4.1.8 | One completes actuator of each type or min 10% for each type and size whichever is more. | |
| 4.1.9 | 20% of Solenoid valves or min 2 no. of each type for total qty. of control valves. | |
| 4.1.10 | 20% of I to P converters, Pressure regulators. | |
| **15.0** | 10% or 1 no. (whichever is more) of each type of sensor/instrument, instrumentation/mechanical fittings etc for any other electronic system. | |

**Notes:**

1) Mandatory spares listed above is bare minimum requirement. In case any additional mandatory spares requirement is covered elsewhere in the tender specification apart from specified above, same shall be deemed to have been covered in bidders scope of supply.

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

3) In case of Bought Out items, itemised spares list may be vendor specific and may differ from the list of spares mentioned above. In such cases, the quoted price shall be considered for applicable items only without any change in the contract price.

4) In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities generally in line with the approach followed in the above list.

## PERCENTAGE OF BILLING BREAK UP (BBU)

**TABLE-C**

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.

| Break-up (%) of Supply prices of Pre Treatment plant package. (To be used during contract execution for payment). | |
|---|---|
| Lump sum firm price for supply of Clarifier Mechanism along with accessories inclusive of all taxes, duties and other levies as applicable. | 13% of Total supply price of Pre Treatment plant package. |
| Lump sum firm price for supply of pumps with Motors inclusive of all taxes, duties and other levies as applicable. | 18% of Total supply price of Pre Treatment plant package. |
| Lump sum firm price for supply blowers, agitator with Motors inclusive of all taxes, duties and other levies as applicable. | 7% of Total supply price of Pre Treatment plant package. |
| Lump sum firm price for supply of Piping & fittings inclusive of all taxes, duties and other levies as applicable. | 25% of Total supply price of Pre Treatment plant package. |
| Lump sum firm price for supply of Valves inclusive of all taxes, duties and other levies as applicable. | 16% of Total supply price of Pre Treatment plant package. |
| Lump sum firm price for supply of Instrument & analysers inclusive of all taxes, duties and other levies as applicable. | 6% of Total supply price of Pre Treatment plant package. |
| Lump sum firm price for supply of Misc. Balance Items inclusive of all taxes, duties and other levies as applicable. | 15% of Total supply price of Pre Treatment plant package. |

# DATA SHEET-A

| | | |
|---|---|---|
| **1.0** | **INLET VALVES** | |
| 1.1 | Inlet valves | The referred clause shall be read as Inlet valves:-Two (2) numbers motorized butterfly flow control valve, located at inlet to aerator, with manual upstream and downstream isolation valves along with by-pass manual butterfly flow valve. Control valve shall have "auto manual" selection option, position indicator with "openclose" push buttons. Inching operation of valve shall be possible from DDCMIS based control panel. |
| 1.2 | Inlet control valve size | Suitable to cater to total flow |
| 1.3 | Code | AWWA – C 504 for butterfly valve |
| 1.4 | Control | Under "Auto" mode of flow control valve, valve shall automatically maintain the level of water in the clarified water reservoir, i.e valve shall automatically close when reservoir level becomes high. |
| **2.0** | **AERATOR** | |
| 2.1 | Nos. | One (1) [common for two clarifier]. |
| 2.2 | Material of construction | RCC |
| 2.3 | Surface flow rate | 0.045 $m^2$/ hr/ $m^3$ |
| 2.4 | Riser | Min 250 mm. |
| 2.5 | Tread | Max 400 mm. |
| 2.6 | Number of steps | 7 Nos (Min). |
| **3.0** | **STILLING CHAMBER** | |
| 3.1 | No. | One (1) [common for two clarifier]. |
| 3.2 | Purpose | To dampen out any turbulence of the incoming water. |
| 3.3 | Retention time and capacity | 60 seconds and (min) 75 Cum. |
| 3.4 | Material of construction | RCC |
| 3.5 | Drain arrangement | Suitable draining arrangement shall be provided for the stilling chamber and drain lines shall be connected to sludge sump. |
| **4.0** | **PARSHALL FLUME** | |
| 4.1 | No. | One (1) [common for two clarifier]. |
| 4.2 | Purpose | To measure flow. |
| 4.3 | Material of construction | RCC |
| 4.4 | Capacity | 1.2 times of clariflocculator (min). |
| **5.0** | **FLASH MIXER** | |
| 5.1 | Nos. | One (1) |
| 5.2 | Retention time | 60 seconds |
| 5.3 | Capacity | Minimum 75 cum. |
| 5.4 | MOC of Flash Mixer Pit | RCC |
| 5.5 | Agitator (MOC: Duplex Stainless Steel) | One (1) for flash mixer |
| 5.6 | Free board | 500 mm (min) |
| 5.7 | Motor rating for agitator | DDE (During Detail Engineering). |
| 5.8 | Drain arrangement | Suitable draining arrangement shall be provided for the stilling chamber and drain lines shall be connected to sludge sump. |
| 6.0 | **CLARIFLOCCULATOR** | |
| 6.1 | Number | Two (2X50%) |
| 6.2 | Capacity (Net output) | 1160 cum/hr. |
| 6.3 | Type | Radial, conventional. |
| 6.4 | Effluent water quality | Turbidity and TSS shall be less than 10 NTU/PPM. |
| 6.5 | Side Water Depth (SWD) | Minimum 4.5 meter. |
| 6.6 | Rise rate | 1.2 CuM/Hr/SqM (maximum). |
| 6.7 | Retention Time | Flocculation zone 30 min, Clarifier zone-150 min. |
| 6.8 | Sludge Blow Off | By gravity through telescopic stand-pipe for continuous discharge and through manual operated blow-off valve for intermittent. |
| 6.9 | Platform with hand railing | Shall be provided (1 meter wide all along Clariflocculator) |
| 6.10 | Rake bridge (Half Bridge) | Shall be provided (MOC: MS as per IS 2062 corroborated or FRP coated). Gearbox for scraper drive shall be of oil-free type. |
| 6.11 | Flocculation agitator (MOC: Duplex Stainless Steel) | Two (2) Numbers. Vertical slow speed motor reduction gear driven. |
| 6.12 | Velocity in launder | 0.4 m/s (max). |
| 6.13 | Free board b in launder and channel | Minimum 300 mm. |
| 6.14 | MOC of inlet Pipe | MS internally coated with Corrocoat |

| | | |
|---|---|---|
| 6.15 | Surface flow rate of clarifier zone | Not more than 1.2 cum/hr/ m2. |
| **7.0** | **CLARIFIER SCRAPPERS** | |
| 7.1 | Type | Designer's Design Specific (shall be furnished DDE). |
| 7.2 | Number required | One per clarifier. |
| 7.3 | Material | Mild steel (MS) with FRP coated. |
| 7.5 | Traction drive | Slow speed motor driven. |
| **8.0** | **SUITABLE ACCESSORIES** | |
| 8.1 | Access ladder, platform, staircase, hand railings etc. | Shall be provided of structural steel. |
| 8.2 | Walkway | Shall be provided with hand railings around launder periphery of width 1000 mm. |
| 8.3 | Electrical requirements | For each clariflouculator, one (1) Distribution Board to be located on clariflocculator bridge for all drives of clariflocculator bridge assembly. |
| **9.0** | **SLUDGE SUMP** | |
| 9.1 | Number | One (1) with two compartments. |
| 9.2 | Capacity (effective) | 300 Cum (each compartment). |
| 9.3 | Dimension | Suitable |
| 9.4 | Material | RCC with FRP/PP lining. |
| 9.5 | Location | Shall be finalized during Detailed Engineering (DDE). |
| 9.6 | Isolation gates with hand wheel and penstock | Two number per compartment. |
| 9.7 | Instrument | As per Flow Diagram. |
| 9.8 | Air Agitation facility | Air Agitation with pipe grid by 2x100 Air Blower (Twin Lobe Positive Displacement Type, MOC-Casing-CI IS-210 FG 260, Shaft-CS to EN8 (BS 970), Lobe-CI IS 210 FG 260) and sludge recirculation line shall be provided in sludge sump. |
| 9.9 | Hoist | |
| 9.9.1 | Type | Electric in monorail |
| 9.9.2 | Location | sludge transfer pumps |
| 9.9.3 | Number | One (1). |
| 9.9.4 | Capacity | 1 T |
| **10.0** | **CHEMICAL HOUSE** | |
| 10.1 | Number | One (1). |
| 10.2 | Type | Two storied building of civil construction. |
| 10.3 | Building dimensions | DDE |
| 10.4 | Ground floor | Storage of chemical required for FeCl3, Lime, Poly Electrolyte and NaOCl dosing (for Potable water) for 30 days storage capacity and MCC. |
| 10.5 | First floor | Location of all chemical dosing tanks and pumps and Control room for DDCMIS for entire PT Plant. |
| **11.0** | **WEIGHING SCALE FOR CHEMICAL HOUSE** | |
| 11.1 | Type | Platform, dial type. |
| 11.2 | Number | One (1) |
| 11.3 | Capacity | 0-1000 Kgs |
| **12.0** | **HOIST** | |
| 12.1 | Type | Electric in monorail |
| 12.2 | Location | ground and first floor of chemical house |
| 12.3 | Number | Two (2). |
| 12.4 | Capacity | 1 T |
| **13.0** | **OVERHEAD CLARIFIED WATER STORAGE TANK** | |
| 13.1 | Capacity (Net) | To suit water requirement for chemical preparation for one day requirement+ flushing requirement of dosing lines +20 % margin. |
| 13.2 | Location | Top of Chemical House. |
| 13.3 | Nos. | One (1) |
| 13.4 | Material | RCC |
| 13.5 | Free board over the maximum water level | 300 mm |
| 13.7 | Instruments | As per flow diagram. |
| **19.1** | **POLYMER DOSING SYSTEM (@ 1 ppm)** | |
| | a) Tank – | Number-Two (2) numbers.<br>Capacity- 12 Hrs storage capacity (each) for minimum 0.5% (w/v) solution.<br>Type – vertical.<br>Material- RCC+FRP/PP lining. |

| | | |
|---|---|---|
| | | Instrument- As per Flow Diagram.<br>Motorized Stirrer (MOC-SS316)-One (1) number per tank vertical type.<br>Dissolving Basket- 1 no per tank (MOC SS 316 L).<br>Free board- 300 mm (min). |
| | b) Pump - | Number-Two (2) numbers.<br>Type – Plunger Type positive displacement pump.<br>Capacity (each)- 1000 LPH (minimum).<br>Material- SS-316 (all wetted parts).<br>Instrument- As per Flow Diagram.<br>Suction strainer (MOC:CPVC Sch 10) -2X100 %. |
| **19.2** | **$FeCl_3$ DOSING SYSTEM (@ 40 ppm)** | |
| | a) Tank – | Number-Three (3) numbers<br>Capacity- 12 Hrs storage capacity (each) for minimum 10% (w/v) solution.<br>Type – vertical.<br>Material- RCC+FRP/PP lining.<br>Instrument- As per Flow Diagram.<br>Motorized Stirrer (MOC-Duplex SS)- One (1) number per tank vertical type.<br>Dissolving Basket- 1 no per tank (MOC Duplex SS).<br>Free board- 300 mm (min). |
| | b) Pump- | Number-Two (2) numbers (1W+1S)<br>Type – Plunger Type positive displacement pump.<br>Capacity (each)- 2000 LPH (minimum).<br>Material- Duplex SS (all wetted parts).<br>Instrument- As per Flow Diagram.<br>Suction strainer (MOC:CPVC Sch 10) -2X100 %. |
| **19.3** | **LIME DOSING SYSTEM (@ 10 ppm)** | |
| | a) Tank – | Number-Two (2) numbers<br>Capacity- 12 Hrs storage capacity (each) for minimum 5% (w/v) solution.<br>Type – vertical.<br>Material- RCC+FRP/PP lining.<br>Instrument- As per Flow Diagram.<br>Motorized Stirrer (MOC-SS316)- One (1) number per tank Horizontal type.<br>Dissolving Basket- 1 no per tank (MOC SS 316 L).<br>Free board- 300 mm (min). |
| | b) Pump- | Number-Two (2) numbers (1W+1S)<br>Type – Screw Type positive displacement pump.<br>Capacity (each)- 1000 LPH (minimum).<br>Material- SS-316 (all wetted parts).<br>Instrument- As per Flow Diagram.<br>Suction strainer (MOC:CPVC Sch 10) -2X100 %. |
| **19.4** | **NaOCl DOSING SYSTEM FOR POTABLE WATER (@ 2 ppm)** | |
| | a) Tank – | Number-One (1x100%).<br>Capacity- 500 Ltrs (considering 7-10% commercial grade NaOCl).<br>Type – vertical cylindrical.<br>Material-FRP with 6mm thickness.<br>Instrument- As per Flow Diagram.<br>Free board- 300 mm (min). |
| | b) Pump- | Number-Two (2) numbers (1W+1S)<br>Type – diaphragm type positive displacement pump.<br>Capacity (each)- 5 LPH (minimum).<br>Material- PVDF and PTFE (all wetted parts).<br>Instrument- As per Flow Diagram.<br>Suction strainer (MOC:CPVC Sch 10) -2X100 %. |

**20.0 MOC and type of the pumps shall be as per the following details.**

| | **Pump Description** | **Quantity** | **Pump Type** | **Capacity** | **Material of Construction** |
|---|---|---|---|---|---|
| 20.1 | Sludge transfer pump | Three (3X100%) | Vertical, Non clot type.<br>Impeller – semi open.<br>Lubrication-Self lubricated. | 500 CuM/Hr. (each). | Casing – Duplex SS 2205 UNS 31803.<br>Impeller- Duplex SS 2205 UNS 31803.<br>Shaft- Duplex SS 2205 UNS 31803.<br>Shaft sleeves- Duplex SS 2205 UNS 31803.<br>Packing-Braided Impregnated Teflon.<br>Flexible coupling- Duplex SS 2205 UNS 31803.<br>Nuts and Bolts-SS 316L. |
| **21** | **VALVES** | | **Material of Construction** | | |

| | | |
|---|---|---|
| i. | Gate (All gate valves shall have flanged end connections, it shall be outside screw rising stem type with hand wheel) | Body/Bonnet – Super duplex stainless steel, ASTM A890-5A (CE3MN).<br>Stem – stainless steel AISI 410/ 13% chrome steel.<br>Disc/Gate – Super duplex stainless steel, ASTM A890-5A (CE3MN).<br>Seat & seat rings – Duplex Stainless Steel.<br>Hand wheel- Cast iron. |
| ii. | NRV<br>(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). | <u>Swing Check type</u><br>Body – Super duplex stainless steel, ASTM A890-5A (CE3MN).<br>Disc/door – Super duplex stainless steel, ASTM A890-5A (CE3MN).<br>Hinged pin – Duplex Stainless Steel.<br><u>Piston type</u><br>Body – Super duplex stainless steel, ASTM A890-5A (CE3MN).<br>Hinge pin – SS316<br>Piston – Super duplex stainless steel, ASTM A890-5A (CE3MN). |
| iii | Ball valve | Type :Full bore<br>Rating: PN 10 (min).<br>Body: Super duplex stainless steel, ASTM A890-5A (CE3MN).<br>Ball: Super duplex stainless steel, ASTM A182-F53 or ASTM A890-5A (CE3MN).<br>Seat ring: PTFE<br>Stem: Super duplex stainless steel, ASTM A890-5A (CE3MN) or Zeron 100<br>Seat: Nitrile rubber,PTFE |
| iv | Globe valve | Type: Double flanged.<br>Rating: PN 10 (min).<br>Body: Super duplex stainless steel, ASTM A890-5A (CE3MN).<br>Plug: Super duplex stainless steel, ASTM A890-5A (CE3MN).<br>Seat ring: Super duplex stainless steel, ASTM A890-5A (CE3MN). |
| v | Plug Valve | Type :Full bore<br>Rating: PN 10 (min).<br>Body: Super duplex stainless steel, ASTM A890-5A (CE3MN).<br>Plug: Super duplex stainless steel, ASTM A890-5A (CE3MN).<br>Sleeve: PTFE. |
| vi | Butterfly valve | Butterfly valves shall be of double flanged type of low leakage rate confirming to AWWA-C-504 class 150 (min.) or BS:5155 PN 10 (min.)<br>Body: ASTM A995 Gr. 5A - CE3MN (Duplex Stainless Steel).<br>Disc: ASTM A995 Gr. 5A - CE3MN (Duplex Stainless Steel).<br>Shaft: ASTM A276 S31803 (Duplex Stainless Steel).<br>Seat rings: Nitrilerubber, EPDM,Hypalon<br>All the butterfly valves shall be provided with Hand wheel or lever as per the requirements.<br>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<br>i) Design standard: BS:5156 or equivalent of required rating/class. (minimum rating of valves shall be PN 10).<br>ii) Type: Flanged and lined body ends, sealed bonnet, weir pattern, tight shut off type<br>iii) Material of Construction<br>a. Body , Bonnet: Cast iron IS 210 Gr. FG 260 or equivalent or Cast steel ASTM A-216 Gr. WCB<br>b. Body lining : Soft natural rubber, ebonite , Polypropelene<br>c. Handwheel : Cast Iron<br>d. Compressor : Duplex Stainless steel.<br>e. Stem and Bush : Duplex Stainless steel. |
| **21** | **PIPE** | **Refer P&I Diagram.** |
| **22** | **SAFETY EQIPMENTS** | Four sets of safety equipment comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall also be provided. A personnel water drench shower and eye bath shall be provided. |

Bidder to note that this is a sea water application plant. Bidder to select MOC to suit sea water application wherever required and not indicated in technical specification.

# SECTION – C2

# (SPECIFIC TECHNICAL REQUIREMENTS FOR ELECTRICAL)

# TECHNICAL SPECIFICATION

# FOR

# PRE-TREATMENT PALNT (ELECTRICAL PORTION)

## 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 Condensate Poilishing Unit
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.
b) Technical specification for motors.
c) Datasheets & quality plan for motors.
d) Electrical Load data format.
**e)** BHEL cable listing formt.

# ELECTRICAL LOAD FORMAT

| LOAD TITLE | RATING (KW / A) | | UNIT (U)/STN (S) | Nos. | | VOLTAGE CODE* | FEEDER CODE** | EMER. LOAD (Y) | CONT.(C)/ INTT.(I) | STARTING TIME >5 SEC (Y) | LOCATION | BOARD NO. | CABLE | | BLOCK CABLE DRG. No. | CONTROL CODE | REMARKS | LOAD 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 |
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NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)

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

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

| | | | | | | |
|---|---|---|---|---|---|---|
| | LOAD DATA (ELECTRICAL) | JOB NO. | 402 | ORIGINATING AGENCY | | PEM (ELECTRICAL) |
| | | PROJECT TITLE | 2X660 MW ENNORE SEZ STPP | NAME | | DATA FILLED UP ON |
| | | SYSTEM | PRE-TREATMENT PLANT | SIGN. | | DATA ENTERED ON |
| | | DEPTT. / SECTION | ELECTRICAL | SHEET 1 OF 1 | REV. 00 | DE'S SIGN. & DATE |

# ELECTRICAL SCOPE FOR VENDOR AND BHEL

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

**PACKAGES: PRE-TREATMENT PLANT**

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

**PROJECT: 2X660 MW ENNORE SEZ COAL BASED STPP**

| 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<br>a) both end equipment in BHEL's scope<br>b) both end equipment in vendor's scope<br>c) one end equipment in vendor's scope | <br><br>BHEL<br>BHEL<br>BHEL | <br><br>BHEL<br>Vendor<br>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.<br>2. Termination at BHEL equipment terminals by BHEL.<br>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<br><br>100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling | BHEL<br><br>Vendor | BHEL<br><br>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<br>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 | |
| 12 | LT Motors with base plate and foundation hardware | Vendor | Vendor | Makes shall be subject to customer/ BHEL approval at contract stage. |

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

**PACKAGES: PRE-TREATMENT PLANT**

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

**PROJECT: 2X660 MW ENNORE SEZ COAL BASED STPP**

| S.NO | DETAILS | SCOPE SUPPLY | SCOPE E&C | REMARKS |
|---|---|---|---|---|
| 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)<br>b) Cable interconnection details for above<br>c) Cable block diagram | Vendor<br>Vendor<br>Vendor | -<br>-<br>- | 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.

## SECTION – C3

## (SPECIFIC TECHNICAL REQUIREMENTS FOR C&I)

## 1.0 SCOPE OF SUPPLY

Instrumentation (Minimum) as shown in the flow diagram, however any additional instrumentation required to complete the system will be in bidder's scope. All required piping, tubing and wiring for instrumentation including fittings, support and other accessories.

- Instruments (Transmitter, Indicator, Gauges, Switches, Analysers, Actuators, etc) as indicted in enclosed P&ID **PE-V0-412-158-A001.**
- Any other instrument not listed but required to complete the system.

## 2.0 CONTROL PHILOSOPHY (PROCESS INSTRUMENTATION, CONTROL AND INTERLOCKS):

i) The operation of the Pre-Treatment Plant shall be done from DDCMIS based. Two no. OWS, one no. Operating cum engineering station with one no. A3/A4 size colour LJP shall be provided provided by BHEL. In addition Backup control desk with coloured Mimic, H.W. Annunciator, P.B. Ammeters, parameters Indicators, recorders and indication Lamps, Ammeters shall also be provided by BHEL. Separate Local control panel is not envisaged.
ii) A mimic with the status of drives including ON, OFF, TRIP indication of respective motors/pumps and control valve shall be provided on the OWS of DDCMIS.
iii) All the dosing pumps shall be capable of being adjusted manually to any output with in the stated range.
iv) All pumps shall trip at level low in respective tanks or Sumps.
v) All remote indications from instruments as per P & ID such as raw water flow transmitter, opening / closing status and percentage positioning indicator for inlet motor operated flow control valve, level indicating controller for Clarified Water Tank etc. shall be available on the OWS.
vi) Detailed control write-up of PT Plant shall be submitted after placement of order on PT plant vendor.
vii) Alarm annunciations as per P & ID & as per system requirement and trip annunciation of all drives shall be displayed on OWS.
viii) Local Start/Stop facility from individual pump shall be provided.
ix) The dosing of chemical at various stages of process shall be controlled through Stroke controller in local through Stroke adjustment. The command for the same shall be issued from OWS of DDCMIS.
x) The following pumps shall be started and stopped from DDCMIS.
xi) Alum dosing pumps.
xii) Lime dosing pumps
xiii) PE dosing pumps.
xiv) Naocl dosing pumps.
xv) Sludge transfer pump.
xvi) Suitable arrangement by adjustable timers shall be provided for sludge blow down valve of Clarifier with the provision for manual intervention and adjustment independently.
xvii) Provisions for data transfer with reference to important parameters related with Pre Treatment Plant from PT Plant DDCMIS to main plant DDCMIS shall be made through soft link through OPC on Fiber optic.
xviii) All pumps and agitators shall trip at level low in respective tanks.
xix) Alarms pertaining to Clarified water tank- Very High (VH), High (H), Low (L), Very Low (VL) shall be included in PT plant controls.
xx) Torque trip for all the clarifier shall be provided.
xxi) The dosing of chemical at various stages of process shall be controlled through Stroke controller in
xxii) local through Stroke adjustment. The command for the same shall be issued from OWS of DDCMIS.
xxiii) Number of signals / Annunciation shall be provided in DDCMIS and the same shall be decidedDuring Detailed Engineering stage.

## 3.0 SPECIFIC TECHNICAL REQUIREMENTS (C&I)

1. The Contractor shall provide complete Instrumentation for control, monitoring and operation of entire PTP. The requirements given are to be read in conjunction with detailed technical specification enclosed in the specification. Further in case of any discrepancy in the requirement noted by the bidder in the specification, the same will 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 BHEL's interpretation shall be complied by the bidder during contract stage without any commercial implication to BHEL.

2. The instrumentation to be provided for PTP shall be as per the technical specification document / drawings wherever provided for the respective systems as a minimum requirement for bidding purpose. However for completeness of the system and its associated equipment, Bidder shall also provide all the necessary instruments to the process requirement even if it is not specifically indicated in the given technical Specification document / drawings. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any technical, commercial and delivery implication to BHEL.

3. The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable.

4. All the instruments/equipment/electrical items shall be provided & designed with maximum star rating as available in line with energy conservation policies notified by BEE, GOI at the time of supply.

5. Instruments shall be suitable for sea or saline water application. MOC of impulse tubing & impulse pipe shall be CPVC (3/8") Sch 80 or better, Industrial grade up to manifold. MOC of impulse tubing, fittings (from manifold to instrument) and manifold shall be super duplex SS in case of sea water applications.

6. The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg / Cm2.

7. All the instruments/drives shall be terminated on JBs in field. JBs shall be in Bidder's scope. Bidder to consider minimum 5 nos. of JBs.

8. All local gauges, transmitters and switches shall be mounted on suitable enclosures, racks subject to owner's approval. The same shall be in Bidder's scope. All transmitters shall be HART compatible.

9. All the instruments indicated in PID are minimum requirement and it is mandatory to use sensors/signals/measurements with 1 out of 2 logics for all control & interlock (Analog & Binary) application/service as explained below: Dual sensors shall be provided for instruments required for auto starting of LT driven pumps or LT driven pump tripping due to very low level of water/ discharge pressure very low. Dual measurement shall be employed for the measurements used for analog control functions.

10. All the instruments/ sensors/transmitters/switches meant for redundant applications shall have completely separate and independent impulse pipes/ root valves etc. No redundant instrument shall share a single process tapping. There will be separate and independent tapping for every individual instrument.

11. Doppler effect type flow meters shall be used for sludge applications.

12. DP instruments with min. Capillary length of 15m to be supplied in case of Installation in pit.

13. Instrument installation shall be as per the attached "Standard Hook-up diagram of instrument."

14. All motorised valves of 200NB or more than 200NB size shall be provided with integral motorized bypass valves on all process lines.

15. All motorised actuator shall be provided with conventional actuators with integral starter for ON/OFF valves. Non-contact type electronic 2- wire position transmitters shall be provided for all inching type motorised valves. The detailed specification is attached elsewhere in the specification.

16. Valve end position (Open & Close) shall be monitored for the manual critical valves, wherever provided.

17. Bidder to comply with codes and standards as mentioned in the specification.

18. Bidder must offer general tools and tackles and special calibration instruments required during start-up, trial run, operation and maintenance of the system.

19. All approval/Inspection are to be carried out by Owner or owner appointed agency only.

20. Bidder shall provide erection hardware as per installation drawings.

21. Bidder to provide mandatory spares as per mandatory spares list attached elsewhere in the specification.

22. Bidder to perform tests of C&I items/instruments/systems as per Quality plans/type test attached in the specification.

23. Power Supply Requirement: Power supply for instruments, analysers etc. shall be provided at a single point which shall be decided during detail engineering. Further any electrical distribution shall be in bidder's scope. Any other voltage requirement for instruments, analysers etc. to be arranged/derived by bidder by providing suitable control transformer.

24. All cables terminated in the terminal block, power distribution scheme instruments shall be ferruled. Ferruling shall be double cross ferruling (i.e.) source and destination addresses shall be marked on both sides of the tube ferruling.

25. Scope of Instrumentation cables (Screened Control Cables), Fibre Optic cable & Control cables shall be as per Electrical Cable scope matrix in Electrical portion of specification.

26. Number of pairs to be selected for Instrumentation cable (Size: 0.5 mm2):
a) F-Type: 2P/4P/8P/12P/24P
b) b) G-Type: 4P/8P/12P

27. Number of cores to be selected for Control cable (Size: 2.5 mm2):
a) 3 Core
b) 5 Core
c) 12 Core

28. Each pneumatic device requiring air supply and intended for field mounting shall include a filter regulator air set with gauge, to owner's approval.

29. Bidder's presence is required for 3 Man days (Excluding travel time) at EDN Bangalore during FAT of DDCMIS for certifying correctness & completeness of implementation of Control logic. Intimation to attained FAT shall be informed in 2 days advance. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.

30. Contractor's C&I representative shall be present at BHEL-PEM for 3 man days, for preparation of Control scheme of PTP. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.

31. Bidder's presence is required for 15 Man days (in three visit) at site during commissioning of DDCMIS for assistance related to process correctness. Three visit with total 15 Man days (Excluding travel time) in which one visit shall be of 5 Man days each. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.

32. Bidder to ensure participation of their senior personnel and experts in discussions with Owners and other equipment bidders during various stages of contract implementation as required by the Owner.

**SECTION-D**

**(GENERAL TECHNICAL REQUIREMENT)**

**SECTION-D1**

**(GENERAL TECHNICAL REQUIREMENT FOR MECHANICAL)**

## 1.0 SYSTEM DESCRIPTION PRE-TREATMENT PLANT (Ref. Drg. no. PE-V0-412-158- A001):

Pre-Treatment Plant (PTP) shall receive Raw Water (Sea Water Analysis) as per the analysis given in **TABLE – A.** PTP shall mainly consist of equipment such as inlet flow control station, cascade aerator, stilling chamber, parshall flume, clarifloculators, alum dosing system, Lime Dosing System, polyelectrolyte dosing system, Chlorine (NaOCl) Dosing system, sludge sumps and pumps, sludge transfer system to Guard Pond (at ETP).

The major technical parameters of this equipment are listed in Data Sheet-A.

The stream has one number inlet (regulating) valve to regulate inlet flow entering the cascade aerator to stilling chamber. Water from the stilling chamber where Sodium Hypochlorite (Chlorine) @ 5 ppm is dosed is passed through parshall flume. The flow after parshall flume goes to a distribution chamber to clarifloculators where FeCl3 @ 40 ppm**, Lime @10 ppm** and Coagulant aid (Polyelectrolyte) @1 ppm** may also be dosed if necessary. The sludge from the clarifiers collected by gravity into a sludge sump. From the sludge sump the sludge is pumped to Guard pond (located at ETP). One number telescopic type continuous bleed and intermittent bleed through valve per clarifloculator on sludge line from clarifier to sludge sump shall be provided.

A chemical house is located near the clarifiers with FeCl3, Lime, polyelectrolyte dosing systems and Potable water Hypo chlorite Dosing system (commercial grade) and MCC room. The solution preparation tanks are on the first floor and space for storage of chemicals and MCC room are on the ground floor.

The clarified water shall be stored in the clarified water storage tank for various uses in the power plant.

**** NOTE: FINAL DOSING RATE SHALL BE DECIDED AT SITE BY JAR TEST METHOD.**

**SECTION-D2**

**(GENERAL TECHNICAL REQUIREMENT FOR ELECTRICAL)**

# STANDARD SPECIFICATION FOR LV MOTORS

# GENERAL TECHNICAL REQUIREMENTS

# FOR

# LV MOTORS

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

## 1.0 INTENT OF SPECIFIATION

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

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

## 2.0 CODES AND STANDARDS

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

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

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

## 3.0 DESIGN REQUIREMENTS

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

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

### 3.3 Starting Requirements

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

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

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

3.3.3 The following frequency of starts shall apply

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

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

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

3.4 **Running Requirements**

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

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

3.5 **Stress During bus Transfer**

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

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

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

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

4.0 **CONSTRUCTIONAL FEATURES**

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

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

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

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

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

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

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

4.7 **Terminals and Terminal Boxes**

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

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

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

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

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

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

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

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

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

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

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

4.9 **General**

4.9.1 Motors provided for similar drives shall be interchangeable.

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

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

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

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

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

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

## 5.0 INSPECTION AND TESTING

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

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

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

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

## 6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

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

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

# BASIC TECHNICAL FEATURES OF LT AND HT MOTORS

# BASIC TECHNICAL FEATURES

# FOR HT/LT MOTORS

# (FOR BHEL-PEM SCOPE PACKAGES)

| REV | DATE | ALTD | CHD | APPD |
|---|---|---|---|---|
| 02 | 13.05.15 | RKG/ AB | SL | RG |

REVISED AS PER TANGEDCO COMMENTS DATED 10.04.2015

| REV | DATE | ALTD | CHD | APPD |
|---|---|---|---|---|
| 01 | 13.03.15 | BKR -SD- | SL -SD- | RG -SD- |

REVISED AS PER TANGEDCO COMMENTS DATED 13.02.2015

| | | |
|---|---|---|
| PROJECT | 2X660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS,CHENNAI | |
| OWNER | TAMIL NADU GENERATION & DISTRIBUTION CORPOARATION LIMITED | |
| OWNER'S CONSULTANT | DESEIN PRIVATE LIMITED, DESEIN HOUSE,NEW DELHI | |
| EPC CONTRACTOR | BHARAT HEAVY ELECTRICALS LIMITED POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA(U.P) INDIA | |

BHARAT HEAVY ELECTRICALS LTD.
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

| DEPT CODE | | NAME | SIGN | DATE |
|---|---|---|---|---|
| E | DRN | BKR | | |
| | DSGN | BKR | -SD- | 13.01.15 |
| | CHD | SL | -SD- | 13.01.15 |
| | APPD | RG | -SD- | 13.01.15 |

TITLE: BASIC TECHNICAL FEATURES FOR HT/LT MOTORS

DRAWING NO. PE-DC-412-565-E003

SHEET 1 OF 7 REV. 02

1.0 This document covers the basic technical features of high tension (HT) and low tension (LT) squirrel cage induction AC motors employed for driving auxiliaries of BHEL-PEM scope packages in **2 x 660 MW ENNORE SEZ STPP.**

2.0 CODES AND STANDARDS

**The motors shall generally conform to IS 325/IEC-60034. LT motors above 10 kW with continuous duty (S1) shall be energy efficient ~~IE2~~ IE3 conforming to IS-12615: 2011.**

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 |
|---|---|---|
| Above 1500 kW | 11 KV | 11 KV |
| Above 160 kW up to & including 1500 kW | 3.3 KV | 3.3 KV |
| From 200W up to & including 160 kW | 415 V | 415 V |
| Below 200W | 240V | 240V |

3.2.1 Supply voltage & variations shall be as follows:-

Voltage variation (AC Supply) (+/-) 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 degree C and relative humidity of 85%. Maximum continuous motor ratings shall have at least a 10% margin above the maximum load demand of the driven equipment under entire operating range including voltage & frequency variation.

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% of the motor's full load torque.

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

Minimum Starting Voltage requirement for all motors (except mill motors):

1. 85 % of rated voltage for motors up to 1000 kW
2. 80 % of rated voltage for above 1000 kW and up to 4000 kW
3. 75 % of rated voltage for above 4000 kW

3.4.3 The locked rotor current of the HV (11 kV) motors (except MDBFP motors) shall not exceed 650% of full load current inclusive of tolerance as per IS: 325 and for MV (3.3 kV) motors locked rotor current shall not exceed 700% of full load current inclusive of tolerance as per IS: 325. For LT motors (except energy efficient motors) locked rotor current shall not exceed 700% of full load current inclusive of tolerance as per IS: 325. For LT energy efficient motors above 10kW with S1 duty, locked rotor current shall be as per IS: 12615-2011.

3.4.4 The following frequency of starts shall apply to HV (11 kV), MV (3.3 kV) & LT motors

i) Two nos. consecutive cold starts in quick succession with third start after 5 minutes in cold condition.

ii) Two nos. consecutive hot starts in the interval of 15 minutes in hot condition.

3.4.5 Locked motor withstand time of motors under hot condition at highest voltage limit shall be as follows:

a) For motors with starting time up to 20 sec.

- at least 2.5 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. For motors and in cases where 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.

3.5 Running Requirements

3.5.1 Motors shall run satisfactorily at a supply voltage of 80% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.5.2 Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.

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

The maximum noise level for motors shall be in line with IS 12065.

3.8 Vibration

The maximum vibration for motors shall be in line with IS: 12075.

**3.9** Crane duty motors will be of squirrel cage induction motor and shall suit the duty class S4, cyclic duration factor 40% and 300 starts. Crane duty motors shall be provided with VVFD for speed control.

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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 motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Canopy shall be provided for outdoor motors. CW motors (in case of screen prot. Drip proof) shall conform to degree of protection IP: 23 as per IS: 4691. The degree of protection for terminal boxes shall be IP 55 for outdoor area & IP 54 for indoor area as per IS 4691.

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.

4.2 Enclosure and Cooling

4.2.1 Motors shall generally have totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) enclosures or Closed Air circuit Air (CACA), the method of cooling conforming to IC-0141 or IC-0151 or IC-0161 of IS: 6362 up to 3000 kW motor. CW Motors may be screen protected drip proof (SPDP).

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.

4.3 Class of Insulation

HV/MV/LT motors shall have class F insulation. The temperature rise of all motors 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 Horizontally mounted motors shall have grease lubricated ball/roller or sleeve bearings. For HV/MV motors, the bearings shall be regreasable type and for LV motors, these bearings can be either sealed life lubricated type or regreasable type as per manufacturer's standard.

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 equipment 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 below 15 kW shall be provided with sealed ZZ bearing.

4.4.6 Motors rated above 1000kW shall be provided with insulated end shield on non-driving end to prevent flow of shaft current.

4.5 Terminals and Terminal Boxes

4.5.1 Motors of rating 90 kW and up to 160kW will be controlled by air circuit breaker with numerical protection. For all motors of rating up to 90kW shall be provided with MCCBs. The terminal box of motors for HV (11 kV), MV (3.3 kV) & LT motors shall be designed for the maximum fault current for a duration of at least 0.25 secs. 11kV & 3.3kV motors terminals shall be able to withstand 44kA for 0.25 seconds.

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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 For HV/MV motors, the main terminal box shall be of phase-segregated type with clamping arrangement for the terminals.

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

4.5.5 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.

4.5.6 Motor terminals and terminal leads shall be fully insulated with no bar live parts.

4.5.7 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 of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non-magnetic material for single core cables) with double compression tinned brass glands shall be provided in terminal boxes.

4.5.8 Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 180 and 90 degree for HT and LT motors respectively.

4.5.9 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. 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.

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 Fuel oil unloading and drain oil pumps located in hazardous areas shall be with flame-proof enclosures in accordance with IS 2148 / IEC 60079.

a) Fuel oil area: Group - IIB.

b) Hydrogen generation plant area: Group - IIC

4.8 Neutral terminal box of motors rated 1000kW and above shall provision of mounting Neutral CTs of PS class identical to the CTs to be provided at switchgear end. Further the neutral terminals of HV motors rated below 1000kW shall be accessible. 1

5.0 ACCESSORIES

5.1 SPACE HEATERS

All motors rated 30KW and above 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.

5.2 RESISTANCE TEMPERATURE DETECTORS (RTDs)

5.2.1 HV/MV motors stator windings shall be provided with 12 nos. Simplex 3 wire Platinum RTDs with 100 ohms resistance at 0 deg C for remote monitoring of winding temperature. The leads from RTDs of each motor shall be brought out to a separate terminal Box.

5.2.2 For HV/MV motors, each bearing shall be provided with 1 no. Duplex 3 wire Platinum RTDs with 100 ohms resistance at 0 deg C for remote monitoring of bearing temperature. The leads from these RTDs shall be brought out to a separate terminal Box or the terminal box same as for winding RTDs.

5.3 DIAL TYPE TEMP. INDICATORS

5.3.1 For HV/MV motors, each bearing shall be provided with dial type thermometer with adjustable alarm contact and resistance type temperature detector. The indicators shall have 2 nos. NO contacts rated for 5A, 240 V AC and 0.5 A, 220 V DC for alarm/trip purpose.

5.4 Vibration monitoring pads

5.4.1 Provision shall be made in all HV/MV motors for mounting vibration detectors.

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

Motor including fan shall be painted with corrosion proof paints of colour shade Siemens grey (RAL 7032).

8.0 TESTING

8.1 Type Tests

For HT & LT Motors, type test reports for type tests as per IS: 325/ IS: 12615 conducted on equipment similar to those proposed to be supplied and carried out within last five years 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 in the presence of customer or customer representative.

# MOTOR DATA SHEET-A

# SPECIFIC ELECTRICAL REQUIREMENT

| SL.NO. | PARAMETERS | UNIT | ENNORE |
|---|---|---|---|
| | **MOTOR** | | |
| 1 | DESIGN AMBIENT TEMP | DEG. C | 50 |
| 2 | VOLTAGE SUPPLY AND VARIATION | VOLT | 415V, ± 10% |
| 3 | FREQUENCY WITH VARIATION | Hz | 50 (+) 3% to (-) 5% |
| 4 | COMBINED VOLTAGE & FREQUENCY VARIATION | | 10% |
| 5 | MAX ACCEPTABLE RATING OF MOTOR AT 415 V | KW | 160 kW |
| 6 | SYSTEM FAULT LEVEL AND ITS DUARTION | KA | 50 KA, 1 Sec |
| 7 | SUTABILITY OF TERMINAL BOX FOR FAULT LEVEL AND DURATION | | 50 KA, 0.25 sec |
| 8 | CLASS OF INSULATION & TEMP RISE LIMITED TO | | Class-F and temp rise limited to Class-B |
| 9 | MIN. STARTING VOLTAGE | | 85% |
| 10 | MOTOR RATING FOR SINGLE PHASE SUPPLY | | Upto 200W |
| 11 | MAXIMUM LOCKED ROTOR CURRENT | % OF FLC | For LT motors (except energy efficient motors) locked rotor current shall not exceed 700% of full load current inclusive of tolerance as per IS: 325. For LT energy efficient motors above 10kW with S1 duty, locked rotor current shall be as per IS: 12615-2011. |
| 12 | ACCEPTABLE NOISE LEVEL | DB | 85dB at 1.0m in line with IS 12065 |
| 13 | TYPE OF STARTER PROVIDED IN MCC | | DOL |
| 14 | DOP OF ENCLOSURE | | Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor 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 for outdoor area & IP 54 for indoor area as per IS 4691. |
| 15 | SPACE HEATER REQUIREMENT | | 30KW & ABOVE |
| 16 | PAINT SHADE | | Shall be confirmed during detailed engineering. |
| 17 | SPECIAL REQUIREMENT | | For HT & LT Motors, type test reports for type tests as per IS: 325/ IS: 12615 conducted on equipment similar to those proposed to be supplied and carried out within last five years 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.<br><br>All motors shall be subjected to routine tests as per IS: 325 / IS: 12615.<br><br>The motors shall generally conform to IS: 325 / IEC-60034. |

# MOTOR DATA SHEET-C

| 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 | |

| 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**<br>(To be enclosed for motors of rating ≥ 55KW) | |
| | a) Torque speed characteristic | |
| | b) Thermal withstand characteristic | |
| | c) Current vs time | |
| | d) Speed vs time | |

# QUALITY PLAN FOR AC MOTORS BELOW 55 KW (LV MOTORS)

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

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

| | QUALITY PLAN | CUSTOMER : | PROJECT TITLE | SPECIFICATION : NUMBER : |
|---|---|---|---|---|
| | | BIDDER/ VENDOR : | QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01 | SPECIFICATION : TITLE : |
| | SHEET 2 OF 2 | SYSTEM | ITEM AC ELECT. MOTORS BELOW 55KW (LV) | SECTION VOLUME III |

| SL. NO. | COMPONENT/OPERATION | CHARACTERISTICS CHECK | CAT. | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY P | AGENCY W | AGENCY V | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 10 | 10 | 11 |
| | | 3.NAMEPLATE DETAILS | MA | VISUAL | 100% | IS-325 & DATA SHEET | IS-325 & DATA SHEET | INSPN. REPORT | 2 | 1 | - | |

NOTES:

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

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

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

Legends for Inspection agency

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

P. PERFORM
W. WITNESS
V. VERIFY

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

# CABLE SCHEDULE FORMAT

**Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.**

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
    a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
    b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
    f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
    g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

| A | NN | A | NNN |
|---|---|---|---|
| \| | \| | \| | \| |
| Cable Voltage Code (see B below) | No. of cores (e.g. 01,03,3H, 07) | Cable code (See C below) | Cable size (e.g. 035,185,2.5, 0.5) |

(A) SYSTEM VOLTAGE CODES:

(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V

(dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) CABLE VOLTAGE CODES:

A = 11KV (Power cables)

**Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.**

B = 6.6KV (Power cables)
C = 3.3KV (Power cables)
D = 1.1KV (LV & DC system power & control cables)
E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

| | |
|---|---|
| A = Armoured FRLS | B = Armoured Non-FRLS |
| C = unarmoured FRLS | D = Unarmoured Non-FRLS |

PVC Aluminium

| | |
|---|---|
| E = Armoured FRLS | F = Armoured Non-FRLS |
| G = unarmoured FRLS | H = Unarmoured Non-FRLS |

XLPE Copper

| | |
|---|---|
| J = Armoured FRLS | K = Armoured Non-FRLS |
| L = unarmoured FRLS | M = Unarmoured Non-FRLS |

XLPE Aluminium

| | |
|---|---|
| N = Armoured FRLS | P = Armoured Non-FRLS |
| Q = unarmoured FRLS | R = Unarmoured Non-FRLS |

S = FIRE SURVIVAL CABLES
T = TOUGH RUBBER SHEATH
U = OVERALL SCREENED
V = PAIRED OVERALL SCREENED
W = PAIRED INDIVIDUAL SCREENED
Y = COMPENSATING CABLES
I = PRE-FABRICATED CABLES
Z = JELLY FILLED CABLES

**CABLE SCHEDULE FORMAT** **ANNEXURE III**

| UNITCABLENO | FROM | TO | PURPOSE | CABLE SCOPE (BHEL PEM/ VENDOR) | REMARKS | CABLESIZE | PATHCABLENO | TENTATIVE CABLE LENGTH |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

**SECTION-D3**

**(GENERAL TECHNICAL REQUIREMENT FOR C&I)**

# DATA SHEET FOR MOTORIZED VALVE

FORM NO. PEM-6666-0

| | | |
|---|---|---|
| | **Data Sheet FOR MOTORISED VALVE ACTUATOR** | SPECIFICATION NO.: PE-ID-412-145-I902 |
| | | VOLUME II B |
| | | SECTION D |
| | | REV. NO. 01 DATE: 04.07.15 |
| | | 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 | 2x 660 MW ENNORE STP | |
| | OFFER REFERENCE | | |
| | * TAG NO. SERVICE | | |
| | * DUTY | ☐ ON / OFF ☐ INCHING | |
| | * 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:68 | |
| | MECHANICAL POSITION INDICATOR | TO BE PROVIDED FOR 0-100% TRAVEL | |
| | BEARINGS | DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION. | |
| | GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION | METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED. | |
| | SIZING | OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. **FOR INCHING SERVICE - 150 STARTS/HR MINIMUM & FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM.** | |
| **HANDWHEEL** | * REQUIRED | ■ YES ☐ NO | |
| | * ORIENTATION | ☐ TOP MOUNTED ☐ SIDE MOUNTED | |
| | *TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION. | | |
| **ELECTRIC ACTUATOR** | ACTUATOR MAKE/MODEL | BIDDER TO SPECIFY | |
| | MOTOR MAKE / MODEL / TYPE / RATING (KW) | BIDDER TO SPECIFY | |
| | @ MOTOR TYPE | SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT-INCLUSIVE OF **I.S.** TOLERANCE | |
| | ACTUATOR APPLICABLE WIRING DIAGRAM | ☐ ENCLOSED (BIDDER TO CONFIRM)<br>A: ☐ DRG. NO. 3-V-MISC-24227 R00<br>B: ☐ DRG. NO. 3-V-MISC-24550 R00<br>C: ☐ DRG. NO. 3-V-MISC-24283 R00<br>D: ☐ DRG. NO. 4-V-MISC-90271 R11<br>E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram | |
| | COLOUR SHADE | ☐ BLUE (RAL 5012) ☐ DURING DETAIL ENGG. | |
| | PAINT TYPE **(## Refer Notes)** | ☐ ENAMEL ■ ☐ EPOXY ☐ ..... | |
| | SHAFT RPM | BIDDER TO SPECIFY | |
| | OLR SET VALUE | BIDDER TO SPECIFY | |
| | @ STARTING / FULL LOAD CURRENT | BIDDER TO SPECIFY | |
| | NO. OF REV FOR FULL TRAVEL | BIDDER TO SPECIFY | |
| | @ PWR SUPP TO MTR / STARTER | 415V, 3PH, AC | |
| | @ CONTROL VOLTAGE REQUIREMENT | TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V | |

| | SPECIFICATION FOR MOTORISED VALVE ACTUATOR | SPECIFICATION NO.: PE-ID-412-145-I902 | |
|---|---|---|---|
| | | VOLUME II B | |
| | | SECTION D | |
| | | REV. NO. 01 | DATE: 04.07.15 |
| | | SHEET 2 OF 3 | |

## Data Sheet A & B

| | | DATA SHEET-A (TO BE FILLED BY PURCHASER) | DATA SHEET-B (TO BE FILLED-UP BY BIDDER) |
|---|---|---|---|
| | @ ENCLOSURE CLASS OF MOTOR | ☐ IP 67 ☐ FLAME PROOF | |
| | @ INSULATION CLASS | CLASS-F TEMP. RISE LIMITED TO CLASS-B | |
| | @ WINDING TEMP PROTECTION | ■ THERMOSTAT (3 Nos.,1 IN EACH PHASE)<br>☐ ---------- | |
| | SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION | REQUIRED | |
| **INTEGRAL STARTER** | INTEGRAL STARTER | ■ REQUIRED ☐ NOT REQUIRED | |
| | TYPE OF SWITCHING DEVICE | ■ CONTACTORS ☐ THYRISTORS | |
| | TYPE | ■ CONVENTIONAL ☐ SMART (NON-INTRUSIVE) | |
| | STEP DOWN CONT. TRANSFORMER | ■ REQUIRED | |
| | OPEN / CLOSE PB | ■ REQUIRED ☐ NOT REQUIRED | |
| | STOP PB | ■ REQUIRED ☐ NOT REQUIRED | |
| | INDICATING LAMPS | ■ REQUIRED ☐ NOT REQUIRED | |
| | LOCAL REMOTE S/S | ■REQUIRED ☐ NOT REQUIRED | |
| | STATUS CONTACTS FOR MONITORING | ■ REQUIRED ☐ NOT REQUIRED | |
| | INTEGRAL STARTER DISTURBED SIGNAL | REQUIRED (MOTOR THERMOSTST TRIP,O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, PHASE LOSS, S/S IN LOCAL/OFF MODE, STOP PB OPTD, TORQUE OPEN/CLOSE CUTOFF) 1 | |
| **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<br>☐ > _____ohms - < _____ohms | |
| **TORQUE SWITCH** (Not Applicable for Smart Actuator) **($$ Refer Notes)** | MFR & MODEL NO. | BIDDER TO SPECIFY | |
| | OPEN / CLOSE | ■1 No. ☐2Nos. / ■1 No. ☐2Nos | |
| | CONTACT TYPE | 2 NO + 2 NC | |
| | RATING | 5A 240V AC AND 0.5A 220V DC | |
| | CALIBRATED KNOBS(OPEN&CLOSE TS) | REQUIRED FOR SETTING DESIRED TORQUE | |
| | ACCURACY | +3% OF SET VALUE | |
| **LIMIT SWITCH** (Not Applicable for Smart Actuator) **($$ Refer Notes)** | MFR & MODEL NO. | BIDDER TO SPECIFY | |
| | OPEN : INT : CLOSE | ☐1 No ■2 Nos. / 2 Nos. (ADJ.) / ☐1 No. ■2Nos. | |
| | CONTACT TYPE | 2 NO + 2 NC | |
| | RATING (AC / DC) | 5A 240V AC AND 0.5A 220V DC | |

| | Data Sheet FOR MOTORISED VALVE ACTUATOR | SPECIFICATION NO.: PE-ID-412-145-I902 | |
|---|---|---|---|
| | | VOLUME II B | |
| | | SECTION D | |
| | | REV. NO. 01 | DATE: 04.07.15 |
| | | SHEET 3 OF 3 | |

## Data Sheet A & B

| | | DATA SHEET-A (TO BE FILLED BY PURCHASER) | DATA SHEET-B (TO BE FILLED-UP BY BIDDER) |
|---|---|---|---|
| **POSITION TRANSMITTER** | POSITION TRANSMITTER (For inching duty & other specific applications) | ■ REQUIRED ☐ NOT REQUIRED | |
| | MFR & MODEL NO. | BIDDER TO SPECIFY | |
| | TYPE | ☐ ELECTRONIC (2 WIRE) R/I CONVERTER<br>■ ELECTRONIC (2 WIRE) CONTACTLESS | |
| | SUPPLY | ■ 24V DC ☐ ..... | |
| | OUTPUT | ■ 4-20mA | |
| | ACCURACY | ± 1% FS | |
| **SPACE HEATER** | @SPACE HEATER | REQUIRED | |
| | @ POWER SUPPLY (NON INTEGRAL) | 230V AC,1 PH.,50 Hz | |
| | @ POWER SUPPLY (INTEGRAL) | BIDDER TO SPECIFY | |
| | @ RATING | | |
| **TERMINAL BOX** | ACTUATOR/MOTOR TERMINAL BOX | REQUIRED | |
| | ENCL CLASS ACTUATOR/MOTOR T.B. | @■ IP 68 @☐..... | |
| | @ EARTHING TERMINAL | REQUIRED | |
| | PLUG & SOCKET(9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT) | ☐REQUIRED ■ NOT REQUIRED☐<br>☐ 2 NOS. ☐ ---------- | |
| **CABLE GLANDS** | @ POWER CABLE GLAND | SIZE:---------- | |
| | @ SPACE HEATER CABLE GLAND | SIZE:---------- | |
| | OTHER CONTROL CABLE GLANDS | QUANTITY & SIZE :Cable gland suitable for 8Px0.5 sq mm & 2P x 0.5 sq mm Cable. | |
| **WEIGHT** | TOTAL WEIGHT (ACTUATOR + ACCESSORIES) | BIDDER TO SPECIFY | _____ Kg. |

**NOTES**:

1. **SCOPE**: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
2. **CODES & STANDARDS**: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATION STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
   IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
3. ACTUATOR SHALL HAVE HARDWIRED CONTACTS FOR FOLLOWING SIGNALS (a) ACTUATOR IN LOCAL MODE (b) ACTUATOR IN REMOTE MODE.
4. BIDDER TO ENSURE AVAILABILITY OF SPARE 1NO + 1NC LIMIT SWITCH & TORQUE SWITCH. 1
5. SS TAG NAME PLATE SHALL BE PROVIDED.
6. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
7. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, Ni PLATED BRASS MATERIAL SHALL BE PROVIDED.
8. 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.
9. 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%.
10. 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.**

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

# DATA SHEET FOR MEASURING INSTRUMENT

## CHAPTER-3

## FIELD AND MEASURING INSTRUMENTS

### 3.00.00 FIELD & MEASURING INSTRUMENTS (PRIMARY & SECONDARY INSTRUMENTS)

### 3.01.00 GENERAL REQUIREMENTS

**3.01.01** Instruments, control devices and other equipment accessories covered under this specification shall be furnished in accordance with I&C specification sheets and drawings enclosed herewith and the requirements of all applicable clauses of this specification.

**3.01.02** The instrumentation and control equipment shall conform to all applicable codes and standards including those referred in Cl. no. 1.08.00 in this Volume. All equipment and systems shall also fully comply with the design criteria stated in chapter-2 of this part.

**3.01.03** The instrumentation/control equipment and accessories shall be from the latest proven design for which the performance and high availability have been demonstrated by a considerable record of successful operation in power station service for similar applications. The bidder shall furnish sufficient evidence to fully satisfy the Owner in this regard.

**3.01.04** For plug in type instruments, The plug & sockets shall be polarized to prevent wrong connections and have facility for secure coupling in plug-in position to prevent loose connections.
Signal/Electrical connection shall be screwed connection with double compression type Nickel-plated brass cable glands for Explosion proof area, Flame proof area and high vibration prone area.

**3.01.05** Every instrument requiring power supply shall be provided with a pair of easily replaceable glass cartridge fuse of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.

**3.01.06** All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved. The enclosures of all electronic instruments shall conform to IP-65 unless otherwise specified (Explosion proof for NEC article 500, class 1, Division 1 area & flame proof) and an anti corrosive paint shall be applied to the field mounted enclosures / instruments. All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland. Gaskets, Fasteners, Counter and mating flange shall also be included wherever required with the field instruments.

3.02.00 Following minimum requirement of field instruments shall be fulfilled by Bidder ( In addition, Redundancy criteria for field instruments shall be as specified elsewhere in specification): -

i. Level switches / pressure switches / flow switches/any other process switches etc. for OLCS / Alarms / Interlocks / Protection. Pressure switches at inlet, outlet

of individual pumps and discharge header of pumps for protection and auto start / stop & alarms.

ii. Level switches for sump/tank level high/normal/ low/very low interlocks.

iii. Level Transmitters (Type as per Owner approval) for open sump/ tank/bunker/vessel/heaters.

iv. Stand pipes on both side of tank for all level instruments (LT, LS & LG).

v. Flow elements with flow transmitter & Flow meter for flow measurement of process medium like Steam, Water, Air, Flue Gas, Fuel oil, open channel liquid, solid fuel, ash flow, DM water, Raw water, Instrument and Service air etc. as decided by owner.

vi. Pressure gauges and temp. Gauges at inlet and outlet of each heat exchanger and cooler.

vii. DPG, DPT & DPS across the filters/strainers.

viii. Tapping points/test points shall be provided.

ix. All primary Instruments, hardwares & JBs etc used for measurement for HFO, LDO & Turbine Lube Oil system shall be flame proof (IEC-79.1, Part I). All primary Instruments, hardwares & JBs etc used for measurement for Hydrogen shall be intrinsically safe and explosion proof as per NEC article 500, class 1, Division 1 area I.

x. All Thermocouples & RTDs shall be Duplex.

xi. All Field Instruments used in acid or alkaline atmosphere shall be with standard Anti corrosion coating i.e. the combination of Polyurethane and epoxy resin baked coating (ANSI/ISA-71.04).

xii. All primary instruments installed at “Minus level or Floor” shall be with protection class of IP 68.

xiii. Transmitters (all type) for monitoring & controls purpose.

xiv Pull cord, belt sway, zero speed switches, emergency stop PB for conveyers, other limit switches, cable gland etc. of CHP which produce spark shall be provided with dust and flame proof enclosure conforming to IS-2148.

xv Lockable Deinterlock switches shall be provided for CHP as per requirement.

xvi Bidder shall provide electronics weighing in motion system as per IS-11547, hermitically sealed load cell of precision strain gauge type,100% over load protection of cell and 250% overload protection for the construction; one calibrator attachment with two weighers.

xvii All field mounted push button, selector switch etc. shall be as per IEC or NEMA 4X protection.

xviii All limit switch shall be conform to IEC-60947-5-1.

xix At APH, **temperature measuring device of different lengths forming grid** shall be provided to have average temperature for variable flow of flue gas, secondary air and primary air. These temperatures may be connected to nearest remote I/O panel.

xx. On both left and right sides of furnace, separate lines shall be laid and provided with **furnace pressure transmitters having wider range** than the furnace pressure transmitter.

xxi. Temp. Transmitters are envisaged with RTD & Thermocouples for monitoring services/application only. However any RTD & Thermocouples are used for control, interlock & protection application, same shall be directly wired to DDCMIS/DCS/PLC using instrumentation & Extension cables respectively.

xxii. As for the water flow/ steam flow measurements, **necessary flow elements/ transmitters are chosen in the process line and supplied such that their algebric summation shall be mass balanced for calculating the system efficiency**.

xxiii. Contacts less, electronic 2-wire position transmitters shall be provided for all inching type motorised valve and dampers.

xxiv. For CW sump level, Raw water reservoir level, Turbine oil tank, coal bunkers, Ash Silo, LDO/HFO tank, DM water tanks, CS tank, Acid and alkali applications, only non contact type level transmitters like Acoustic, Ultrasonic, Radar based shall be provided by bidders as specified in NIT and as approved by owner.

xxv. Considering the type of application, wireless technology to bring signals to DDCMIS may be adopted by interfacing with OPC gateway to avoid cabling for smart level transmitters specified above at sr. no. xxiv. However Wireless technology as adopted by Bidder shall be reliable and field proven in power plants and same shall be approved by Owner.

xxvi. For Turbine oil, HFO/LDO applications & H2 Gas application, zener protection on power supplies shall be included.

xxvii. Where 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. For HFO, LFO Applications, SS capillary with thin wafer element with ANSI RF flanged ends are to be provided. For hazardous area, explosions proof enclosure as described in NEC article 500 shall be provided.

**FIELD INSTRUMENTS SHALL BE SUPPLIED & OFFERED AS PER DATA SHEETS SPECIFIED BELOW:**

## 3.03.00 TRANSMITTERS, SWITCHES, GAUGES AND PANEL MOUNTED INSTRUMENTS

### 3.03.01 Pressure, Differential Pressure, DP type Level and Flow Transmitters (PT, DPT, LT & FT)

Smart Transmitters of the electronic type shall be furnished.

All Transmitter shall be installed in closed LIE in the boiler area. Similarly transmitter for TG shall also be in LIE except the transmitters located in covered area on TG floor and these shall be mounted in LIR.

Transmitters shall be equipped with mounting brackets suitable for a mounting in transmitter enclosures.

In general, Transmitters are envisaged to be grouped at several places as to be decided during detailed engg. stage. For this purpose, suitable enclosures complete with all tubing, fittings, purge meters, loop cable trays etc. shall be provided.

| | | |
|---|---|---|
| **Type/Construction** | : | Sealed capacitance/ Inductance/ Silicon resonance type |
| **Material** | | |
| - Body | : | Die cast Aluminum with epoxy coating for air & flue gas<br>SS316 for other services |
| - Diaphragm | : | 316 SS |
| - Measurement element | : | Teflon seal |
| - Valves | : | Carbon steel for non-corrosive Applications<br>SS316 for corrosive applications. |
| Output signal | : | 4 to 20 m Amp. DC (Two wires)<br>HART Compatible |
| Local Indicator | : | LCD indicator (5 digit) with scale of Engg. unit |
| Overall Accuracy | : | ± 0.04% or better of Span for BTG package<br>± 0.065% or better of Span for BOP packages<br>± 0.2% or better of span for remote seal type transmitter. |
| Turn down ratio | : | 100:1 in general |
| Stability | : | ± 0.15% of URL for 5 years. |
| Response time | : | 150 msec. |
| Power supply | : | 24V DC nominal |
| Drive capability | : | 600 Ohms nominal |
| Enclosure Class | : | IP-65 (Explosion proof for NEC Class-1, Division 1 area) |
| Span and Zero | : | Locally adjustable, non-interacting |

| | | |
|---|---|---|
| Zero suppression / elevation | : | At least 100% of Span |
| **Connection** | | |
| - Process | : | 1. Half (1/2) inch NPT (F)<br>Quarter (1/4) inch NPT<br>with/without oval flanges |
| - Electrical | : | Suitable for Plug in type connection (Both side of transmitter), unused entry with blind plug. |
| **Accessories** | : | |
| - For Absolute Pressure Transmitters: | | Two (2) valve SS316 manifold |
| - For Gauge & Vacuum pressure transmitter | : | Three (3) valve SS316 manifold |
| - For DP, level & flow transmitter | : | Five (5) valve SS316 manifold |
| - For oil and corrosive liquids | : | Separator diaphragm seals |
| - For all transmitters | : | Mounting bracket |

Manifold should not be mounted on the transmitter, Manifold shall be non integral and standalone type. Snubbers/Pulsation dampners shall be used where the process media is unstable for measurement such as the discharge of a pump. Over range protection shall be used where necessary. The coil syphons & condensate pots shall be used for steam services. Transmitters shall be provided with suitable drain & vent points.

3.03.01.01 Transmitters & other HART based instruments shall be supplied along with 3 Nos. of universal type hand held/portable pressure calibrators. Temperature transmitters shall be supplied along with 3 Nos. of hand held/portable mV source generators.

### 3.03.02 PRESSURE SWITCHES (PS) & DIFFERENTIAL PRESSURE SWITCHES (DPS)

| | | |
|---|---|---|
| Applicable Standards | : | IS3624 - 1966/ISA-RP-8.1 except as modified in spec. |
| Type/Construction | : | Bourdon/Sealed Diaphragm Piston Actuated preferable. Indicators with contacts are not acceptable. |
| **Materials** | | |
| - Bellows | : | 316 SS |
| - Bourdon tube | : | 316 SS |
| - Movement | : | 316 SS |
| - Enclouser | : | Die-cast aluminum with stoved enamel black finish. Epoxy coating shall be provided for corrosive atmosphere. |
| - Protective Diaphragm | : | Teflon |

| | | |
|---|---|---|
| Accuracy | : | ± One (1) percent or better |
| Repeatability | : | ± 0.5(half) percent or better |
| Setting & Differential | : | Adjustable |
| **Contact** | | |
| - Number | : | DPDT /2 SPDT |
| - Type | : | Auto reset with internal Adjustable snap action micro switch |
| - Rating | : | 5 Amp, 240V AC / 0.2 Amp, 220V DC |
| Connection - instrument | : | Half (1/2) inch NPT Male Process |
| Electrical | : | Suitable for Plug in type connection. All the switches are internally connected and brought to the surface with Amphenol male/female connection. Cabling need not terminated inside the switch. Cable ends are to be soldiered in connector and to be inserted for easy maintenance. |
| - Over range protection | : | One Fifty (150) percent of full scale |
| Enclosure Class | : | IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area) |
| **Accessories** | | |
| - 3 / 5 valve manifold | : | As applicable for all switches |
| - Self cleaning type pulsation dampners/Snubber (Material SS316) | : | Pump and compressor discharge lines |
| - Syphon | : | For all steam lines |
| - Protective separating diaphragm | : | For fuel oil & corrosive liquid lines. |
| Mounting | : | Local (in LIE/LIR for BTG package). |

**3.03.03 PRESSURE & DIFFERENTIAL PRESSURE GAUGES (PG & DPG)**

| | | |
|---|---|---|
| Applicable standard | : | IS:3602-1966, IS/3624, ASME B 40.1 |
| Type/Construction | | |
| -760 mm to 1.0Kg/cm2 | : | Bellows/Diaphragm |
| -Above1.0Kg/cm2 | : | Bourdon Tube |
| - Suction side of pumps | : | Compound gauge |
| **Materials** | | |
| - Bourdon tube | : | 316 SS |
| - Bellows | : | 316 SS |
| - Movement | : | 316 SS |
| - Case | : | SS 316/ Die-cast aluminum with stoved enamel black finish. Epoxy coating |

| | | |
|---|---|---|
| | | shall be provided for corrosive atmosphere. |
| - Protective Diaphragm | : | Teflon |
| Dial size | : | 150mm with shatter proof glass |
| Scale Details | : | Graduations in black lines on white dial, on white dial, 270 Deg. pointer deflection scale provided with glass cover. Smallest scale division shall be one (1) percent of full scale value or smaller. Pointer stop for all gauges. |
| Accuracy | : | ± One (1) percent or better |
| Connection - Instrument Process | : | 1/2 inch NPT Male Bottom |
| Mounting | : | Local |
| | : | 1/2 inch NPT Male (Back entry) mounted on local gauge board. |
| Enclosure Class | : | IP-65 or better (Explosion/Flame proof for NEC Class-1, Division 1 area) |

**Accessories**

| | | |
|---|---|---|
| - 3 way needle valve/manifolds | : | For all gauges |
| - Self cleaning type Pulsation dampener/snubber (S316) | : | Pump and compressor discharge lines |
| - Syphon | : | For all steam lines |
| - Protective separating | : | For fuel oil and corrosive liquid lines |

Other particulars

| | | |
|---|---|---|
| - External Zero adjustment | : | For all gauges |
| - Safety device | | |
| Ranges 5 to 20 Kg/cm2 | : | Rubber blow out disc with open front construction. |
| Ranges above 20 Kg/cm2 | : | Neoprene safety diaphragm at the back with solid front construction. |
| - Over range protection | : | One Fifty (150) percent of full scale |
| **Other Requirments** | : | Movement mechanism shall be glycerin filled for oil services & vibration prone area. |
| | : | For Fuel oil & corrosive liquid lines diaphragm type sensors required. Armored capillary of 10 M for Fuel oil & Corrosive liquid service. |

: Contact type pressure gauges are not acceptable for interlock & protection.

: For condensate storage tank the pressure gauge in terms of0-10000 mm wc or suitable range having **dial size of 300mm or bigger size** shall be provided.

3.03.04 **TEMERATURE TRANSMITTERS**

| | | |
|---|---|---|
| Type | : | SMART type configurable from control room through HART protocol (HMS System). |
| Display type | : | Indicating type (5 digit LCD Display), |
| Accuracy | : | ±0.10%, |
| Ambient temperature error | : | 0.1% per 10°C change |
| Output | : | 4-20 mA DC (2 wire system) HART compatible signals for analogue monitoring inputs to the distributed control system (DDCMIS), DCS & PLC. |
| Protection class | : | NEMA 4/IP66 or equivalent degree of protection for enclosure)/ (Explosion/Flame proof for NEC Class-1, Division 1 area)/ flame proof (IEC-79.1, Part I). As applicable). |
| Material of accessories | : | SS316. |
| Stability | : | ± 0.1 % or ± 0.1 deg C of reading (whichever is great) for 2 years in case of RTD inputs and for 1 year in case of Thermocouples inputs. |
| Operating Voltage | : | 16 – 48 V DC |
| Calibration | : | as per NIST monograph 125 for T/C & European Curve Alpha = 0.00385 for RTD . |
| Ref. Junction compensation | : | Provided |
| Span/zero adjustment | : | Locally adjustable, Non interacting |
| Auto calibration | : | Provided |
| Burn out protection upscale | : | Provided |
| Input - output isolation | : | Provided |
| Circuit ungrounded | : | Provided |

Any RTD & Thermocouples shall be directly wired to DDCMIS/DCS/PLC for metal temperature application, bearing & winding temp application only.

The Temperature transmitter shall accept Universal dual inputs of all types of thermocouples & RTD, 0-5V input signals etc.

Temp., Fuel oil temp. measurement as per IBR rules and regulations

### 3.03.10 TEST THERMOWELLS (TW)

| | | |
|---|---|---|
| Applicable Standard | : | ASME PTC 19.3 TW - 2010 |
| Type/Construction | : | Machined from Bar Stock |
| Material | : | 316 SS/F11/F22/F91 |
| Connection | | |
| - Pipe | : | M33 x 2 |
| - Test Instrument | : | To suit test instruments |
| Accessories | : | Plug with chain |
| IBR Certification | : | For high pressure service, Steam Temp., Fuel oil temp. measurement as per IBR rules and regulations<br>Bidder shall provide calculation for thermowell as per ASME – PTC-19.3 TW - 2010. |

Test wells shall be provided on main steam, reheat steam, extraction steam, feed water, condensate, spray water lines and other piping as required to meet ASME test requirements.

### 3.03.11 DIRECT MOUNTED LEVEL TRANSMITTERS (LT)

Displacer type level transmitter shall not be used in the process anywhere in the plant.

### 3.03.12 Ultrasonic Level Transmitter (for Water sump/Tank level, Raw water reservoir level, Cooling water fore bay level measurements)

| | | |
|---|---|---|
| Principle of Operation | : | Detection of reflected ultrasonic pulse |
| Measuring Ranges | : | Up to 30 meters (typical) |
| Signal Processing | : | Microprocessor Controlled Signal Processing |
| Operating Freq. | : | 10 KHz to 50 KHz (typical) |
| Display | : | Head mounted alpha-numeric back lit LCD/LED |
| Calibration & Configuration | : | Accessible from front of panel & HART calibrator. |
| Diagnosis | : | On-line |
| Status | : | For power, Hi / Lo / V. Hi / V. Lo-level indication, fault etc. |
| Construction | : | Plug-on board |
| Power supply | : | 240 V AC 50 Hz / 24V DC |
| Signal Output | : | 4-20 mA DC with HART (isolated) - 600 Ohm load. |
| Hysteresis | : | Fully adjustable preferred |
| Output contacts | : | 2SPDT Potential free changeover contacts @ 8A 230V AC. |
| Accuracy & Repeatability | : | $\pm$ 0.25% of span or better |
| Resolution | : | $\pm$ 0.1% of span |

Temperature Compensation: To be provided with Transducer.

| | | |
|---|---|---|
| Operating temp. | : | Transmitter-50 deg C and Sensor – 80 deg C |
| MOC Sensor | : | Body- PVDF and Face – Polyurethene |
| Humidity | : | 1% to 95% non condensing. |
| Enclosure | : | IP-67 Epoxy painted die cast Aluminum or SS316L housing. |
| Cable Connection | : | 3/4" ET |
| Mounting | : | 2" – 4" NPT or flanged |
| Accessories | : | Cable gland, prefab cable, mounting accessories like EPDM seal, SS316 flanged etc. Additional separate local display unit with large Alphanumeric back light LCD/LED & to be provided for the applications which will be decided during detailed engineering. |

### 3.03.13 CAPACITANCE TYPE LEVEL TRANSMITTER

The total system shall consist of capacitance probe, pre-amplifier and transmitter

| | | |
|---|---|---|
| Type | : | Capacitance type |
| Probe | : | a) Rod or suspended electrode.<br>b) Rope type probes may be used only where required probe length is greater than 3 meters |
| Probe Mounting | : | Stainless steel 1-1/2 ANSI RF Flange / ¾" NPT (M) |
| Material of construction | : | 316 SS |
| Insulation | : | PTFE Part/Full as per service. |
| Transmitter | : | The transmitter shall receive output of the preamplifier and convert it into 4-20 mA DC output signal. |
| Accuracy | : | ± 1% of Full scale |
| Repeatability | : | ± 0.5 % of Full scale |
| Load | : | Min 600 Ohms |
| Enclosure | : | Powder/Epoxy coated Die cast aluminum. with neoprene gasket conforming to IP 65. (Explosion proof for NEC Class-1, Division 1 area). |
| Ambient temperature | : | 0-60 ºC. |
| Mounting | : | Wall / Surface |
| Supply voltage | : | 240V AC, 50Hz / 24V DC |
| Response time | : | 100 m sec or better |
| Cable connection | : | ¾" ET |
| Accessories | : | Counter flange, Cable gland, prefab cable if any |
| Preferable features | : | Alarm output contacts with adjustable set point facility |

### 3.03.14 GUIDED WAVE RADAR/RADAR LEVEL TRANSMITTER

| | | |
|---|---|---|
| Type | : | Guided wave Radar (Contact type)/Radar (Non contact type) as finalized by owner. |
| Application | : | For Turbine Lube oil tank, HFO & LDO tank level, |

| | | |
|---|---|---|
| ~~Output Signal~~ | ~~:~~ | ~~Pulse~~ |
| ~~Material of Construction~~ | ~~:~~ | ~~AISI 316~~ |
| ~~Sensor Seal~~ | ~~:~~ | ~~PTFE / higher based on temperature~~ |
| ~~Flow range~~ | ~~:~~ | ~~As required.~~ |
| ~~Linearity~~ | ~~:~~ | ~~0.25% or better.~~ |
| ~~Repeatability~~ | ~~:~~ | ~~0.02% or better.~~ |
| ~~Ambient temperature~~ | ~~:~~ | ~~50 deg C~~ |
| ~~Mounting~~ | ~~:~~ | ~~On-Line mounting with flanges of stainless steel.~~ |
| ~~Enclosure~~ | ~~:~~ | ~~IP 65~~ |
| ~~Accessories~~ | ~~:~~ | ~~Nuts, bolts, gaskets etc.~~ |

~~**Transmitter**~~

| | | |
|---|---|---|
| ~~Electronics~~ | ~~:~~ | ~~Solid State~~ |
| ~~Power Supply~~ | ~~:~~ | ~~240V AC, 50Hz. UPS~~ |
| ~~Input~~ | ~~:~~ | ~~Input from Sensor~~ |
| ~~Display~~ | ~~:~~ | ~~4 1/2 digit LCD~~ |
| ~~Output~~ | ~~:~~ | ~~Isolated 4-20mA DC HART~~ |
| ~~Measuring Accuracy~~ | ~~:~~ | ~~0.5% of full scale range~~ |
| ~~Totalized Value~~ | ~~:~~ | ~~Required~~ |
| ~~Housing~~ | ~~:~~ | ~~IP 65 (Explosion proof for NEC Class 1, Division 1 area)~~ |
| ~~Nameplate~~ | ~~:~~ | ~~Tag number, service engraved in stainless steel tag plate~~ |
| ~~Accessories~~ | ~~:~~ | ~~Clamping strip, bracket, prefab cable etc. Special tool kit for calibration/ configuration .~~ |

### 3.03.23 Flow Transmitter (Ultrasonic)

| | | |
|---|---|---|
| Type | : | ULTRA SONIC, 2-wired |
| Sensing element | : | Non-contact |
| Output | : | 4-20mA with HART Protocol |
| Accuracy | : | ± 0.1% FS |
| Supply | : | 24 V DC |
| Enclosure class | : | IP-65 |

**Transmitter**

| | | |
|---|---|---|
| Mounting | : | On Nozzle |
| Mounting position | : | Top mounted |
| Housing | : | Plastic |
| Display | : | Head mounted LCD Display and remote LCD display |
| Process connection | : | NPT/Flanged |
| Electrical connection | : | NPT |
| Turn Down ratio | : | 1:100 |
| Measuring range | : | Adjustable (as per process requirement) |
| Totaliser | : | Required |
| Accessories | : | As per process requirement<br>Additional separate local display unit with large Alphanumeric back light LCD/LED & to be provided for the applications which will be decided during |

Nuts, bolts, gaskets, mesh etc.

b) Special tool kit for calibration/configuration.

**3.03.25 Electromagnetic Flow meter**

Electromagnetic flow meters shall have separate transmitter having accuracy ±0.2% with zero stability feature, suitable for process medium with <= 5 micron Siemens conductivity, flanges material SS-316, electrode & measuring tube material SS-316, liner material Teflon and enclosure IP-66, local digital display configurable as totaliser, 4-20 mA output signal HART compatible with zero and span field adjustable. Application – DM Water and for other application as decided by owner.

**3.03.26 FLOW GAUGES (FG)**

| | | |
|---|---|---|
| Type/Construction | : | a) On-line type Rotameter for 50 Nb and below lines<br>b) Bypass type Rotameter for above 50 Nb lines. |

**Material**

**- For On-line type**

| | | |
|---|---|---|
| Metering Tube | : | Borosilicate glass |
| Float | : | 316 SS |
| Packing | : | Teflon |
| End fittings | : | 304 SS |

**-For Bypass type**

| | | |
|---|---|---|
| Metering Tube | : | Borosilicate glass |
| Float | : | 316 SS |
| Packing | : | Teflon |
| End Fittings | : | 304 SS |
| Orifice Plate | : | 316 SS |
| Carrier ring | : | 304 SS |
| Flanges & Mating flanges | : | Same as pipe material, 200 lbs ANSI - RF |
| Impulse pipe | : | Same as pipe material |
| Fittings | : | 2000 ANSI, SW ends to match with pipe material. |
| Dial Size/Scale length | : | 250 mm |
| Scale Details | : | Direct reading type engraved on detachable Aluminum scale |
| Accuracy | : | ± Two (2) percent |
| Reproducibility | : | Half (1/2) percent |
| Rangeability | : | 1:10 |
| Connection | : | SCRD NPT |

| | | | |
|---|---|---|---|
| Accessories | : | a) | Isolating valves (for Bypass type only) |
| | | b) | Bolts, Nuts and Gaskets as required |
| Tests | : | Shall be tested at two hundred (200) percent of the maximum process pressure | |

**3.03.27 SIGHT FLOW GLASS INDICATORS**

| | | |
|---|---|---|
| Type/Construction | : | Flapper type. |
| **Materials** | : | |
| Body | : | Carbon steel/SS316 as per process requirement |
| Glass | : | Toughened Borosilicate |
| Gaskets | : | Neoprene |
| Bolts & nuts | : | SS |
| Flappers / Rotating Wheel | : | 316 SS |
| Flappers / Rotating Wheel holder | : | 304 SS |
| Process Connection | : | SW (Socket Welded) |
| Accessories | : | Scale, Bolts, Nuts, Cover plates and Gaskets as required |
| Tests | : | Tested at two hundred (200) percent of the maximum process pressure. |

3.03.28 **SOLID FLOWMETER**

| | | |
|---|---|---|
| Type | : | Online Impact type Microprocessor Based |
| Measuring Principle | : | The system measurement is basically pertains to the m easurement o f horizontal def lection usi ng LVDT, c reated by t he i mpact o f so lid flow up on online sensing plate. The horizontal deflection being proportional to the impact forces, LVDT convert this horizontal movement into electrical signal. The inbuilt integrator convert this signal into time based flow rate indication & provide totalized flow also. |
| Sensing plate | : | 316 SS |
| Sensing head | : | Sensing mechanism shall be mounted outside the process flow line. |
| Enclosure | : | 316 SS |
| Enclosure protection | : | IP 67 class |
| Accuracy | : | +/-1% |
| Repeatability | : | +/- 0.2% |
| Drift | : | Both zero & span $\pm$ 2% / month |
| Output | : | 4-20mA DC isolated, load 600 ohm (min) |
| Digital communication | : | yes, (HART) facility |
| Power supply | : | 240 V AC, 50Hz. UPS |
| Ambient condition | : | Temperature -60$^0$ C, RH-95% Environment – Highly Dusty |

| | | |
|---|---|---|
| Accessories | : | Shall be complete with all the accessories including digital display for flow rate, integral vents, baffles for air separation, etc. which ever required for satisfactory operation. |

Note:-

1. The above on line flow meter shall not create any obstruction on flow.

2. User's list shall be submitted to support on proven satisfactory performance for similar process application.

3.03.29 **Instrument Air System**

The instrument Air Supply System for various pneumatic Control & Instrumentation devices like pneumatic actuators, power cylinders, I/P converters, pneumatically operated valves etc. shall be complete in all respect with necessary Air Filter Regulators, valves, piping/tubing etc.. Each pneumatic instrument shall have an individual air shut off valve. The pressure-regulating valve shall be equipped with an internal filter, a 50 mm pressure gauge and a built in filter-housing blow down valve.

Filter shall be of minimum 5-micron size & sintered bronze material.

On collection of water in the drains of instrument air lines, mechanical automatic drains and periodically solenoid operated drains (with electronic timer - 15m, 30m, 60m and 2 Hours & Timing adjustable) are to be provided.

For mechanical type & Electrical type, the locations to be provided in the instrument air lines of boiler area, Chimney area, turbine area etc., shall be decided during detailed Engineering.

**Bulk header** nearby the crowded applications shall be provided and from this bulk header individual air lines with necessary isolation values are laid to the application.

These bulk header are to be provided with **mechanical / electronic based automatic Drains.**

Individual moisture separator for $O_2$ analyzer or vital application shall be provided nearby the instrument so as to enhance the cell life or the performance of vital final control elements.

3.03.30 **Air Filter Regulator (AFR)**

Constant bleed type AFR with an accuracy of $\pm$ 1.0 % inlet pressure range of 5-8 kg/ cm2 and suitable spring ranges (AFR) for use with positioners in control valves, control damper, E/P convertors and shut off valves for phosphor bronze filter element; Filtering particles above five microns. Weather and water proof enclosure. Material of accessories will be SS316.

**Air filter regulators shall be provided in the :**

(a) Air supply line to valve positioners / power cylinders
(b) Air supply line to electric to pneumatic converters.

(c) Air supply line to pneumatic interlocked block valves.
(d) For each instrument rack, field instruments enclosure for purging.

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

Two wire type E/P convertors with an accuracy of ±0.25% accepting 4-20 mA dc signals from control system and converting to 0.2 to 1 kg/cm2 air pressure to operate valve positioner of all final control elements; Housed in cast aluminum casing (with polyurethane paint); NEMA 4 or equivalent degree of protection for enclosure. Material of accessories will be S S. E/P convertors shall have fail freeze (stay put) feature also. Process connection shall be 1/4" NPT (F) and Electrical connection shall be ½" NPT (F). Zero/span adjustment facility shall be provided. The E to P converters shall **retain the pneumatic signal (last value) even in failure of control signal** and shall have **self volume boosters.** Necessary air lock devices and pressure switches for air pressure low alarming shall be provided.

3.03.32 **Solenoid Valves**

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

(a) Two (2) way solenoid valves shall be provided, where process line of less than 50 mm with low pressure and temperature application.
(b) Three (3) way solenoid valve shall be provided commonly, where the pressure is admitted or exhausted from a diaphragm valve or single acting cylinder, e.g, Pneumatic operated spray water block valve.
(c) Four (4) way solenoid valve shall be provided for operating double acting cylinders, e.g, Pneumatically operated on-off type dampers.
(d) For operation of the fuel oil corner nozzle valves, fuel oil trip valves etc., **double coil solenoid valve** ( latch coil & relatch coil) shall be adopted.
**Single coil usage requires always power and loss of power leads to closure of above valves resulting the unit trip or loss of generation.**
(e) Solenoid Valve coils shall be Class-H high-temperature or Class-F construction as applicable and shall be designed for continuous duty. Three-way solenoid valves shall be designed for universal operation so that the supply air may be connected to any port. Solenoid enclosures shall be NEMA-4)/ (Explosion proof for NEC Class-1, Division 1 area)/ flame proof (IEC-79.1, Part I) As applicable). Body material of solenoid valve shall be Die Cast Aluminum or SS316.

.
(f) All solenoid shall be with varister, LED indication, surge suppress diode and circuits.

**3.03.33 Power Cylinders (Pneumatic)**

| | | |
|---|---|---|
| Mounting Type | : | a) Fixed position mounting (End mounting). |
| | : | b) Trunnion mounting |
| Control Signal | : | 0.2 to 1 Kg/Sq. cm. from I/P converter for modulating purposes. 24V/48VDC operated solenoid valve operating on pneumatic line. |

| | | |
|---|---|---|
| | | The Pilot solenoid will have separate coils for open closing purpose. |
| Supply Air | : | 0-7 Kg / Cm2. |
| Selection | : | Based upon thrust / torque, stroke length, angular movement, full-scale travel time, repeatability, space factor etc. Provision for air-to-open and air-to-close operation. |
| Casing | : | IP-65. |
| Accessories (as required) | : | a) Air lock relay<br>b) Hand wheel.<br>c) Air filter regulator with gauge.<br>d) Volume Booster.<br>e) Limit Switches.<br>f) Positioner with Input, Output and supply pressure gauges.<br>g) Pilot Solenoid Valve (Double Coil type)<br>h) Position Transmitter (4-20 mA DC linear output, LVDT or non contact type). |
| Fail-safe operation | : | Stay put, open or close position on pneumatic / electrical power supply failure as per process safety criteria. |
| Repeatability | : | Better than 0.5% of full travel. |
| Hysterisis | : | Less than 1% of full travel. |

- Local LCD Display for Dew Point

3.03.42 **Junction Boxes**

| | | | |
|---|---|---|---|
| v. | Type | : | Flame proof/weather proof |
| vi. | Enclosure | : | IP-65/Explosion/Flame Proof as per area classification. |
| vii. | Material | : | FRP with protective Coating |
| viii. | Cable entry | : | Bottom or Side |
| ix. | Cable glands | : | Double compression type – Nickel plated brass with PVC hoods. |
| x. | Mounting | : | Indoor/Outdoor |
| xi. | No. of terminals | : | As required with standardization with 20% spare of each size & type. |
| xii. | Terminals | : | Phoenix/Wago (screw less cage clamp type spring loaded) |
| xiii. | Grounding | : | Two terminals for body and shield ground |
| xiv. | Door | : | Hinged, lockable type. |

xi. Suitable mounting clamps and other accessories shall be in scope of bidder.

xii The brackets, bolts, nuts, screws, glands, lugs required for erection shall be of brass, included in bidder scope of supply. High voltage & insulation resistance test shall also be conducted.

Xiii M6 Ni plated Brass earthing stud shall be provided (external 2 nos. internal 1 no.)

xiv Gasket (Normal)- Neoprene thickness 6.0 mm

3.03.43 **Interposing Relays (IPR)**

Electro magnetic type IPRs with modular design, plug-in type connections, suitable for channel/DIN rail mounting in cabinets; coil rating 24V D.C; 2 set of silver plated change over contacts rated for 0.5A 220 V DC/8 A 240 V AC. Free wheeling diode across relay copper coil and self reset type status LED indicator flag (electronic) shall be provided. Manual forcing/override facility is required. The test voltage for relay shall not be less than 4 KV with operating temperature from –20 deg. C to 60 deg. C. The relay shall have the necessary approvals like V 0 inflammability class in accordance with UL94", IEC60664/IEC60664A/DIN VDE 0110. Facility to stimulate IPR manually shall be provided.The VA burden of relays shall be suitable to match the capacity of output modules. Interposing relay & sockets for mounting the interposing relay shall be of same make only.

**3.03.44 RECORDERS (CHARTLESS)**

| | | |
|---|---|---|
| Type | : | Micro-processor based, Digital TFT display type |
| - No. of Channels | : | Forty Eight (48) point). |

**6 Nos. of recorders** shall be supplied with BTG packages and the parameters shall be decided during detailed Engineering. Quantities of recorders for BOP packages shall be decided during detailed Engineering.
(Simultaneous parameter display preferred)

| | | |
|---|---|---|
| Input Signal | : | Fully configurable multi range (Programmable) universal (input) |
| Recording method | : | Continuous with different colour, for each channel |
| Display colour | : | Selectable from 30 Colours |
| Bar graph facility | : | To be provided |
| Digital indication | : | To be provided |
| Accuracy | : | +/- 0.1 % for reading for DC V Input And 0.1 Deg for TC/RTD input |
| Programmability | : | Front key board |
| Data Storage | : | hard disk/ Flash Memory |
| Data Retrieval | : | Compact 4 GB flash Memory card and USB port with 8 GB USB drive. |
| Scan rate | : | ≤ 20 m **second** for individual channel. **Selection of scan time for individual channel is required.** |
| Power Supply | : | 240 VAC 1 Phase UPS |
| Ambient Temperature | : | 0-50 Degrees |
| Mounting | : | Front panel mounted weather & Dust proof IP 65 |
| Application software | : | Yes, To be provided |
| Internal Memory | : | 400 MB or more |
| Screen | : | ≥ 10.5" colour LCD TFT |
| Resolution | : | ≥ 640 X 480 Pixels |
| Type of Display | : | i) Trends<br>ii) Bar Graph<br>iii)Digital display/ values |
| Event Sampling | : | 1/2/5/10/30/60/120 sec. |
| Zoom & Scroll Facility | : | Required |
| OWS and printer connectivity port | : | Required |
| | : | Necessary software shall be supplied for uploading the data. |
| Communication | : | Additional MODBUS/PROFIBUS ports connectivity between recorder and third party systems. |

### 3.03.45 DIGITAL INDICATOR

| | | |
|---|---|---|
| Type | : | **Programmable electronic digital indicator** with floating point decimal. |
| Input | : | 4-20 mA DC/1-5V DC/RTD/T/C. |
| Number of inputs | : | One |
| Range | : | As per requirement/adjustable by end user |

through key pad available on the indicator.

| | | |
|---|---|---|
| Number of digits | : | Four plus sign |
| Digit height | : | 20 mm or larger |
| Display | : | Fluorescent red |
| Input over range/open sensor (T/C) | : | All digits to flash |
| Input hold time | : | 0.7 seconds max. |
| Accuracy | : | ±0.25% of span |
| Power supply | : | 240V AC, 50Hz |
| Mounting | : | Flush panel, compatible for mounting on mosaic grid panel |
| Size | : | 96x48 mm |
| Other Particular | : | Indicator receiving thermocouple signal shall have automatic cold junction compensation. |
| | : | Retransmission Output 4 -20 mA isolated required. |
| | : | 24 V DC inbuilt power supply |
| | : | Alarm contact with 2 NO/NC contact (rating 5A/230 V AC) |

### 3.03.46 RECEIVER INDICATORS (SINGLE/DUAL CHANNEL)

| | | |
|---|---|---|
| Type | : | Analogue indicator |
| Input Signal | : | Universal input (T/C, RTD, 4-20 mA, Voltage) |
| Scale | : | Range fully configurable and programmable |
| Measurement Accuracy | : | ± 0.2% of span ± 1 count |
| Resolution | : | 0.5% Span |
| Dead band | : | ± 0.2% of span |
| Repeatability | : | 0.2% of span |
| Full scale response time | : | Less than two(2)seconds |
| Power Supply | : | 240V AC, 50 Hz |
| Connection | : | Plug in type |
| Accessories | : | Mounting Bracket for Bins |
| Other Particulars | : | Indicator receiving thermocouple Signal shall have automatic cold junction compensation. |
| | : | Retransmission Output 4 -20 mA isolated required. |

### 3.03.47 Temperature Scanner

| | | |
|---|---|---|
| Type | : | Microprocessor based Electronic Digital Scanner. |
| No. of channels | : | 16/24 (as per the application) |
| Input | : | RTD /Thermocouple/4-20mA |
| Accuracy | : | ± 0.1 of FS ± 1 count |
| Number of digits | : | 4 digit (7 segment display with Engg. Units) |
| Digit height | : | 12 mm or larger |
| Display color | : | Fluorescent red/green |
| Display mode for | | |

| | | |
|---|---|---|
| Input over range/open sensor | : | All digits to flash |
| Mounting | : | Panel mounting |
| Zero and Span | : | Adjustable by digital calibration |
| Serial communication communication | : | Isolated RS232/485 for modbus-RTU |
| Memory Capacity | : | 5MB Flash |
| Alarm output | : | Required |
| Contact rating | : | 2A at 220 V AC |
| Power supply | : | 240 V AC/24 V DC |
| Properties | : | i. Any channel shall be configured for Data Logging<br>ii. Channel to Channel online Isolation shall be provided<br>iii. Real Time RTC Interface for Printer shall be provided |
| Operation Modes | : | Auto/manual mode, Run mode, Verify mode, Calibration Mode, Program mode. |

**3.03.48 AMMETERS (AMM)**

| | | |
|---|---|---|
| Input | : | 4-20 mA DC |
| Mounting | : | Flush panel, compatible for mounting on mosaic grid panel |
| Face Dimensions | : | 96 x 96 mm |
| Scale/Type | : | Moving coil, circular, FSD 240 deg. With six times suppression scale |
| Zero adjustment | : | Screw on meter face |
| Accuracy | : | $\pm$ 1 percent (class 1) |
| Indication | : | Pointer with scale |
| Magnetic Shield | : | Shielded Case |
| Quantities | : | For all HT Motors & LT motor with rating $\geq$ 30 KW and other critical application motors/drives. |

**3.03.49 VOLTMETER**:

| | | |
|---|---|---|
| Input | : | 4 - 20 mA DC |
| Mounting | : | Flush Panel, compatible for mounting on mosaic grid panel |
| Face Dimension | : | 96x96 mm |
| Range | : | As per requirement |
| Accuracy | : | $\pm$ < 0.5 % |
| Indication | : | Digital type 4 1/2 digit |
| Magnetic Shield | : | Shielded Case |
| Connection | : | Plug in type |
| Quantities | : | For 230 V AC input power supply, UPS power supply, 24 V DC interrogation voltage & 220 V DC. |

**3.03.50 FREQUENCY METER/MW METER (DIGITAL)**

| | | |
|---|---|---|
| Type | : | Electronic digital 7- segment with fluorescent display |
| Input | : | 4 - 20 mA DC |
| Mounting | : | Flush Panel compatible for mounting On mosaic grid panel |
| Number of digits | : | 41/2 digit |
| Face Dimension | : | 192X192 mm |
| Digit size | : | Approximately 40 mm |
| Range | : | As per requirements |
| Accuracy | : | ± 0.2 Hz |
| Display | : | Red LED display. |
| Connection | : | Plug in type |
| Magnetic Shield | : | Shielded Case |

**3.03.51 AC CURRENT TRANSDUCERS**

| | | |
|---|---|---|
| Input | : | 0 - 1 A CT current |
| Output | : | Dual 4-20 mA with 500 impedance |
| Mounting | : | Back rail |
| Accuracy | : | ± 0.25% |

**3.03.52 DC CURRENT TRANSDUCERS**

| | | |
|---|---|---|
| Input | : | 0 - 75 mV |
| Output | : | Dual 4-20 mA with 500 impedance |
| Mounting | : | Back rail |
| Accuracy | : | ± 0.25% |

**3.03.53 AC VOLTAGE TRANSDUCERS**

| | | |
|---|---|---|
| Input | : | 0 - 110 V PT, Volts |
| Output | : | 4-20 mA with 500 impedance |
| Mounting | : | Back rail |
| Accuracy | : | + 0.25% |

**3.03.54 DC VOLT TRANSDUCERS**

| | | |
|---|---|---|
| Input | : | System Voltage |
| Output | : | 4-20 mA with 500 impedance |
| Mounting | : | Back rail |
| Accuracy | : | ± 0.25% |

**3.03.55 TRANSDUCERS FOR POWER**

| | | |
|---|---|---|
| Input | : | CT and PT (1A) (110V) |
| Output | : | 4-20 mA with 500 impedance |
| Mounting | : | Back rail |
| Accuracy | : | ± 0.25% |

**3.03.56 TRANSDUCERS FOR FREQUENCY**

| | | |
|---|---|---|
| Input | : | 110 V PT Volts |
| Output | : | 4-20 mA with 500 impedance |
| Mounting | : | Back rail |
| Accuracy | : | ± 0.25% |

**3.03.57 TRANSDUCERS FOR POWER FACTOR**

| | | |
|---|---|---|
| Input | : | PT (110V) |
| Output | : | 4-20 mA with 500 impedance |
| Mounting | : | Back rail |
| Accuracy | : | ± 0.25% |

**3.03.58 TRANSDUCERS FOR MVAR**

| | | |
|---|---|---|
| Input | : | CT & PT (110V/1A) |
| Output | : | 4-20 mA with 500 impedance |
| Mounting | : | Back rail |
| Accuracy | : | ± 0.25% |

**3.03.59 DIFFERENTIAL FREQUENCY TRANSDUCERS (FOR SYNCHRONIZATION)**

| | | |
|---|---|---|
| Input | : | 110 V PT |
| Output | : | 4-20 mA with 500 impedance |
| Mounting | : | Back rail |
| Accuracy | : | ± 0.25% |

**3.03.60 DIFFERENTIAL VOLT TRANSDUCERS (FOR SYNCHRONIZATION)**

| | | |
|---|---|---|
| Input | : | System voltage |
| Output | : | 4-20 mA with 500 impedance |
| Mounting | : | Back rail |
| Accuracy | : | ± 0.25% |

**3.03.61 PUSH BUTTONS (PB)/ ILPBs FOR ON/OFF, OPEN/CLOSE, START/STOP**

| | | |
|---|---|---|
| Type | : | Momentary/Miniaturised<br>Suitable for mosaic grid 24x48<br>Mm with 2 PB and 3 coloured LED. |
| Contact Configuration | : | 2 NO + 2 NC |
| Contact Material | : | Hard Silver Alloy |
| Contact Rating | : | 500V / 10 A |
| Insulation Voltage terminals and earth | : | 2 KV for 1 minute between |
| Lamp Rating :- | | |
| a) Voltage | : | 240 V AC |
| b) Watt | : | 2 Watt (approx.) |

Colour

## 5.19.00 Technical Specification of Chlorine Analyzer

| | | |
|---|---|---|
| i) | Type | Microprocessor based Continuous flow through sample type with automatic temperature compensation. |
| ii) | Analyzer power supply | 240V AC, 50 Hz, Single Phase from UPS |
| iii) | Analyzer output | i) 4-20 mA, DC spare output<br>ii) 4-20 mA, DC isolated output for DDCMIS |
| iv) | Accuracy | 0.005 mg/ltr. or 1% of range. |
| v) | Sensitivity | 0.001 mg/ltr. (1 ppb) |
| vi) | Range | As per schedule. |
| vii) | Annunciation contacts: | |
| | - Number | As per schedule, 2 SPDT |

| | | | |
|---|---|---|---|
| | - | Type | Snap action micro switch |
| | - | Rating | 5A, 240V AC, 0.2A, 220V DC |
| | - | Mounting | Flush |
| viii) | Terminal points | | All components piped & wired to terminal points |
| ix) | Accessories | i) | Flow regulator |
| | | ii) | Flow gauges |
| | | iii) | Sample rate set valves |
| | | iv) | Other accessories as required to make the system complete |

## 5.20.00 Technical Specification of Residual Chlorine Analyser

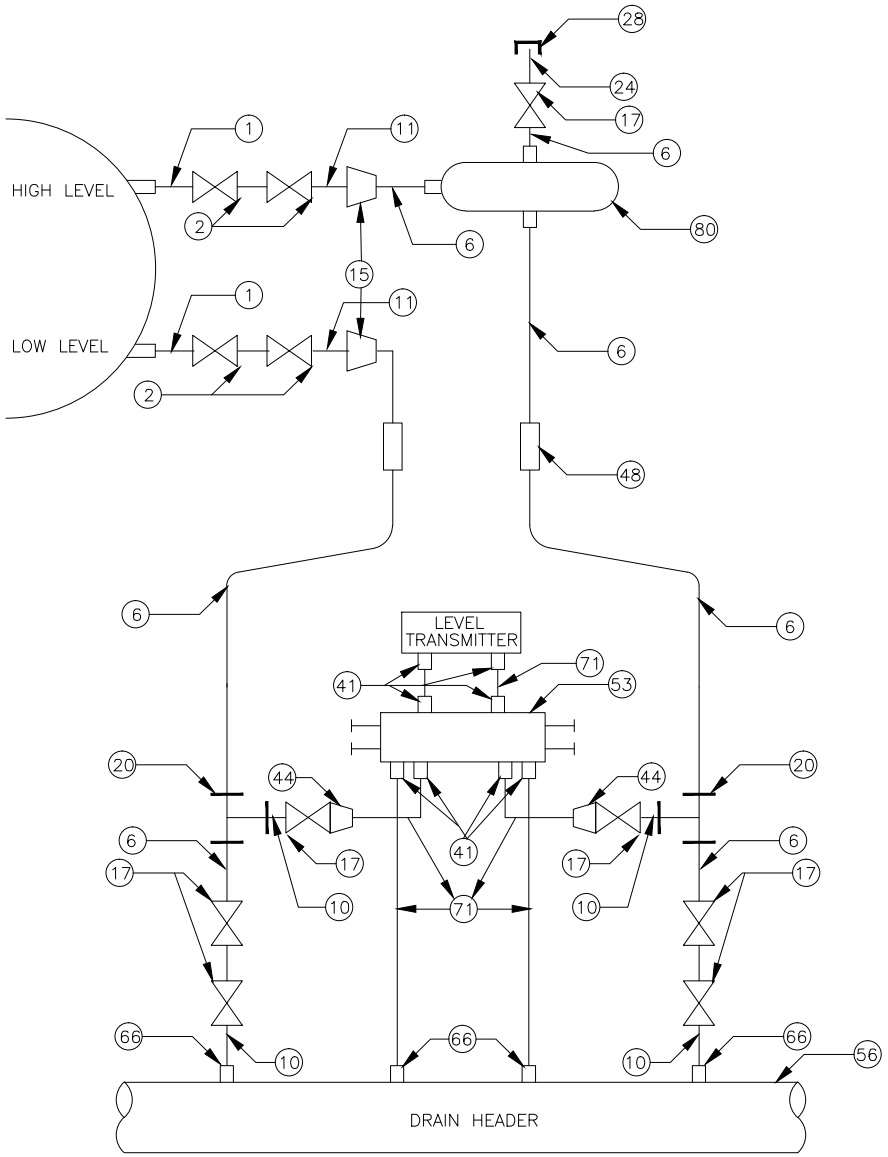
### SENSOR

| | | |
|---|---|---|
| Method | : | Amperometric |
| Electrodes | : | Gold Cathode/Silver Anode |
| Cell Material | : | PVC |
| Electrolyte | : | Potassium Bromide |

### TRANSMITTER

| | | |
|---|---|---|
| Type | : | Microprocessor Based with self diagnostic features |
| Transmitter Output | : | 4 – 20 mA |
| Enclosure Protection | : | IP65 |
| Enclosure Material | : | Polyester coated Al. |
| Electrical Connection | : | ½" NPT (F) |
| Mounting | : | FIELD |
| Display Type | : | LCD |
| Display Details | : | 4 digit backlit LCD matrix |
| Diagnostics | : | Required |
| Meter Range | : | 0-1 mg/l |
| Resolution | : | 0.01 ppm |
| Area Classification | : | SAFE |
| Electromagnetic Compatibility | : | BUILT – IN |
| Temp. Compensator | : | AUTO – BUILT – IN |
| Temp. Compensating element | : | PT100 |

# HOOK UP DRAWING




TRANSMITTER MOUNTED BELOW INST. SOURCE POINT

| TAG NO. | DESCRIPTION | BOM |
|---|---|---|
| 80 | CONDENSATION CHAMBER | 1 |
| 71 | 1/2"OD IMPULSE TUBE, SS-316 | AS REQD. |
| 66 | 1/2" GI SOCKET / FUNNEL | 4 |
| 56 | 2"NB GI DRAIN HEADER | AS REQD. |
| 53 | 5-VALVE MANIFOLD, SS-316 | 1 |
| 48 | 1/2" SW, CS/AS BULK HEAD PIPE UNION | 2 |
| 44 | 1/2"BWX1/2"OD COMPRESSION TUBE FITTING,SS-316 | 2 |
| 41 | 1/2"NPT(M)X1/2"OD TUBE COMPRESSION FITTING,SS-316 | 8 |
| 28 | 1/2" NPT (F) CS CAP | 1 |
| 24 | 1/2" NPS SCH-80/160X1/2"NPT(M) CS/AS NIPPLE | 1 |
| 20 | 1/2" SOCKET WELDED EQUAL TEE CS/AS | 2 |
| 17 | 1/2" SOCKET WELDED CS GLOBE VALVE | 7 |
| 15 | 1"TO 1/2" SOCKET WELD REDUCER | 2 |
| 11 | 1" NPS SCH 80/160 CS/AS NIPPLE | 2 |
| 10 | 1/2" NPS SCH 80/160,CS/AS NIPPLE | 4 |
| 6 | 1/2" NPS SCH 80/160 CS/AS PIPE | AS REQD. |
| 2 | 1/2"/3/4"/1" SOCKET WELDED GLOBE VLV/ROOT VLV. | 4 |
| 1 | 1/2" NPS SCH 80 NIPPLES OF MATERIAL SAME AS MAIN PIPE WITH NECESSARY ATTACH TO FLANGES | AS REQD. |

NOTE:-
1. FOR HIGH TEMP. SERVICE (MORE THAN 80°C) A 'U' TUBE(REF. DWG NO. 114-04-0100) SHALL BE PROVIDED BETWEEN THE MANIFOLD AND THE TRANSMITTER
2. FOR HIGH PR.(MORE THAN 40kg/sqcm) ONE NO. OF ISOLATING VLV. IS PROVIDED IN EACH LINE BETWEEN VLV. MANIFOLD AND 1/2"SW EQUAL TEE AND 2NO. DRAIN VLV. ARE ALSO

**REFERENCE DRAWINGS.**

**NOTES**

1. DO NOT SCALE, ASK WHEN IN DOUBT.
2. ALL DIMENSIONS ARE IN MILIMETRES UNLESS NOTED OTHERWISE.
3. BULK HEAD FITTING SW TYPE SHALL BE PROVIDED AT LIE/LIR
4. ABOVE DRWING IS FOR BASIC GUIDE LINE TO BE MEET BY BIDDER, ANY FURTHER IMPROVEMENT DURING DETAILED ENGINEERING SHALL ALSO BE CONFIRMED/PROVIDED BY CONTRACTOR.
5. QUANTITIES OF INSTRUMENTS/ ERECTION HARDWARE SHALL BE AS PER NIT AND AS FINALISED DURING DETAIL ENGINEERING
6. FOR DM PLANT MATERIAL OF ERECTION HARDWARE SHALL BE SS 316 ONLY.

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TITLE :- INST. DRAWING FOR LEVEL TRANSMITTERS

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| CHECKED | S.K.M. | | 24.04.13 |
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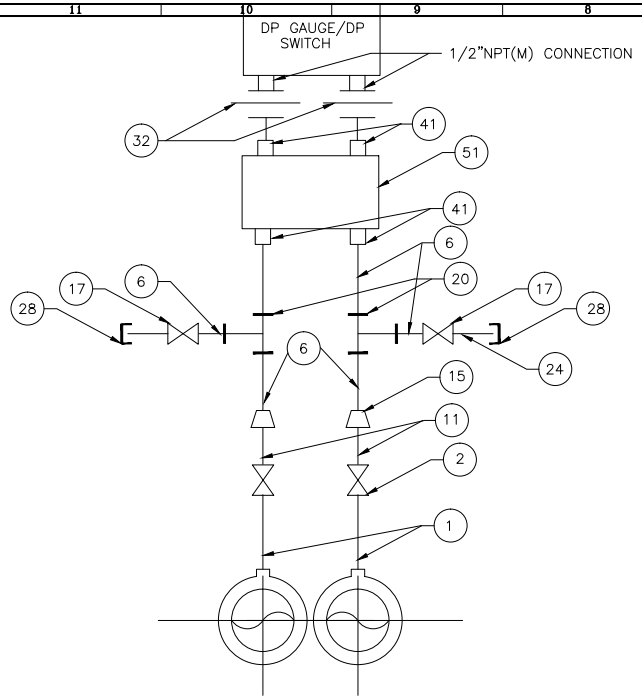
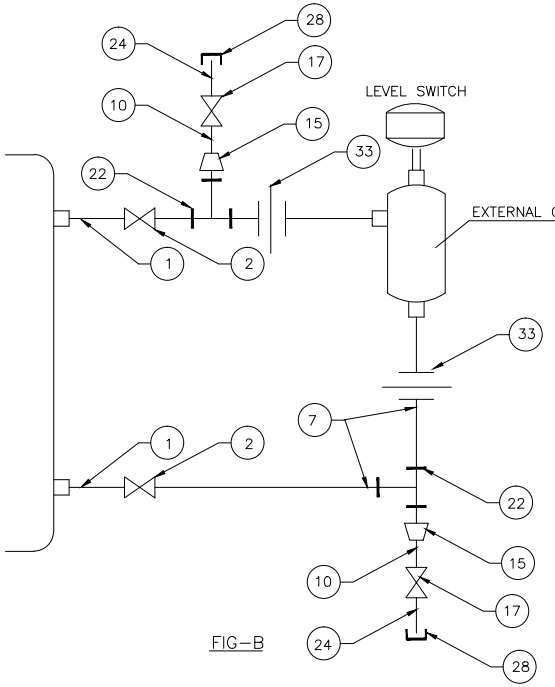
| JOB. No. | D-4027 | | |
| DWG.No. | 114-04-0110 | | REV. 0 |

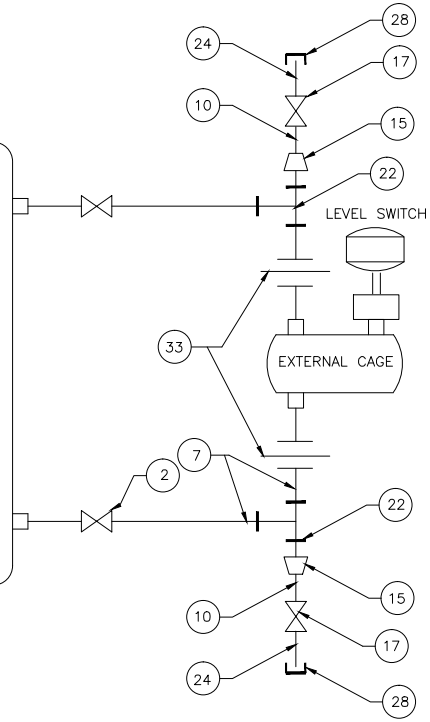
Sheet No. 13 of 19




FIG–A




FIG–B




FIG–C

| TAG NO. | DESCRIPTION | A | B | C |
|---|---|---|---|---|
| | | QTY. | | |
| 78 | 1/2" NPT(F) X 1/2" NPT(M) SNUBBER/PULSATION DAMPNER | 1 | – | – |
| 51 | 5 VALVE MANIFOLDS, SS–316 | – | – | – |
| 41 | 1/2" NPT(M) X 1/2" OD TUBE COMPRESSION FITTING,SS–316 | – | – | – |
| 38 | 3 WAY GAUGE VALVE 1/2"NB SW | 1 | – | – |
| 33 | 1" SW EQUAL PIPE UNION | – | 2 | 2 |
| 32 | 1/2" NPS,3 PIECE PIPE UNION 1/2" NPT(F) SCREWED AND 1/2" SW CONNECTION | 1 | – | – |
| 28 | 1/2" NPT(F) CS. CAP | 1 | 2 | 2 |
| 24 | 1/2" NPS,SCH 80/160 X 1/2" NPT(M) CS/AS NIPPLE | 1 | 2 | 2 |
| 22 | 1" SW EQUAL TEE CS/AS | – | 1 | 2 |
| 20 | 1/2"SW EQUAL TEE CS/AS | 1 | – | – |
| 17 | 1/2" SW,CS/AS, GLOBE VALVE | 1 | 2 | 2 |
| 15 | 1" TO 1/2" SOCKET WELD REDUCER | 1 | 2 | 2 |
| 11 | 1"NPS SCH 80/160 CS/AS NIPPLE | 1 | – | – |
| 10 | 1/2"NPS,SCH 80/160 CA/AS NIPPLE | – | 2 | 2 |
| 6 | 1/2"NPS,SCH 80/160 CARBON/ALLOY STEEL PIPE | AS REQD. | | |
| 7 | 1" NPS,SCH 80/160 CS/AS STEEL PIPE | AS REQD. | | |
| 2 | 1/2"3/4"/1" ROOT VALVE – SW GLOBE VALVE | 2 | 2 | 2 |
| 1 | 1/2"/3/4"/1" CARBON/ALLOY STEEL NIPPLE OF MTL SAME AS THAT OF MAIN PIPE (AS PER PROCESS REQD.) | AS REQD. | | |

NOTE:–
WITH VALVE OF SIZE 1/2"SW NIPPLE PIECE IS NOT REQUIERED

**REFERENCE DRAWINGS.**

**NOTES**

1. DO NOT SCALE, ASK WHEN IN DOUBT.
2. ALL DIMENSIONS ARE IN MILIMETRES UNLESS NOTED OTHERWISE.
3. ABOVE DRWING IS FOR BASIC GUIDE LINE TO BE MEET BY BIDDER, ANY FURTHER IMPROVEMENT DURING DETAILED ENGINEERING SHALL ALSO BE CONFIRMED/PROVIDED BY CONTRACTOR.
4. QUANTITIES OF INSTRUMENTS/ ERECTION HARDWARE SHALL BE AS PER NIT AND AS FINALISED DURING DETAIL ENGINEERING
5. FOR DM PLANT MATERIAL OF ERECTION HARDWARE SHALL BE SS 316 ONLY.

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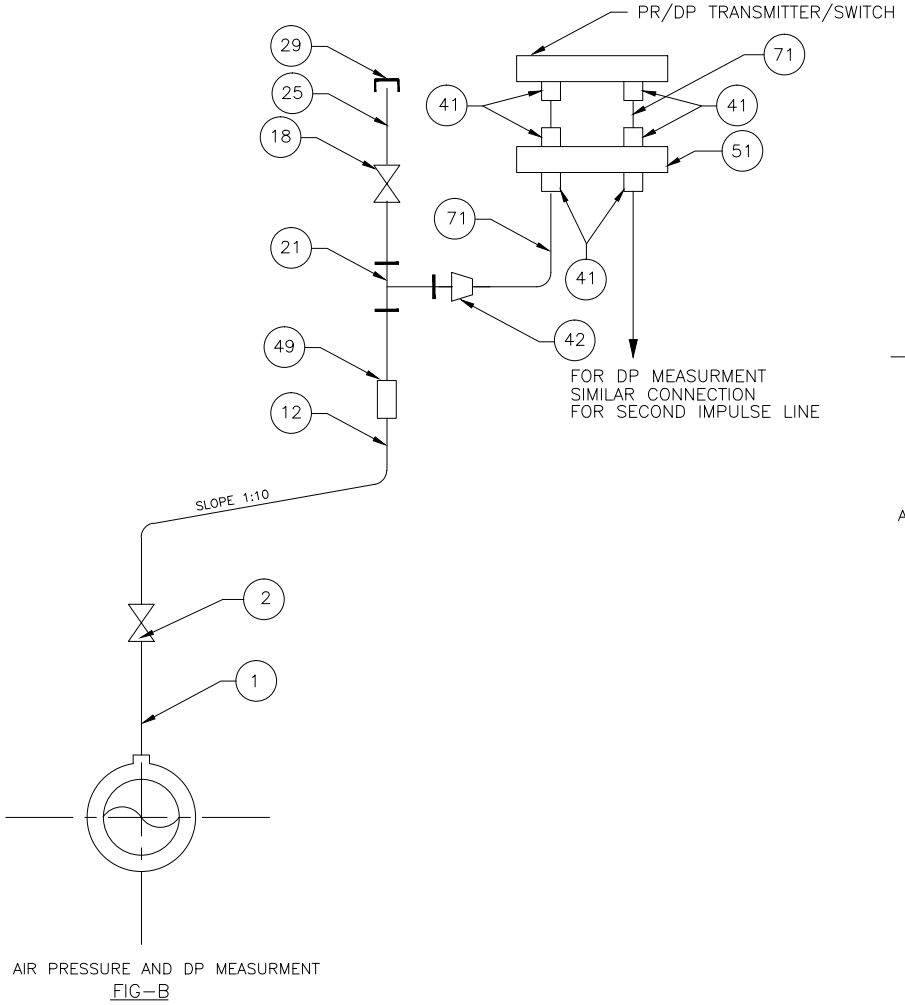
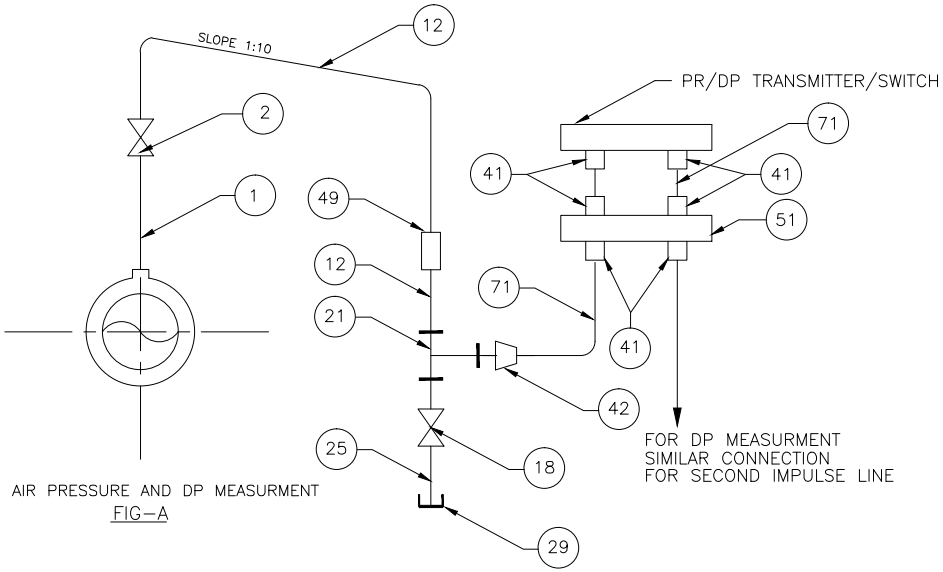



AIR PRESSURE AND DP MEASURMENT
FIG–B




AIR PRESSURE AND DP MEASURMENT
FIG–A

| TAG NO. | DESCRIPTION | A | B |
|---|---|---|---|
| | | QTY. | |
| 71 | 1/2"OD IMPULSE TUBE,SS–316 | AS REQD. | |
| 51 | 5/3/2–VALVE MANIFOLDS,SS–316 | 1 | 1 |
| 49 | 3/4"SW,CS/AS BULK HEAD PIPE UNION | 1 | 1 |
| 42 | 3/4"BW X 1/2"OD TUBE FITTING,SS–316 | 1 | 1 |
| 41 | 1/2"NPT(M) X 1/2"00 TUBE COMPRESSION FITTING,SS–316 | 6 | 6 |
| 29 | 3/4"NPT(F) CS CAP | 1 | 1 |
| 25 | 3/4"NPS,SCH–80 X 3/4"NPS(M)CS NIPPLE | 1 | 1 |
| 21 | 3/4" EQUAL TEE,CS | 1 | 1 |
| 18 | 3/4" SW,CS GLOBE VALVE | – | 1 |
| 12 | 3/4" NPS. SCH–80 CARBON STEEL PIPE | AS REQD. | |
| 2 | 1/2"/3/4"/1" ROOT VALVE – SW GLOBE VALVE | 1 | 1 |
| 1 | 1/2"/3/4"/1" CARBON/ALLOY STEEL NIPPLE OF MTL. SAME AS THAT OF MAIN PIPE(AS PER PROCESS REQD.) | AS REQD. | |

BILL OF MATERIAL

NOTE:–
QUANTITY IN COLUMN A&B TO BE DOUBLED
FOR DP TAPPING EXCEPT ITEM NO. 51

**REFERENCE DRAWINGS.**

**NOTES**
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2. ALL DIMENSIONS ARE IN MILIMETRES UNLESS NOTED OTHERWISE.
3. ABOVE DRWING IS FOR BASIC GUIDE LINE TO BE MEET BY BIDDER, ANY FURTHER IMPROVEMENT DURING DETAILED ENGINEERING SHALL ALSO BE CONFIRMED/PROVIDED BY CONTRACTOR.
4. QUANTITIES OF INSTRUMENTS/ ERECTION HARDWARE SHALL BE AS PER NIT AND AS FINALISED DURING DETAIL ENGINEERING
5. FOR DM PLANT MATERIAL OF ERECTION HARDWARE SHALL BE SS 316 ONLY.

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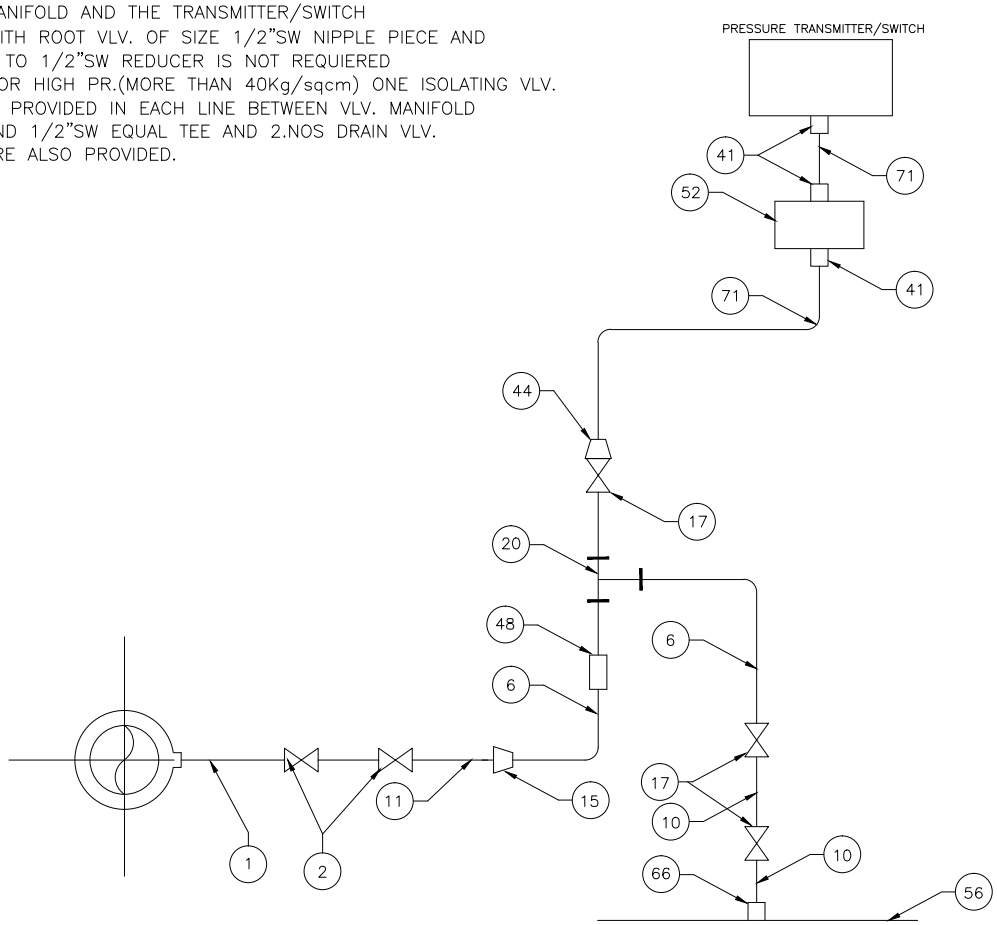
| JOB. No. | D–4027 | | |
| DWG.No. | 114–04–0103 | | REV. 0 |

Sheet No. 5 of 19

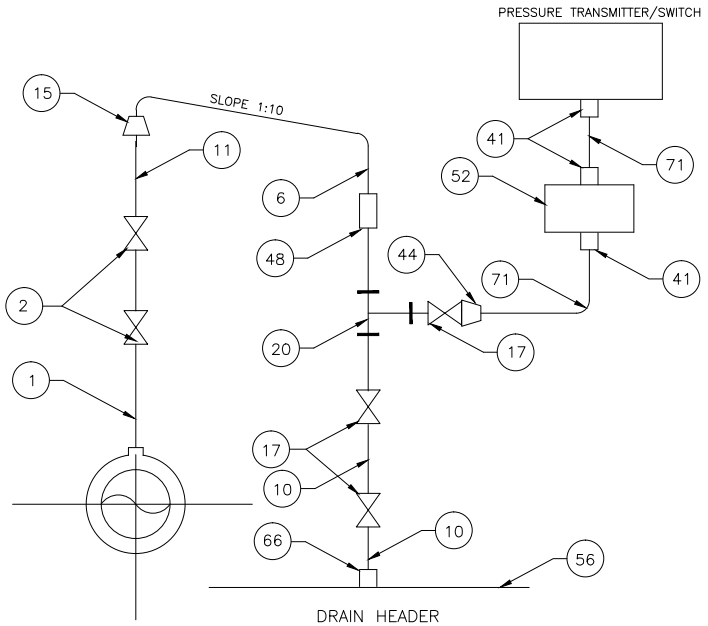
NOTE:–

1. FOR HIGH TEMP. SERVICE (MORE THAN °80C) A 'U'–TUBE / SYPHON (REF. DWG NO. IN–114–04–0100)SHALL BE PROVIDED BETWEEN THE MANIFOLD AND THE TRANSMITTER/SWITCH
2. WITH ROOT VLV. OF SIZE 1/2"SW NIPPLE PIECE AND 1 TO 1/2"SW REDUCER IS NOT REQUIERED
3. FOR HIGH PR.(MORE THAN 40Kg/sqcm) ONE ISOLATING VLV. IS PROVIDED IN EACH LINE BETWEEN VLV. MANIFOLD AND 1/2"SW EQUAL TEE AND 2.NOS DRAIN VLV. ARE ALSO PROVIDED.




TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

FIG–D




TRANSMITTER MOUNTED ABOVE INSTRUMENT SOURCE POINT

FIG–C

| TAG NO. | DESCRIPTION | C | D |
|---|---|---|---|
| | | QTY. | |
| 71 | 1/2"OD IMPULSE TUBE,SS–316 | AS REQD. | |
| 66 | 1/2" GI SOCKET | 1 | 1 |
| 56 | 2"NB GI DRAIN HEADER | | |
| 52 | 5/3/2–VALVE MANIFOLDS,SS–316 | 1 | 1 |
| 48 | 1/2"SW,CS/AS BULK HEAD PIPE UNION | 1 | 1 |
| 44 | 1/2"BW X 1/2"OD COMRESSION TUBE FITTING,SS–316 | 1 | 1 |
| 41 | 1/2"NPT(M) X 1/2"00 TUBE COMPRESSION FITTING,SS–316 | 3 | 3 |
| 20 | 1/2"SW EQUAL TEE,CS | 1 | 1 |
| 17 | 1/2" SW,CS GLOBE VALVE / NEEDLE VALVE | 3 | 3 |
| 15 | 1" TO 1/2" SW REDUCER | 1 | 1 |
| 11 | 1" NPS SCH–80 CS/AS NIPPLE | 1 | 1 |
| 10 | 1/2" NPS,SCH 80/160, CS/AS NIPPLE | 2 | 2 |
| 6 | 1/2" NPS. SCH–80/160 CS/ AS PIPE | AS REQD. | |
| 2 | 1/2"/3/4"/1" ROOT VALVE | 2 | 2 |
| 1 | 1/2"/3/4"/1" CARBON/ALLOY STEEL NIPPLE OF MTL. SAME AS THAT OF MAIN PIPE(AS PER PROCESS REQD.) | AS REQD. | |

BILL OF MATERIAL

**REFERENCE DRAWINGS.**

**NOTES**

1. DO NOT SCALE, ASK WHEN IN DOUBT.
2. ALL DIMENSIONS ARE IN MILIMETRES UNLESS NOTED OTHERWISE.
3. BULK HEAD FITTING SW TYPE SHALL BE PROVIDED AT LIE/LIR
4. ABOVE DRWING IS FOR BASIC GUIDE LINE TO BE MEET BY BIDDER, ANY FURTHER IMPROVEMENT DURING DETAILED ENGINEERING SHALL ALSO BE CONFIRMED/PROVIDED BY CONTRACTOR.
5. QUANTITIES OF INSTRUMENTS,/ ERECTION HARDWARE SHALL BE AS PER NIT AND AS FINALISED DURING DETAIL ENGINEERING
6. FOR DM PLANT MATERIAL OF ERECTION HARDWARE SHALL BE SS 316 ONLY.

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JOB. No. D–4027

DWG.No. 114–04–0104 REV. 0

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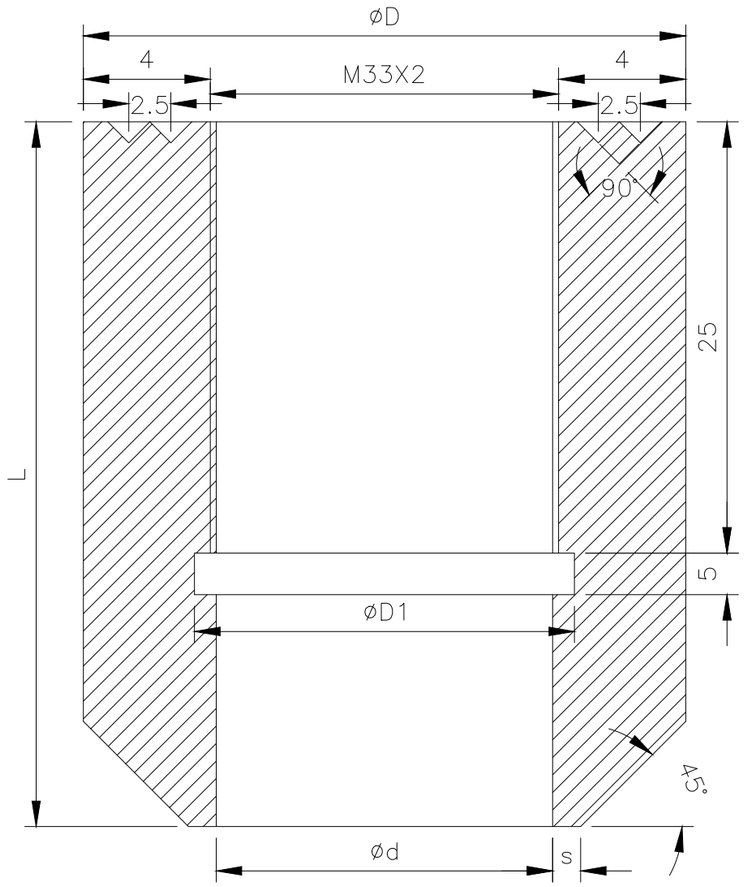
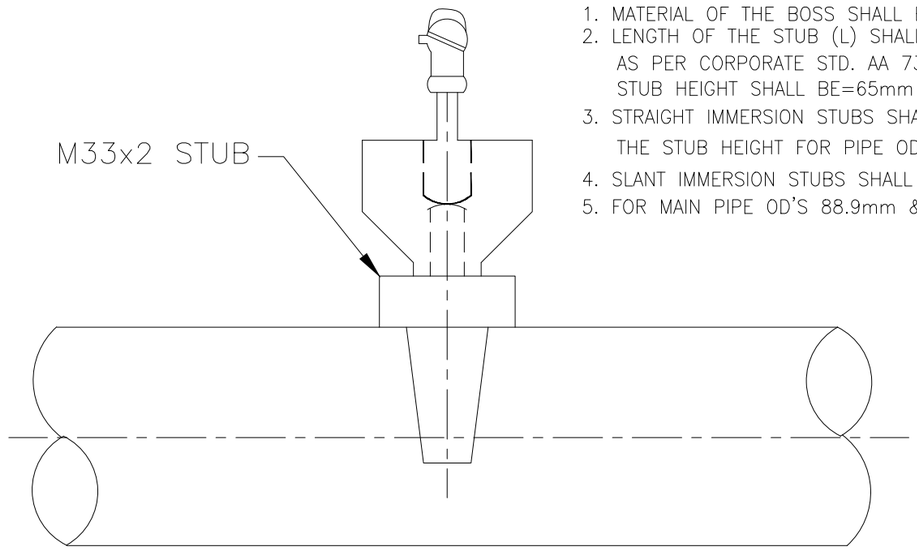


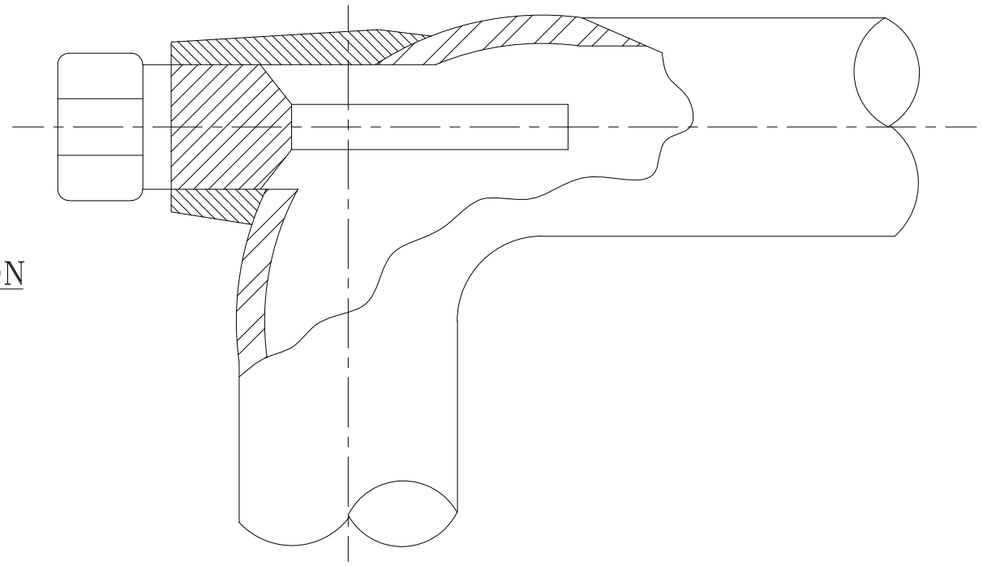

## TEMPERATURE STUB FOR STRAIGHT IMMERSION

| | | | | | |
|---|---|---|---|---|---|
| FOR PIPE OD BELOW 219.1mm | 29 | 55 | 33.5 | 1.5 | 65 |
| FOR PIPE OD 219.1mm & ABOVE | 29 | 55 | 33.5 | 1.5 | 45 |
| MAIN PIPE SIZES | d | D | D1 | S | L |




## INSTALLATION TYPE-1

(FOR MAIN PIPE OD 168.3mm & ABOVE)



## INSTALLATION TYPE-2

(FOR MAIN PIPE OD 88.9mm & BELOW)

NOTE :-

1. MATERIAL OF THE BOSS SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED.
2. LENGTH OF THE STUB (L) SHALL BE 65/45 mm DEPENDING UPON PIPE SIZE, AS PER CORPORATE STD. AA 7326102.(FOR PIPE OD 88.9mm TO 159mm STUB HEIGHT SHALL BE=65mm & FOR PIPE OD >219.1mm STUB HEIGHT SHALL BE=45mm)
3. STRAIGHT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 168.3mm & ABOVE. THE STUB HEIGHT FOR PIPE OD, 168.3mm TO <219.1mm SHALL BE 65mm.
4. SLANT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 88.9mm TO 159mm.
5. FOR MAIN PIPE OD'S 88.9mm & bELOW SUITABLE EXPANDER SHALL BE USED.

REFERENCE DRAWINGS.

NOTES

1. DO NOT SCALE, ASK WHEN IN DOUBT.
2. ALL DIMENSIONS ARE IN MILIMETRES UNLESS NOTED OTHERWISE.
3. BULK HEAD FITTING SW TYPE SHALL BE PROVIDED AT LIE/LIR
4. ABOVE DRWING IS FOR BASIC GUIDE LINE TO BE MEET BY BIDDER, ANY FURTHER IMPROVEMENT DURING DETAILED ENGINEERING SHALL ALSO BE CONFIRMED/PROVIDED BY CONTRACTOR.
5. QUANTITIES OF INSTRUMENTS/ ERECTION HARDWARE SHALL BE AS PER NIT AND AS FINALISED DURING DETAIL ENGINEERING
6. FOR DM PLANT MATERIAL OF ERECTION HARDWARE SHALL BE SS 316 ONLY.

NOTICE

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|---|---|---|---|---|---|---|---|---|
| | A | PRELIMINARY | 25.04.13 | | | | SLN | |

REVISIONS | APPROVED

SR. No. PARTY — PRINT DISTRIBUTION

DESEIN
CONSULTING ENGINEERS
NEW DELHI – INDIA

CLIENT: TAMILNADU GEN. & DIST. CORPORATION

PROJECT: 2x660MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI.

TITLE :- INST. DRAWING FOR TEMPERATURE STUB

FOR BID PURPOSE ONLY:

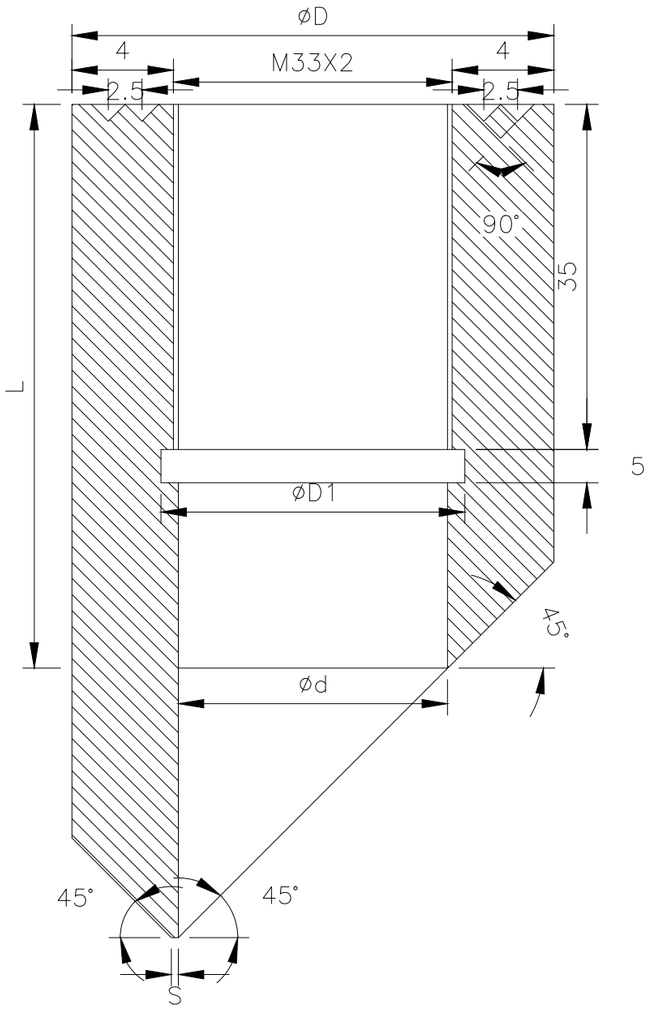
| | NAME | SIGN. | DATE |
|---|---|---|---|
| CAD/DRAWN | VIKAS | | 23.04.13 |
| DESIGNED | SKM/SN | | 23.04.13 |
| CHECKED | S.K.M. | | 24.04.13 |
| SCALE | N.T.S. | | |

JOB. No. D-4027

DWG.No. 114-04-0111 Sheet No. 14 of 19 — REV. 0

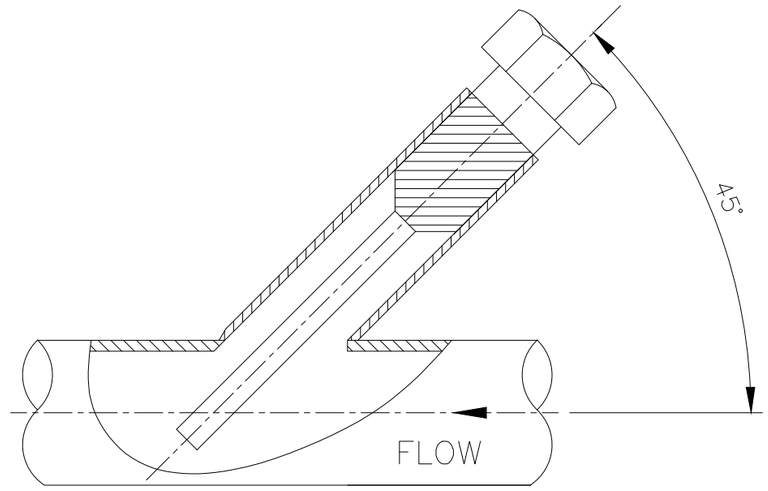
NOTE :–

1. MATERIAL OF THE BOSS SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED.
2. LENGTH OF THE STUB (L) SHALL BE 65/45 mm DEPENDING UPON PIPE SIZE, AS PER CORPORATE STD. AA 7326102.(FOR PIPE OD 88.9mm TO 159mm STUB HEIGHT SHALL BE=65mm & FOR PIPE OD >219.1mm STUB HEIGHT SHALL BE=45mm)
3. STRAIGHT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 168.3mm & ABOVE. THE STUB HEIGHT FOR PIPE OD, 168.3mm TO <219.1mm SHALL BE 65mm.
4. SLANT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 88.9mm TO 159mm.
5. FOR MAIN PIPE OD'S 88.9mm & bELOW SUITABLE EXPANDER SHALL BE USED.



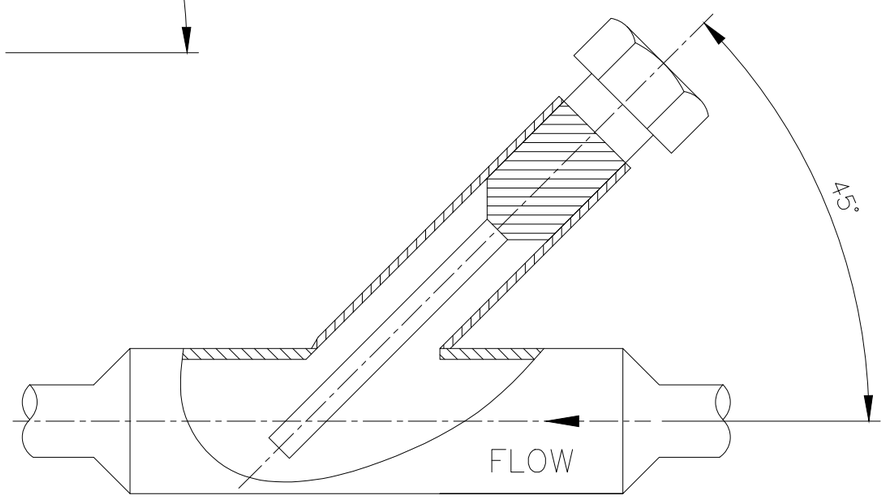

## TEMPERATURE STUB FOR SLANT IMMERSION

| | | | | | |
|---|---|---|---|---|---|
| FOR PIPE OD BELOW 219.1mm | 29 | 55 | 33.5 | 1.5 | 65 |
| FOR PIPE OD 219.1mm & ABOVE | 29 | 55 | 33.5 | 1.5 | 45 |
| MAIN PIPE SIZES | d | D | D1 | S | L |




## INSTALLATION TYPE–3

(FOR MAIN PIPE OD 88.9mm TO 159mm)




## INSTALLATION TYPE–4

(FOR MAIN PIPE OD 88.9mm & BELOW)

| REFERENCE DRAWINGS. | NOTES | NOTICE |
|---|---|---|
| | 1. DO NOT SCALE, ASK WHEN IN DOUBT.<br>2. ALL DIMENSIONS ARE IN MILIMETRES UNLESS NOTED OTHERWISE.<br>3. BULK HEAD FITTING SW TYPE SHALL BE PROVIDED AT LIE/LIR<br>4. ABOVE DRWING IS FOR BASIC GUIDE LINE TO BE MEET BY BIDDER, ANY FURTHER IMPROVEMENT DURING DETAILED ENGINEERING SHALL ALSO BE CONFIRMED/PROVIDED BY CONTRACTOR.<br>5. QUANTITIES OF INSTRUMENTS/ ERECTION HARDWARE SHALL BE AS PER NIT AND AS FINALISED DURING DETAIL ENGINEERING<br>6. FOR DM PLANT MATERIAL OF ERECTION HARDWARE SHALL BE SS 316 ONLY. | THIS DRAWING IS THE PROPERTY OF DESEIN PRIVATE LIMITED, NEW DELHI, AND IS LENT SUBJECT TO THE CONDITION THAT IT SHALL NOT BE REPRODUCED, COPIED, LENT OR OTHERWISE DISPOSED OF, DIRECTLY OR INDIRECTLY. IT SHALL NOT BE USED TO FURNISH ANY INFORMATION FOR THE MAKING OF DRAWINGS, APPARATUS, OR PARTS THEREOF EXCEPT FOR THE PROJECT SPECIFICALLY PROVIDED FOR BY CONTRACT AGREEMENT WITH DESEIN. |

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| | A | PRELIMINARY | 25.04.13 | | | | SLN | |

APPROVED

DESEIN
CONSULTING ENGINEERS
NEW DELHI – INDIA

CLIENT: TAMILNADU GEN. & DIST. CORPORATION

PROJECT: 2x660MW ENNORE SEZ COAL BASED SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI.

TITLE :– INST. DRAWING FOR TEMPERATURE STUB

FOR BID PURPOSE ONLY:

| | NAME | SIGN. | DATE |
|---|---|---|---|
| CAD/DRAWN | VIKAS | | 23.04.13 |
| DESIGNED | SKM/SN | | 23.04.13 |
| CHECKED | S.K.M. | | 24.04.13 |
| SCALE | N.T.S. | | |

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DWG.No. 114–04–0111 REV. 0

Sheet No. 15 of 19

# ERECTION HARDWARE

# CHAPTER-9

# ERECTION HARDWARE

## 9.00.00 PROCESS CONNECTION AND PIPING

### 9.00.01 General Requirements

This section covers the material requirement for instrument connection to process, instrument process, piping, tubing, supports, Instrumentation cables, control cables and power cables for connecting UPS, 24/48 V DC, unregulated power supply for cubicle illumination, compensating cables/Extension cables, transmitter racks and main accessories to be furnished under this specification and the requirements of installation and routing. Impulse lines, fittings and other accessories required for the erection of complete Instrumentation and Control System supplied under various packages of this specification shall be supplied on "as required' basis. Bidder shall offer all necessary items for this section based on his experience on similar plants, plant layout diagrams, installation drawings and other applicable sections of this specification. Based on the good engineering practices Bidder shall furnish installation drawings during the engineering of the system for Owner's review and approval .The installation of the drawings shall be suitable for his installation of his range of instrumentation.

The Bidder shall furnish and test all required erection hardware, which is necessary for proper installation and interconnection of the equipment/systems furnished by the Bidder and their integration with main equipment/systems as per the enclosed installation drawings and other applicable clause. The Bidder shall furnish all hardware and accessories to ensure that the equipment/systems furnished form a complete and operational system meeting the intent and requirement of this specification.

All materials, furnished shall conform to the latest editions of America National Standard Code for Pressure piping, Power piping, ANSI B311.1, ANSI B16.11, ASME Boiler and Pressure Vessel Codes, IBR and other applicable ASME, ANSI and Indian Standards. Schedule numbers, sizes and dimensions of all carbon steel, stainless steel and alloy seamless steel pipe shall confirm to ANSI B.36.10 and of stainless steel pipe shall confirm to ANSI B 36.19 unless otherwise specified.

All materials supplied under this section shall be suitable for intended service; process operating conditions and type of instruments used and shall fully conform to the requirements of this specification.

The Bidder is responsible for the performance of the equipment furnished on system basis any shortfall in erection material observed during erection stage shall be compensated by the Bidder at no extra cost. (Installation drawings # 114-04-0000, 0100 to 0113 shall also be referred by bidder).

## 9.01.00 GUIDLINE FOR INSTALLATION AND ROUTING OF INSTRUMENT PIPING

### 9.01.01 General Requirements

The following general erection guidelines have been enumerated here to enable the Bidder to estimate the requirement of instrument piping in plant:-

i) All instrument piping shall be in accordance with good engineering practice. It shall be finalized during engineering stage. Instrument piping shall be complete with fittings, valves and other required accessories.

ii) Instrument piping shall not be routed:-

a) Across equipment removal areas
b) Below mono-rails and cranes
c) Above or below removable gratings
d) Above or below cable trays.

iii) Primary Impulse Piping System:

a) The primary impulse piping system shall include the instrument piping and all required accessories from process tap off point (root valves onwards) up to the respective instruments. From the same source, Tee off for instruments are not allowed. Separate tapping shall be provided for each instrument. The Bidder shall provide the necessary fittings and accessories along with impulse pipes for completeness and arrangements as per the finalized Instrument Installation Diagrams. Special accessories such as reservoirs and other devices shall be installed as required for flow primary element connection as required by the design of instruments, in accordance with the instructions of the instrument manufacturer.

b) The Bidder shall prepare impulse pipe routing drawings.

c) Impulse piping shall include a blow-down line and shut-off valve adequate for the duty requirements and for withstanding continuous design pressure and temperature of process medium. For process pressure above 40 $Kg/Cm^2g$, double valves shall be used before connecting to the blow-down header (This arrangement shall be provided for installation for the new transmitter if the existing transmitter has the same arrangement.)

d) To assure a constant static head the connections from low pressure steam and low pressure liquid filled lines should preferably slope downward continuously towards the instrument as the instrument is mounted below the source point. If downward slope is not feasible or the instrument is mounted above the source point, the line should slope upward continuously and a “pigtail” installed at the instrument to assure a water seal for temperature protection. Upward sloping liquid lines should be used only if the process pressure is sufficient to assure a head of liquid at the instrument. Horizontal runs should have a slope of not less than 40 mm per meter and must be adequately supported to maintain a constant slope. Vacuum connections to the condenser should always slope upward to the instrument.

e) Primary process piping for steam flow, liquid flow and manometric level measurement systems should preferably slope downward from the primary element connections to the instrument. Primary piping for flue gas and air flow measurement systems should preferably slope upward from

the primary element connections to the instrument. If these requirements cannot be met, special venting or drain provisions will be required. Horizontal runs must have a slope of not less than 40 millimeters per meter and must be adequately supported to maintain a constant slope.

f) Primary process piping from the field which enters the instrument enclosure from the bottom shall extend into the enclosure approximately 150 millimeters and be equipped with a socket weld to flare less tubing coupling of stainless steel. This coupling shall be used to connect the field primary process line to the enclosure process line. The field primary process line shall be anchored to the enclosure angle with U-bolts. Holes for supporting U-bolts shall be field or drilled.

g) All impulse piping shall be supported rigidly at an interval not exceeding 1.5 meters so as to prevent excessive sag in piping. Process piping shall not be used for supporting impulse piping.

h) Impulse lines subject to severe sonic pulsations such as boiler feed pump discharge, shall be of sufficient length and of suitable configuration to scatter harmful sonic wave energy before it reaches the instrument.

i) Impulse piping shall be installed to permit thermal expansion without placing excessive stress on the piping and without affecting the gradient of slope. Long continuous straight runs of piping shall always be avoided. If required, expansion loops shall be provided at least every 2.5 meters to break the continuity.

j) All welded and screwed fittings shall conform to ANSI B16.11. Threads of piping components shall be taper pipe thread in accordance with ANSI B2.1. All threads shall be clean machine cut with all burrs and chips removed. Lubricants shall be of dry filc type. Any one of the following compounds may be used as a pipe thread sealer. Bidder shall supply adequate amount of his preferred sealer for erection purpose.

   a) Permatex
   b) Molycote
   c) Neolube

   (Teflon tape shall not be used as a pipe thread sealer).

**9.01.02 Impulse Piping System**

Impulse piping system consists of primary impulse pipes/tubes, valves, fittings, valve manifolds and other accessories between the source connection point (source shut-off valve onwards) and all instruments/devices. Impulse pipe span for supporting clamp shall be 1.5 mtr. This will also include all piping and valves etc. required for instrument drain and vent connections. The Bidder shall furnish and test all items required for completeness of this specification.

**9.01.03 AIR SUPPLY PIPING**

The piping for air supply shall be as specified below (However the Bidder shall supply the materials as required basis to complete the system in all respect)

i) Individual Supply Lines and Control Signal Lines:-

Air lines shall be ¼ inch size, connected by brass/SS316 flare less tubing fittings. Copper/SS316 tubing shall be light drawn tampered tubing conforming to ATM B75 except copper tubing in tubing cables shall be annealed soft temper tubing conforming to ASTM B68 or B75. Fittings on the branch line to facilitate connections to the individual supply line shall be cast brass screwed type.

ii) Flexible Hoses:-

Flexible hoses shall be ¼ inch SS flexible hose pipe and with Buna-N liner steel wire braid reinforcement complete with ¼ inch brass/SS316 fittings and shall have swivel male pipe threads. Each hose shall be done meter in length.

iii) Pipe Material Specification:-

The piping material shall be carbon steel hot-dipped galvanized inside and outside as per IS-1239 or the equivalent of these standard heavy quality with screwed ends. The piping threads shall be as per ASA B.2.1.

iv) Isolating Valves:-

Gate valves as per ASTM B62 inside screw rising stem screwed female ends as per ASA B.2.1 valve bonnet shall be union type and trim shall be stainless steel body rating 150 pounds ASA. Valves sizes shall be ½ inch to 2 inch.

v) Fittings:-

Forged cast steel A234 Gr. WPM galvanized inside and outside; screwed as per ASA B2.1 dimensions as per ASA B16.11, rating 2000 pounds, elbows and soft seats. The size of the fittings shall be ½ inch through 2 inch.

vi) Air Filter Regulator Set:-

An instrument Air Filter Regulator Set with mounting assembles shall be provided for each pneumatic device requiring air supply.

vii) Instrument Air Piping System:-

a) Instrument Air shall be made available by the bidder at 3.5 to 7.0 Kg/cm² pressure. The instrument air may be arranged as under:-

11. For the control valves and power cylinders in owner's scope but controlled by bidder's control system, the instrument air requirement for E/P converter shall be tapped from the nearby instrument air header laid by bidder / already laid existing piping with accessories available near the control valves or damper.

Complete hardware required for interfacing with Owner system shall be in bidder scope.

b) Air supply piping shall be installed at site always with a slope of over 1/100 to prevent accumulation of condensed water within the pipe.

c) All joints in the instrument air sub-header shall be of screwed type.

d) Instrument air line shall be separate for each individual instrument, equipment & drive with own isolation valve and other required hardware. Tee off of instrument line for two or more same/similar services instrument, equipment & drive are not acceptable.

e) Instrument air flushing/purging lines shall be provided for Bowl Mill DP, secondary air flow measurement instrument and other all flue gas services instruments etc.

viii) Signal / Control Air Tubing System:-

Necessary tubes with fittings and accessories for output signal from pneumatic instruments mounted in the field and control signals to final control elements shall be covered under this tubing system.

## 9.02.00 SPECIFICATION FOR ERECTION HARDWARE

The erection hardware shall meet the following specifications:-

| | Item | Specification |
|---|---|---|
| **9.02.01** | **Impulse Piping** | |
| i) | High pressure and high temperature services (Medium: Steam & Water and furnace region) | Seamless Alloy Steel piping to ASTM A335 GR.P91/22 (schedule XXS/160 for high pressure & high temperature) |
| ii) | Low pressure and low temperature services (Medium: Steam & Water) | Seamless carbon steel piping to STM A106, Gr.C |
| iii) | Low pressure and low temperature services (Air, Flue gas) | ERW carbon steel piping to IS 1239:1973 Heavy class System) |
| iv) | Steam and water analysis system | Seamless stainless steel piping to ASTM A312 GR. TP-321 |
| v) | Seamless copper tubing | ASTM B-75 |

**9.02.02** **Fittings Double compression type**

| | | |
|---|---|---|
| i) | Material for socket weld fittings | ASTM A105<br>ASTM A182,<br>Gr. F22<br>6000/3000 lbs |
| ii) | Dimensions of fittings | ANSI B16.11 |
| iii) | Fittings for steam and water analysis. | Gr. F-321 |

**9.02.03** **Valves**

| | | |
|---|---|---|
| i) | 3 – way valves | SS body/forged CS body stellited internals and SW ends as per requirement for 2500 lb/800 lb ASA ratings. |
| ii) | 5- valve manifolds | FAS body/FCS body 316SS stellited internals with NPT(F) SCRD ends for 3000/2500 lb/1500 lb/800 lb ASA ratings. Construction – Single block (Bar stock) |
| iii) | 3-valve manifolds | FAS body/FCS body 316SS stellited internals with NPT(F) SCRD ends for 3000/2500 lb/1500 lb/800 lb ASA ratings. Construction – Single block (Bar stock) |
| iv) | 2-valve manifolds | FCS body, 316SS stellited internals, NPT(F) SCRD ends. Construction – Single block (Bar stock) |
| v) | Isolation and drain valves | Globe valves with FAS body/FCS body, 316SS stellited internals SW ends for 3000/2500 lb/1500 lb/800 ASA ratings. |

| | | |
|---|---|---|
| **9.02.04** | Condensation vessels | FAS/FCS body with NPT (F) SCRD connection and vent plugs for 3000/2500/1500/800 lb ASA ratings. |
| **9.02.05** | Racks and Associated Equipment | ANSI C83.9-1972 |
| **9.02.06** | Code for pressure piping, welding and Hydrostatic testing | ANSI B-31.1 |

| | | |
|---|---|---|
| **9.02.07** | Flexible conduits with fittings | Lead coated, paper insulated, heat resistant flexible metallic conduits with necessary fittings. |

9.02.08 3 Valve manifold shall be used, wherever Diff Pressure transmitter/switch have been used for pressure measurement.

9.02.09 5 Valve manifold shall be used for Diff. Pressure & Flow measurement Transmitters/Switches.

9.02.10 In addition to above, table # 9.1 shall also be followed for selection of specific erection hard ware as per process requirements.

**9.03.00 TRANSMITTER & SWITCHES ENCLOSURES**

In general, BTG process transmitters & switches installed at outdoor location and in areas where they are subjected to splashing oil, water, steam etc., shall be mounted in closed type transmitter rack. For other areas (indoor), open type racks may be used for installation of transmitters and process switches. However the actual requirement shall be finalized during detailed Engineering considering following:-

i) Transmitter/Switches enclosures shall be free standing, enclosed type offering protection against dust, moisture and vermin. Enclosures shall be suitable for outdoor installations, in thermal power plants.

ii) The enclosures shall comprise of Galvanized Sheet mounting plate internally. Also external-mounting brackets in Polyamide or Stainless Steel shall be available. Alternatively transmitter enclosures can be glass Fiber Reinforced Polyester (GRP) compression moulded and shall be weather proof.

iii) Instrument piping inside the enclosure shall conform to the specification and in line with typical installation drawings enclosed with the specification.

iv) Blow down header shall be provided inside the enclosure as called for.

v) Bulk head connection shall be provided to receive and terminate the impulse pipes from root valves.

vi) Instrument tubing, fittings and isolation, drain valves shall be to ANSI code for pressure piping. Piping/tubing shall be subject to hydrostatic tests at 1.5 times maximum system pressure.

vii) Support angles shall be provided for valve manifolds, wiring trays etc. Enclosures shall be complete with necessary bulk head fittings, junction boxes, drain header and other accessories as needed on the basis of approved hook up drawings.

viii) Sufficient spacing among adjacent transmitters shall be maintained to offer easy accessibility and operational convenience. The enclosure shall be designed with sizes to suit the grouping and to completely include all the hardware for hooking up

the transmitters to the process on the basis of approved installation diagrams. A maximum of five (5) transmitters are envisaged to be grouped in one enclosure.

x) A minimum of twenty (20) percent spare terminals shall be provided. Only one wire per terminal shall be used on the outgoing side of these blocks (for cable panel). Any common connections required shall be provided on the panel side of the block. All incoming power terminals are to be clearly identified in a manner distinctly different from all other terminals and grouped in a logical pattern.

xi) Chapter no. 6 of this volume shall also be referred for designing of Transmitter/Switches enclosures.

**9.04.00 LOCAL INSTRUMENTS, LOCAL BOARDS AND TAPPING POINTS**

i) All local gauges as well as sensors, Transmitters and switches any other instruments for parameters like pressure, temperature, level, flow etc for safe and efficient operation of equipment under the scope of specification, shall be provided by bidder as approved by Owner. Such equipment shall be listed by the Bidder detailing the items with the respective functions in service. All field mounted instruments shall be mounted in such a way as not to be affected by vibration & environmental conditions. Racks to mount these instruments shall be furnished by bidder complete with requisite erection hardware, tubings and junction boxes with all terminals of the instruments duly wired complete with cable glands. Groupings of instruments, actual number of racks for instruments and its construction shall be to Owners approval.

ii) Transmitters & Switches provided shall be mounted in transmitter/Switches enclosures to owner's approval. The junction box for electrical connections shall be outside the transmitter enclosures.

iii) All erection hardware required for complete installation/ implementation of entire instrumentation specified is included in bidders scope. Any change in size, type, rating or in quantity deemed necessary during engineering shall be supplied within package price with no additional financial implication to owner.

iv) Bidders scope includes providing counter flanges on pipe lines/ vessels to suit owner arranged flanged devices. Counter flanges shall be complete with gaskets, nuts, bolts and other requisite accessories for proper installation.

v) Separate and independent tapping on equipment/associated piping shall be provided to suit the philosophy of redundant primary sensors. Separate sensors for control and monitoring etc are as decided by Owner. This shall include application such as first stage pressure. Wherever the process value being measured needs to be compensated for temp, pressure variations, the tapping points for such compensating elements shall be provided in requisite number along with the tapping for the process value.

vi) Whereever transmitters & switches are provided, in addition Local gauges shall also be provided by bidder for local field monitoring.

vii) Local instruments and remote sensors & transmitters to be furnished with the equipment shall generally be as indicated herein and as per redundancy criteria indicated elsewhere but not be limited to the following: -

**1. <u>Pressure Measurement</u>**

i. **Pressure Gauge** for:

a) Shell pressures of all Deaerator, HP and LP heaters and other vessels.
b) Mercury manometers shall be provided during air outlet flows measurement.
c) Bleed steam pressure at extraction point for all turbine extractions and for pressure on drain lines.
d) Pressure gauges at inlets and outlets of condensate extraction pumps, main oil pump, each auxiliary oil pump, AC standby oil pump, DC Emergency oil pump, jacking oil pumps, DM makeup pumps, DMCW pumps, BFP, or any other pumps etc.
Pressure Gauge at outlet of each type of Fan.
e) Lube oil pressure before and after oil coolers, HPT & IPT front seal chamber leak off pressure.
f) MS pressure downstream of ESV, after HPT control valves and after HPT first stage, HRH steams pressure after IV, Gland steam header pressure, HPT exhaust etc.
g) Condensate pressure in condensate pump discharge header, and feed water pressure at inlet and outlet of each LP & HP heaters.
h) LP turbine exhaust pressure and condenser pressure
i) Relay/Lube/Control oil pressure, Drain oil lines pressure.
j) Pressure gauges for vacuum pumps and each pump discharge.
k) Pressure gauge at Instrument and service air header in compressor room and in the field at the main location of instrument/service air header, the pressure gauges shall be provided.
l) Pressure gauges at inlet and outlet of each heat exchanger and cooler.
m) Frame mounted Pressure Gauges (FMG) shall be provided for Main steam Pressure, Feed water pressure to economizer, CRH Steam Pressure, HRH Steam Pressure etc.
n) For condensate storage tank the pressure gauge in terms of 0-10000 mm wc or suitable range having **dial size of 300 mm or bigger size** shall be provided.
o) **U tube manometer with Hg filled for direct measurement of condenser vacuum** shall be provided in the fixed with isolation valve for local indications.
p) Above are the minimum requirements, actual quantities shall be as decided during detailed engineering by owner.
q) Pressure gauge for all BoP packages as decided during detailed engineering by owner.

ii. **Pressure Switches**

a) Pressure switches at condensate Extraction Pump Discharge header, Boiler feed pump, seal water line or any other pumps for alarm (high & low) and interlock purpose.

b) Pressure switches for steam supply to LP/HP heaters.
c) Pressure switches for initiation of turning gear.
d) Pressure switches for control oil, jacking oil and lube oil pressure for all required alarms and interlocks.
e) Steam pressure downstream of ESV, steam pressure after first stage of HPT, gland steam header pressure and suction line from turbine glands to Gland cooler.
f) Pressure switches for condenser vacuum low, very low alarms & interlocks.
g) Condenser water box pressure for alarm interlocks.
h) Pressure switches (low & high) for individual pumps/blowers suction/discharge and discharge header – alarms, interlocks and protection
i) At the main location of instrument air header the pressure low switches shall be provided for alarms in DDCMIS
j) Pressure switches/any other process switch etc. for OLCS / Alarms / Interlocks / Protection. Pressure switches at inlet, outlet of individual pumps and discharge header of pumps for protection and auto start / stop & alarms.
k) Above are the minimum requirements, actual quantities shall be as decided during detailed engineering as per redundancy criteria by owner.
l) Pressure switches for all BoP packages as decided during detailed engineering. by owner.

iii. **Differential Pressure Transmitters, Diff Pressure Switches & Diff. Pressure Gauges**

a) Pressure across strainers and filters.
b) Diff. Pressure Transmitters/switches/Gauges for all BoP packages as decided during detailed engineering by owner.
c) Diff. Pressure Transmitter across condenser on CW lines, Air pre heaters on air & flue gas lines, on PA lines, CEP suction strainers, Feed control station etc.
d) Above are the minimum requirements, actual quantities shall be as decided during detailed engineering as per redundancy criteria by owner.

**iv. Pressure Transmitters**

a) For all services as mentioned for Pressure gauges & Pressure Switches.
b) Pressure Transmitters at condensate Extraction Pump individual Discharge and discharge header, Boiler feed pump individual Discharge and discharge header, seal water line or any other pumps/fans/HT/LT unidirectional drive for alarm (high & low) and interlock purpose.
c) Pressure transmitter for wind box (Left/Right) & pulverizer seal air fans discharge pressure.
d) Pressure Transmitters as on required basis for monitoring, interlocks & controls as per redundancy criteria and approved by owner.
e) Above are the minimum requirements, actual quantities shall be as decided during detailed engineering as per redundancy criteria and approved by owner.
f) Pressure Transmitters for all BoP packages as decided during detailed engineering by owner.

**2. Temperature Measurments:-**

The Bidder shall furnish all temperature sensing elements to be installed in their piping. The scope of supply shall include, but not limited to the following: -

i) Duplex RTDs for all bearing, drain oil from bearings, LPT exhaust steam, 3 no's of duplex RTDs each on left and right CW outlet of condenser etc.

ii) 6 no. duplex or 12 no. simplex Embedded temperature detectors for various motor stator windings and duplex RTDs for Motor/Pump bearing temp.

iii) Chromel-alumel surface/other thermocouples for turbine casings, ESV, IV bodies, superheated steam, hot reheat steam piping, steam of first stage HPT, inlet bowl of IPT, steam exhaust of HPT, down stream of ESV and IV, steam in ESVs and IVs, steam admission pipes metal temperatures, HPC, IPC flange metal temperature etc.

iv) For all HP heaters remote monitoring with redundant independent sensors of inlet/outlet temperatures of feed water and extraction steam shall be provided in addition to local gauges.

v) For all LP heaters remote monitoring with redundant independent sensors of inlet/outlet temperatures of feed water and extraction steam shall be provided in addition to local gauges.

iv) Temperature sensors for HP-LP bypass system for measurement as well as for control.

v) Adequate number of temperature Elements shall be furnished to provide initiating contacts for temperature interlocking and trip circuits. The temperature elements shall be provided, but not limited to the following: -

Steam temperature of HPT exhaust, steam temperature after ESV (L&R), IV (L&R), LPT exhaust hood steam, drain oil temperature of all journal bearings and thrust bearing & lube oil header temperatures, thrust bearing of each condensate extraction pump and vacuum pump protection, interlocks.

vi) Metal Temp measurement and steam temp measurement at each super heater & Reheater location.

vii) Temp. Element & Temp gauges at Feed water line to economizer inlet, economizer to steam separator, spray water lines to desuperheaters, Soot blower steam, Soot blower steam drain lines, steam drain lines, Flue gas & air lines etc

viii) Temp. Measurements (Local & remote) for all BoP packages as decided during detailed engineering.

ix) Thermocouples for Temp. above 200 deg C shall be provided by bidder.

x) For plate heat exchangers, spare thermowell provision shall be made at inlet & outlet of ACW & DMCW lines in addition to local & remote temperature monitoring points.

xi) Each ESP Hopper shall be provided with RTDs to control the temperature of ash through Hopper heater.

**xii) Temperature gauges.**

a) For bearing temperatures AC and DC lube oil pumps, LPT exhaust hood etc.

b) For condensate and feed water at inlet and outlet of HP heaters, Vacuum pumps, LP heaters etc.

c) Steam & water inlet/outlet of LP and HP heaters, steam and air mixture inlet to vacuum pumps, and drain lines etc.
d) Journal/thrust bearing drain oil, lube oil at inlet/outlet of oil coolers, cooling water at inlet and outlet of oil coolers etc.
e) Thrust bearing of each condensate extraction pump.
f) Temp. Gauges at inlet and outlet of each heat exchanger and cooler.
g) Frame mounted Temperature Gauges (FMG) shall be provided for Main steam Temperature, Feed water Temperature to economizer, CRH Steam Temperature, HRH Steam Temperature etc

xiii) Above are the min. requirements, actual quantities shall be as decided during detailed engineering by owner.

**3. Level Measurement**

i) Level gauges - level gauges for boiler separator, HP heaters, LP heaters, deaerator, drain cooler, gland steam cooler, vacuum tanks, condenser hot well CBD tank, stator water tank, Stator water expansion tank and other pressure vessels, main oil tank and all oil tanks in BTG & BOP package. The level gauges shall be mica shielded steel armoured transparent glass type. Level gauges for condenser hot well shall be provided on both sides.

ii) Level switches for HP/LP heaters, drain cooler, gland steam cooler, condenser hot well, deaerator, main oil tank and other pressure vessels, tanks, sumps etc. The separate switches for high, very high and low levels shall be provided as per interlocks and protection requirements.

External cage mounted magnetic level switches/ displacer type shall be employed for low pressure & low temp. services.

However conductivity type level switches shall be provided for high pressure & high temp services like HP heaters, CRH/HRH drain Pot, Turbine Drains etc.

iii) Level Transmitters (Type as per Owner approval) for open sump/tank/bunker/vessel/heaters.

iv) Level measurement for all BoP packages as decided during detailed engineering.

v) Level switches for OLCS / Alarms / Interlocks / Protection. Level switches for sump/tank level high/normal/ low/very low interlocks.

vi) Each ESP hopper must be provided with 3 nos. level switch (switches 2 nos. for high level and One no. for low level.)

vii) Above are the min. requirements, actual quantities shall be as decided during detailed engineering by owner.

**4. Flow Measurements:-**

a) Primary Elements: Flow nozzles shall be used for feed water flow and other critical measurements where weld-in construction is required. Flow nozzles shall be made of stainless steel, with three sets of pressure taps installed in the pipe wall where required. One no. spare set of pressure tap shall also be provided on flow nozzle,

wherever required. Installation of flow nozzles and pressure taps shall be made in the pipe fabricator's shop and shall be witnessed by a representative from the flow nozzle manufacturer.

b) Paddle type orifice plates shall be used for other flow measurements where flanged construction and higher pressure loss are acceptable. Orifice plates shall be made of stainless steel. Orifice flanges shall be of the raised face weld neck type with dual sets of taps.

c) Construction and installation of flow nozzles and orifices shall conform to the requirements of ASME Performance Test Code PTC-19.5, and discharge coefficients shall be predicted in accordance with data published in ASME Research Report on Fluid Meters.

d) Airfoil or venturi flow sections, shall be used for measuring boiler combustion airflow.

e) A special high accuracy flow nozzle pipe shall be provided to determine feed water flow to the economizer. This nozzle shall be hydraulically calibrated and utilized for feed water flow control and for turbine testing as described in ASME PTC 6 (latest revision).

f) Orifice plates shall be supplied with carrier rings as per process requirement.

g) Doppler effect type flow meters shall be used for sludge applications.

h) For Raw water, water treatment plant and effluent treatment plant, ultrasonic type flow meters to be used.

i) Secondary Elements: Secondary elements for differential type flow sensors shall be strain gauge or capacitance type differential pressure transmitters. Square root extraction required for the DP transmitters shall be performed electronically in the transmitter itself.

j) HFO/LDO flow meters shall be based on coriolis mass flow technology. Fuel Oil meters shall be provided for fuel oil unloading system and near boiler after day oil tank (at main supply & return lie).

k) Flow nozzles shall be provided for following services in main plant:-

i) Steam flow measurement for BFP Turbines.
ii) Feed water flow measurement
iii) Auxiliary steam flow measurements
iv) HP bypass flow measurements
v) BFP suction flow.
vi) Deaerator water flow measurement
vii) HP heaters drain Flow measurements.

Orifices shall be provided for following services:-

i) Spray water flow measurement

ii) Condensate flow measurements
iii) DM/hotwell makeup to condenser.
iv.) Condensate dump flow to CST
v) Gland Steam Condensate flow measurements

l) For DM water flow & Ash Slurry flows measurements online electromagnetic flow meter shall be used.

m) At CW & ACW pump discharge headers flow transmitters shall be provided (Non Contact ultrasonic Type are preferable). In addition flow measurement shall also be provided for CW water used any where except condenser service.

n) Instrument and Service Air - Vortex/Swirl type Flow meter

o) Flow transmitters for general applications shall be of the differential pressure type

.

p) Flow switches for OLCS / Alarms / Interlocks / Protection.

q) Lubricating oil Flow transmitter/meter with switch shall be provided for Bearing systems of APH, FD, PA, etc.,

r) Sight glasses flapper indication type shall be provided on lube oil cooling water piping as required to ensure indication of fluid flow.

s) On line Fuel flow & velocity measurement facility in each Pulverized Fuel (PF) pipe for each coal pulveriser shall be provided by bidder for accurate, absolute and simultaneous measurement of coal velocity, coal density, coal mass flow rate and air-to-fuel ratio. The equipments shall compromise of sensors working on micro wave technology.

t) In addition to the **conventional triple DP measurement techniques** involving venturi/Airfoil for secondary air flow measurement, One number **Flow measurement** system each on Left side and Right side shall be provided **as redundant/checking measurement for secondary air flow** which could be used in the optimization package.

On line secondary air flow & velocity measurement facility in each on left side & right side shall be provided by bidder for accurate, absolute and simultaneous measurement of air velocity & flow rate. The equipments shall compromise of sensors working on tribo-electric (Correlation technique) technology.

u) Any other flow element/meter required for system shall be finalised as per system requirement and as per approved drawings/documents by owner.

9.05.00 **Process Connections**

The type of instrument source connection shall depend upon the process parameters and the tapping size. The source connection drawings shall be finalised during the engineering stage.

Size of tapping point stub, number and size of root valves for different types of measurements are as follows:

| Sl. No. | Quantity of root valves | Size of stub and root valve | Service Condition |
|---|---|---|---|
| **Pressure and Differential Pressure Measurement** | | | |
| (i) | 2 | 25NB | ≥ 40 bar(g) OR 425$^0$C |
| (ii) | 1 | 15NB | < 40 bar(g) AND 425$^0$C. |
| **Level Measurement** | | | |
| **(a)** | **Level Gauge & Switch** | | |
| (i) | 2 | 25NB | ≥ 40 bar(g) OR 425$^0$C |
| (ii) | 1 | 25NB | < 40 bar(g) AND 425$^0$C |
| **(b)** | **Level transmitter (displacement type)** | | |
| (i) | 2 | 40NB | ≥40 bar(g) OR 425$^0$C |
| (ii) | 1 | 40NB | <40 bar(g) AND 425$^0$C |
| **(c)** | **Stand pipe for level measuring instrument** | | |
| (i) | 2 | 80 NB | ≥40 bar(g) OR 425$^0$C |
| (ii) | 1 | 80 NB | < 40 bar(g) AND 425$^0$C |
| *Flow Measurement* | | | |
| (i) | 2 | 25NB | ≥ 40bar(g) OR 425$^0$C |
| (ii) | 1 | 25NB | < 40 bar(g) AND 425$^0$C |
| **Sampling system measurement (Steam and Water Service)** | | | |
| (i) | 2 | 25 NB | ≥40 bar(g) OR 425$^0$C |
| (ii) | 1 | 25 NB | < 40 bar(g) AND 425$^0$C |

**Technical Specifications for C&I Systems-Table-No. 9.1**

| S.No. | System/Line Description | Piping Class | Impulse Pipe material | Schedule (Size) | Materials for fitting/ valve body | Valve steam material | Rating of Piping Fitting | Pressure Class of valve |
|---|---|---|---|---|---|---|---|---|
| 1 | Main steam, Up steam & down stream of HP bypass and up stream of auxiliary steam pressure reducing valve. | A | ASTM-A335 Gr.P-91/22 (Note-2) | XXS (½ Inch) | Note-3 | Note-3 | 9000lb | 3000 SPL |
| 2 | BFP discharge/ superheater attemperator/spray to PRDS | B | ASTM-A106 Gr. C | 160 (½ Inch) | Note-3 | ASTM-A-182 Gr.F6a | 6000lb | 2500 SPL |
| 3 | Reheater attemperator | C | ASTM-A106 Gr. C | 160 (½ Inch) | ASTM-A-105 | ASTM-A-182 Gr.F6a | 6000lb | 1500 SPL |
| 4 | Hot. Reheat/Down stream of Aux.Steam pressure reducing valve upto desuperheater/flash tank drain manifold, HRH upstream & down stream of LP Bypass valve. | D | ASTM-A335 Gr.P-91/22 (Note-2) | 160 (½ Inch) | ASTM-A182 Gr.F-22 | Note-3 | 3000lb | 2500 SPL |
| 5 | Cold reheat upto Tee-off for HP bypass. | E | ASTM-A335 Gr.P-22 | 80 (½ Inch) | ASTM-A182 Gr.F-22 | ASTM-A-182 Gr.F6a | 3000lb | 800 |
| 6 | Cold reheat down steam of Tee-off (HP Bypass) | F | ASTM-A106 Gr. C | 80 (½ Inch) | ASTM-A105 | ASTM-A-182 Gr.F6a | 3000lb | 800 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7 | BFP suction/condensate system/Extraction to LPH/HPH and Extractions to BFPT, Desecrator, auxiliary steam. | G | ASTM-A106 Gr. C, ASTM-A335 Gr.P-11/22 | 80 (½ Inch) | ASTM-A105 | ASTM-A-182 Gr.F6a | 3000lb | 800 |
| 8 | Air/Flue gas outside furnace. | M | ASTM-A106 Gr.B/C | 80 (3/4 Inch) | ASTM-A105 | ASTM-A-182 Gr.F6a | 3000lb | 800 |
| 9 | Air flue gas inside furnace | N | ASTM-A335 Gr.P-22 | 80 (3/4 Inch) | ASTM-A182 Gr.F-22 | ASTM-A-182 Gr.F6a | 3000lb | 800 |
| 10. | Purge Air | O | ASTM-A106 Gr.C | 80 (3/4 Inch) | ASTM-A105 | SS316 | 3000lb | 800 |
| 11. | DM Cooling water | P | ASTM-A312 TP 316 | 80/40 (1/2 Inch) | ASTM – A 182 F 316 | SS316 | 3000lb | 800 |
| 12. | CW & ACW | Q | ASTM-A106 Gr.C | 80 (1/2 Inch) | ASTM-A105 | SS316 | 3000lb | 800 |

**Note:-**

1). Above requirements are minimum to be complied by bidder. Rating of piping / fittings / valves etc. is subjected to be approved by owner as per the final design pressure & temperature finalized during the detailed engineering, as per ANSI B 31.1.
2). In case temperature is more than 540 deg C, the material shall be P-91 only.
3). Material shall be compatible with that of the impulse pipe material and design parameter.
4). For DM Plant or DM water services, complete erection Hardware material shall be SS316 only.

# DRAWING DOCUMENTS DISTRIBUTION SCHEDULE (ANNEXURE-A)

**No. of copies required from the contractor after award of the contract.**

| S.NO. | DESCIPTION | TANGEDCO | DESEIN/ CONSULTANT | BHEL (PEM) | BHEL SITE AND REGION |
|---|---|---|---|---|---|
| 1 | Drawing for approval/ information | 5+1S+2CD | 5+1S+1CD | 2+1S | -- |
| 2 | Final drawing (APPROVED) | 4+1S+3CD | 4+1S+3CD | 1+1S | 10+1S+1CD |
| 4 | AS BUILT DRAWINGS | 4+1S+3CD | 4+1S+3CD | 1+1S | 10+1S+1CD |
| 5 | CD ROM "FINAL DRAWING" | 2CD | 1-CD | 1CD | 2CD |
| 6 | Type test reports | 2+1S | 2+1S | --- | 2+1S |
| 7 | O & M Manuals for approval | 2+1CD+SS | 2+1CD+SS | 1+CD+SS | ------ |
| 8 | Final O & M Manuals | 4+6CD+SS | 4+4CD+SS | 1+CD+SS | 10+5CD+SS |
| 9 | Performance guarantee test reports | 2+1S | 2+1S | --- | 2+1S |

* Applicable for vendor drawings

CD - Compact Disc (Read Only)

S-SOFT COPY (IN EMAIL/WRENCH).

**NOTE:** ALL DRGS. SHALL BE PREPARED ON COMPUTER ***AUTOCAD (LATEST VERSION)*** AND OTHER DOCUMENTS (LIKE DATA SHEET ETC.) ON ***MS-OFFICE (LATEST VERSION).*** SOFTWARE. BIDDER NOT COMPLYING WITH THE REQUIREMENT SHALL NOT BE CONSIDERED.

## ALREADY APPROVED DOCUMENTS (SUBMITTED BY M/S OGBL)

## (ANNEXURE-B)

NOTE:

1) BIDDER CAN ALSO GO WITH OTHER MAKE/SUB-VENDOR ITEMS FOR WHICH THE MODIFICATION WORK ON EXISTING CIVIL FOUNDATION TO BE TAKEN CARE BY BIDDER AT SITE.
2) THE MAKE OF ITEMS SHALL BE AS PER ENCLOSED APPROVED SUB VENDOR LIST (PE-V0-412-158-A006). HOWEVER, ANY ADDITIONAL SUB-VENDOR REQUIRED THE SAME SHALL BE SUBJECT TO BHEL/CUSTOMER APPROVAL DURING DETAILED ENGINEERING WITHOUT ANY COMMERCIAL/DELIVERY IMPLICATION TO BHEL/CUSTOMER.

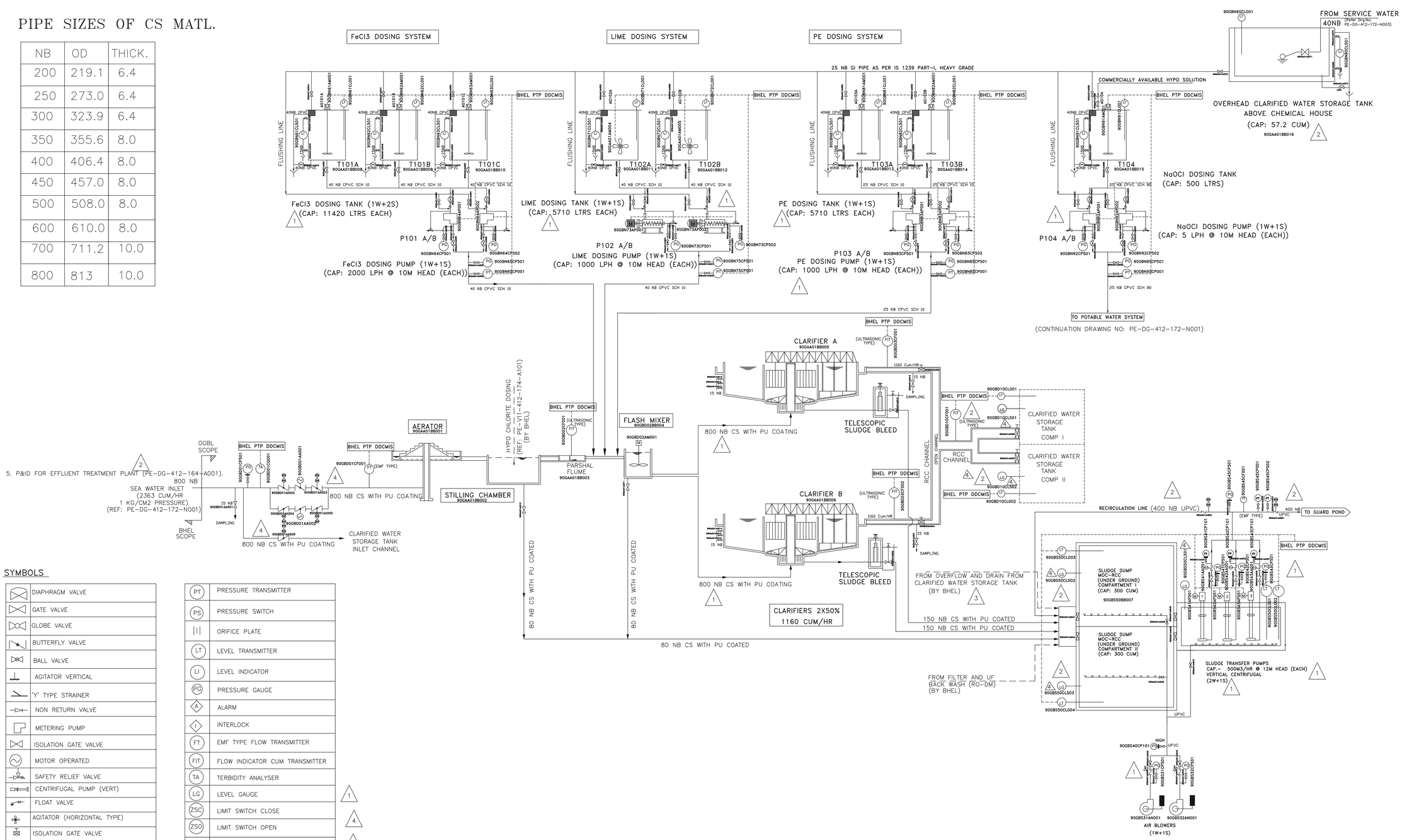
| MDL FOR PRE TREATMENT PLANT | | | |
|---|---|---|---|
| **Sl. No** | **Drawing/Document No** | **Title** | **Status** |
| 1 | PE-V0-412-158-A001 | P&I DIAGRAM FOR PT PLANT | Approved |
| 2 | PE-V0-412-158-A002 | LAYOUT FOR PT LANT | Approved |
| 3 | PE-V0-412-158-A004 | PROCESS SIZING CALCULATION | Approved |
| 4 | PE-V0-412-158-A006 | SUB VENDOR LIST | Approved |
| 5 | PE-V0-412-158-A007 | CONTROL PHILOSOPHY | Approved |
| 6 | PE-V0-412-158-A056 | I/O list | Re Submission Pending |
| 7 | PE-V0-412-158-A057 | Drive list | Approved |
| 8 | PE-V0-412-158-A058 | Control Scheme | Approved |
| 9 | PE-V0-412-158-A003 | HYDRAULIC FLOW DIAGRAM & HYDRAULIC LEVEL CALCULATIONS | Approved |
| 10 | PE-V0-412-158-A008 | TECHNICAL DATA SHEET FOR HORIZONTAL / VERTICAL CENTRIFUGAL PUMPS | Approved |
| 11 | PE-V0-412-158-A010 | TECHNICAL DATA SHEET FOR METERING PUMPS | Approved |
| 12 | PE-V0-412-158-A012 | TECHNICAL DATA SHEET FOR BLOWERS | Approved |
| 13 | PE-V0-412-158-A014 | TECHNICAL DATASHEET FOR BALL VALVES | Approved |
| 14 | PE-V0-412-158-A015 | TECHNICAL DATASHEET FOR BUTTERFLY VALVES | Approved |
| 15 | PE-V0-412-158-A016 | TECHNICAL DATASHEET FOR DIAPHRAGM VALVES | Approved |
| 16 | PE-V0-412-158-A017 | TECHNICAL DATASHEET FOR GATE VALVES | Approved |
| 17 | PE-V0-412-158-A018 | TECHNICAL DATASHEET FOR NON RETURN VALVES | Approved |
| 18 | PE-V0-412-158-A028 | MECH. GA FOR CASCADE AERATOR, STILLING CHAMBER, FLASH MIXER AND PARSHALL FLUME FOR CLARIFIER | Approved |
| 19 | PE-V0-412-158-A030 | MECH. GA FOR CLARIFIER | Approved |
| 20 | PE-V0-412-158-A033 | MECH. GA AND DATA SHEET FOR CLARIFIER BRIDGE MECHANISM | Approved |
| 21 | PE-V0-412-158-A035 | MECH. GA FOR CHEMICAL HOUSE INCLUDING ALL DOSING TANKS | Approved |
| 22 | PE-V0-412-158-A036 | MECH. GA FOR SLUDGE SUMP | Approved |
| 23 | PE-V0-412-158-A094 | PG TEST | Approved |
| 24 | PE-V0-412-158-A021 | VALVE SCHEDULE | Approved |
| 25 | PE-V0-412-158-A049 | INSTRUMENT SCHEDULE | Approved |
| 26 | PE-V0-412-158-A092 | PAINTING SCHEDULE | Approved |
| 27 | PE-V0-412-158-A060 | CIVIL DESIGN CALCULATION FOR CASCADE AERATOR, STILLING CHAMBER, FLASH MIXER AND PARSHALL FLUME FOR CLARIFIER | Approved |
| 28 | PE-V0-412-158-A061 | CIVIL GA FOR CASCADE AERATOR, STILLING CHAMBER, FLASH MIXER AND PARSHALL FLUME FOR CLARIFIER | Approved |
| 29 | PE-V0-412-158-A062 | CIVIL GA & RC DETAILS FOR STILLING CHAMBER, FLASH MIXER AND PARSHALL FLUME(Sh1) & STAIRCASE OF CASCADE AERATOR(Sh2) | Approved |
| 30 | PE-V0-412-158-A064 | CIVIL GA AND RC DETAILS OF CLARIFLOCCULATOR | Approved |
| 31 | PE-V0-412-158-A065 | CIVIL GA AND RC DETAILS OF CLARIFLOCCULATOR OUTLET CHANNEL | Approved |
| 32 | PE-V0-412-158-A075 | CIVIL DESIGN CALCULATION FOR SLUDGE SUMP | Re Submission Pending |

| | | | |
|---|---|---|---|
| 33 | PE-V0-412-158-A077 | CIVIL GA AND REINFORCEMENT DRAWING FOR SLUDGE SUMP | Re Submission Pending |
| 34 | PE-V0-412-158-A046 | TECHNICAL DATSHEET AND HOOK UP DRAWING FOR LOCAL INSTRUMENTS | Approved |
| 35 | PE-V0-412-158-A048 | TECHNICAL DATSHEET AND HOOK UP DRAWING FOR ANALYSERS | Approved |
| 36 | PE-V0-412-158-A027 | TECHNICAL DATA SHEET HOIST, WEIGHING SCALE , TROLLEY AND CHAIN PULLEY BLOCK | Approved |
| 37 | PE-V0-412-158-A024 | PIPING SPECIFICATION | Approved |
| 38 | PE-V0-412-158-A047 | TECHNICAL DATSHEET AND HOOK UP DRAWING FOR TRANSMITTERS | Re Submission Pending |
| 39 | PE-V0-412-158-A068 | GROUND IMPROVEMENT OF CLARIFIER-PTP | Approved |
| 40 | PE-V0-412-158-A067 | GROUND IMPROVEMENT OF CASCADE AERATOR, STILLING CHAMBER, FLASH MIXER AND PARSHALL FLUME -PTP | Approved |
| 41 | PE-V0-412-158-A026 | TECHNICAL DATA SHEET FOR AGITATOR | Approved |
| 42 | PE-V0-412-158-A009 | QAP FOR HORIZONTAL / VERTICAL CENTRIFUGALPUMPS WITH MOTOR | Approved |
| 43 | PE-V0-412-158-A011 | QAP FOR METERING PUMPS WITH MOTOR | Approved |
| 44 | PE-V0-412-158-A013 | QAP FOR BLOWERS WITH MOTOR | Approved |
| 45 | PE-V0-412-158-A020 | QAP FOR VALVES | Approved |
| 46 | PE-V0-412-158-A054 | QAP / CHECK LIST FOR ALL INSTRUMENTS | Approved |
| 47 | PE-V0-412-158-A097 | QAP FOR 800 NB BUTTERFLY VALVES | Approved |
| 48 | PE-V0-412-158-A098 | PIPING ISOMETRIC DRAWING FOR PRE- TREATEMENT PLANT | 1ST Submission Pending. |
| 49 | PE-V0-412-158-A099 | ENGINEERING BOQ FOR FOR PRE- TREATEMENT PLANT | 1ST Submission Pending. |
| 50 | PE-V0-412-158-A096 | O&M MANUAL FOR PRE- TREATEMENT PLANT | 1ST Submission Pending. |
| 51 | PE-V0-412-158-A095 | ELECTRICAL LOAD LIST FOR PRE- TREATEMENT PLANT | 1ST Submission Pending. |
| 52 | PE-V0-412-158-A093 | ERECTION AND COMMISSIONING PROCEDURE FOR PRE-TREATEMENT PLANT | 1ST Submission Pending. |

NOTE:
1) FOR "Re Submission Pending" THE LATEST DRAWING/DOCUMENT ENCLOSED, FURTHER TO BE REVISED BY BIDDER.
2) ENGG BOQ SHOULD BE VERY DETAILED TO COVER 100% OF THE ITEMS (TO THE POSSIBLE EXTEND) SO THAT NO ITEM IS FOUND TO BE UNSUPPLIED DURING ERECTION AND COMMISSIONING.

# PIPE SIZES OF CS MATL.

| NB | OD | THICK. |
|---|---|---|
| 200 | 219.1 | 6.4 |
| 250 | 273.0 | 6.4 |
| 300 | 323.9 | 6.4 |
| 350 | 355.6 | 8.0 |
| 400 | 406.4 | 8.0 |
| 450 | 457.0 | 8.0 |
| 500 | 508.0 | 8.0 |
| 600 | 610.0 | 8.0 |
| 700 | 711.2 | 10.0 |
| 800 | 813 | 10.0 |




## SYMBOLS

| | |
|---|---|
| | DIAPHRAGM VALVE |
| | GATE VALVE |
| | GLOBE VALVE |
| | BUTTERFLY VALVE |
| | BALL VALVE |
| | AGITATOR VERTICAL |
| | 'Y' TYPE STRAINER |
| | NON RETURN VALVE |
| | METERING PUMP |
| | ISOLATION GATE VALVE |
| | MOTOR OPERATED |
| | SAFETY RELIEF VALVE |
| | CENTRIFUGAL PUMP (VERT) |
| | FLOAT VALVE |
| | AGITATOR (HORIZONTAL TYPE) |
| | ISOLATION GATE VALVE |

| | |
|---|---|
| PT | PRESSURE TRANSMITTER |
| PS | PRESSURE SWITCH |
| \|\|\| | ORIFICE PLATE |
| LT | LEVEL TRANSMITTER |
| LI | LEVEL INDICATOR |
| PG | PRESSURE GAUGE |
| A | ALARM |
| I | INTERLOCK |
| FT | EMF TYPE FLOW TRANSMITTER |
| FIT | FLOW INDICATOR CUM TRANSMITTER |
| TA | TERBIDITY ANALYSER |
| LG | LEVEL GAUGE |
| ZSC | LIMIT SWITCH CLOSE |
| ZSO | LIMIT SWITCH OPEN |
| | DIAPHRAGM SEAL |

## REFERENCE DRAWINGS

1. P&ID FOR PLANT WATER SYSTEM (PE-DG-412-172-N001).
2. WATER BALANCE DIAGRAM (PE-DG-412-172-N110).
3. P&ID FOR HYPO CHLORITE DOSING (PE-V11-412-174-A101).
4. P&ID FOR SERVICE WATER SYSTEM (PE-DG-412-172-N003).
5. P&ID FOR EFFLUENT TREATMENT PLANT (PE-DG-412-164-A001).

## NOTES:

1. THE DOSING OF CHEMICAL AT VARIOUS STAGES OF PROCESS SHALL BE CONTROLLED THROGH STROCK ADJUSTMENT FROM OWS AS PER TECHNICAL SPECIFICATION/ CONTRACT VOL V, ANNEXURE C, CL. NO. 5.00.00
2. KKS NO: 90GBD01AA502 TO 90GBD01AA505 ,90GAA01AA652 & 90GAA01AA651 VALVE PROVIDED WITH LIMIT SWITCHES.

| REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | APPD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 02 | 08.06.18 | FN | MI | AA | 00 | 10.02.18 | FN | MI | AA |
| | | | | | 03 | 25.07.18 | FN | MI | AA | 01 | 02.05.18 | FN | MI | AA |

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

JOB NO. 412
STATUS CONTRACT
DISTRIBUTION
TO
No.OFF

CONTRACTOR: OTOKLIN GLOBAL BUSINESS LTD
E-410, CRYSTAL PLAZA, OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT | | NAME | SIGN | DATE |
|---|---|---|---|---|
| CODE | DRN | FAISAL N | FN | 26-09-18 |
| MAX | DESN | FAISAL N | FN | 26-09-18 |
| | CHD | MUAZZAM I | MI | 26-09-18 |
| | APPD | ASLAM A | AA | 26-09-18 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17

BHEL DOC NO.
PE-V0-412-158-A001

TITLE P&I DIAGRAM FOR PT PLANT

DEPT. SCALE
SIGN
DATE

OGBL DOC NO.
0GBL/0C-983/P&ID/PTP/18/300

SHEET 1 OF 1 REV 4

SIZE-A1

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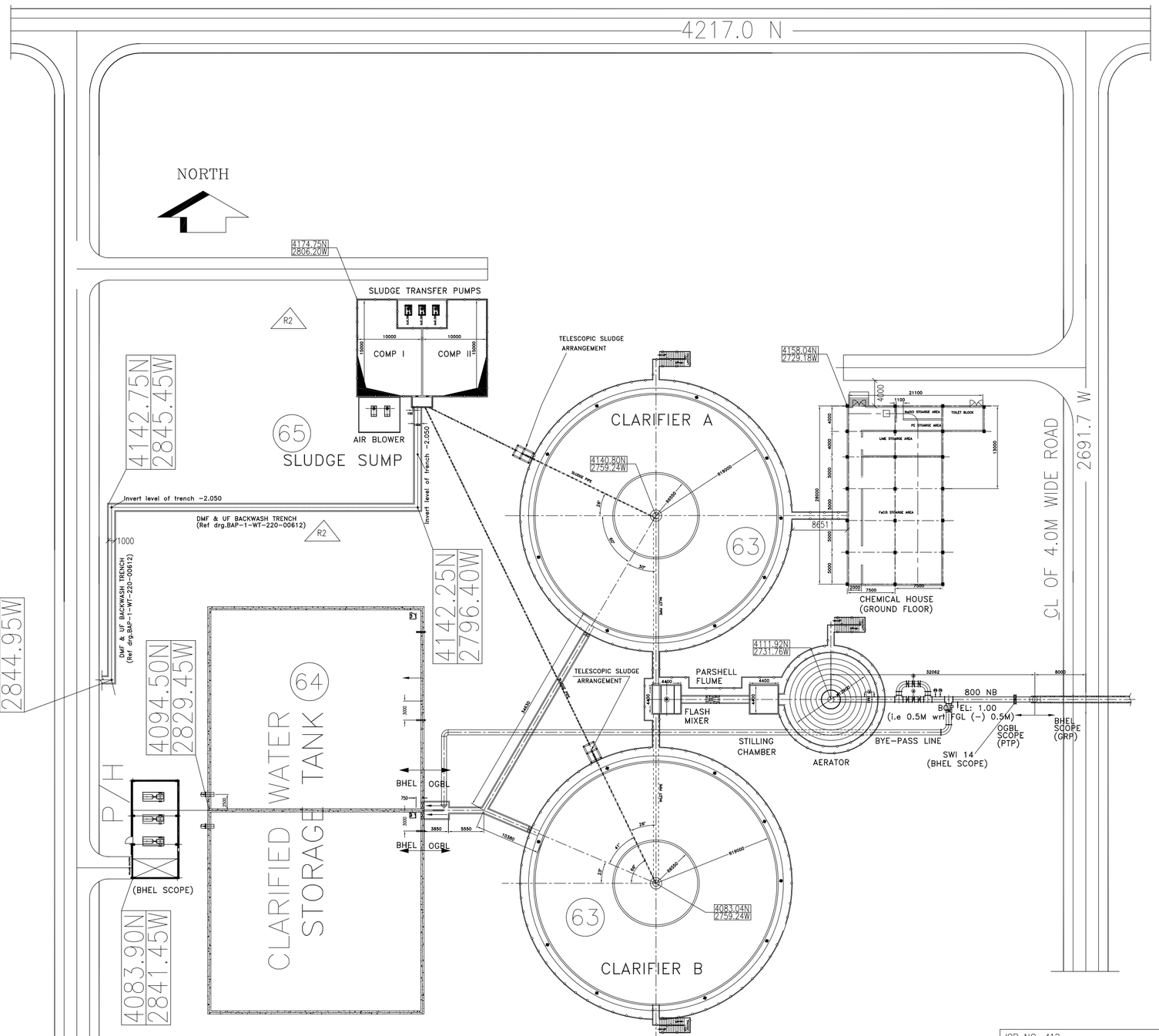
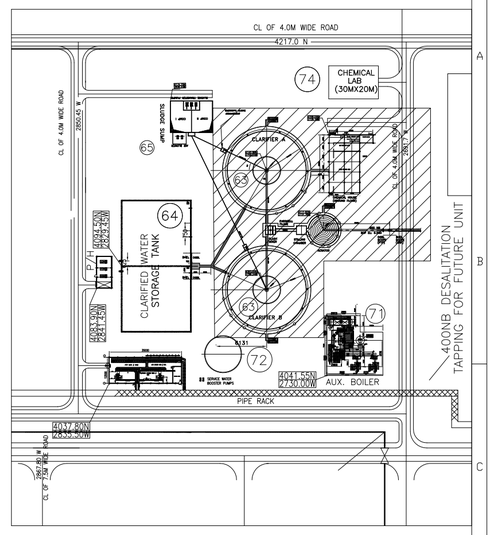
FIRST ANGLE PROJECTION | ALL DIMENSIONS ARE IN MM

DRAWING NO. | CUSTOMER'S DRAWING NO.




NOTES:–

1. ALL DIMENSIONS ARE IN MM AND ELEVATIONS IN METRES.
2. ELEVATION 0.0 M CORRESPONDS TO FGL(–) 0.5M/RL 9.5M R2

Reference drg:
1) P&ID with drg no.(PE-V11-412-158-A001)
2) Plot plant (PE-DG-412-100-M001)
3) PE-DG-412-172-N101
4) PE-DG-412-635-C003
5) BAP-1-WT-220-00612

R2

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

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CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

CONTRACTOR: OTOKLIN GLOBAL BUSINESS LTD
E-4101, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022–26732135

| DEPT CODE | | NAME | SIGN | DATE |
|---|---|---|---|---|
| MAX | DRN | FAISAL N | FN | 12–12–18 |
| | DESN | FAISAL N | FN | 12–12–18 |
| | CHD | MUAZZAM I | MI | 12–12–18 |
| | APPD | ASLAM A | AA | 12–12–18 |

JOB NO. 412
STATUS CONTRACT
DISTRIBUTION
TO
No.OFF

| REV | DATE | ALTD | CHD | APPD |
|---|---|---|---|---|
| A | 11.04.18 | FAISAL N | MUAZZAM | ASLAM A |

REVISED AS PER BHEL COMMENTS

BHEL LOA NO: PW/PE/PG/EN1/P–310/17

TITLE LAYOUT FOR PT PLANT

BHEL DOC NO.
PE–V0–412–158–A002

OGBL DOC NO.
OGBL/OC–983/LAY/PTP/18/301

DEPT. | SCALE | SIGN | DATE

SHEET 1 OF 1 | REV 02

SIZE–A0

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

# BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

## HYDRAULIC FLOW DIAGRAM & HYDRAULIC LEVEL CALCULATIONS

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | FAISAL N | FN | 11-12-18 |
| CHKD | MUAZZAM I | MI | 11-12-18 |
| APPD | ASLAM A | AA | 11-12-18 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17

| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. PE-V0-412-158-A003 | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/HFDLC/PTP/18/302 | 02 |
| DATE | | | | | | | | NO. OF SHEETS 6 EXCLUDING COVER PAGE | |

| HYDRAULIC CALCULATIONS AND DIAGRAM FOR PRE TREATMENT PLANT |
|---|
| CLIENT: BHARAT HEAVY ELECTRICALS LIMITED |
| PROJECT: 2X660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT |
| PACKAGE: PRE TREATMENT PLANT |
| BHEL DOC NO-PE-V0-412-158-A003 |
| OTOKLIN DOC NO-OGBL/OC-983/HFDLC/PTP/18/302 |

| | | | | |
|---|---|---|---|---|
| Flow | = | 2854.00 | m3/hr | |
| | = | 0.7928 | m3/sec | |

**1 Cascade aerator**

| | | | | |
|---|---|---|---|---|
| Top of aerator | = | 7.586 | m | |
| Provided no. of steps | = | 7 | | |
| Height of each step | = | 0.250 | m | |
| Top of aerator (1st step) | = | 7.336 | m | |
| Top of aerator (2st step) | = | 7.086 | m | |
| Top of aerator (3st step) | = | 6.836 | m | |
| Top of aerator (4st step) | = | 6.586 | m | |
| Top of aerator (5th step) | = | 6.336 | m | |
| Top of aerator (6th step) | = | 6.086 | m | |
| Top of aerator (7th step) | = | 5.836 | m | |
| Water level in collection tray | = | 5.546 | m | (R2) |
| Invert level of bottom of collection tray | = | 4.706 | m | (R2) |

**2 Cascade Aerator collection tray to Raw water channel**

| | | | | |
|---|---|---|---|---|
| Total flow | = | 2854.00 | m3/hr | |
| | = | 0.793 | m3/sec | |

For launder design, consider half of the launder circumference for half of the flow and other half of the launder for the other half flow.

| | | | | |
|---|---|---|---|---|
| Half Flow | = | 1427 | m3/hr | |
| | = | 0.396 | m3/sec | |
| Velocity in open channel | = | 0.6 | m/sec | |
| Width of channel | = | 0.8 | m | |
| Depth of channel | = | 0.83 | m | |

By using Manning's Formula
V= 1/n X (r)2/3 X (S)½
Where,
S = Slope of Hydraulic gradient.
V = Velocity in mps &
n = Manning's Co-efficient of Roughness = 0.014
r = Hydraulic radius in meters. (A/P)

| | | | | |
|---|---|---|---|---|
| Area (A) | = | 0.664 | m2 | |
| Perimeter (P) | = | 2.46 | m2 | |
| Hydraulic radius | = | 0.270 | m2 | |
| S | = | 0.000 | (i.e. 1 in 2595) | |

| | | | | |
|---|---|---|---|---|
| Half length of the launder | = | Mean dia of aerator X 3.14/2 | | |
| | = | 23.55 | m | |
| Loss in launder | = | 0.010 | | |
| | = | 0.01 | m | (Considered) |
| Invert level of Lowest point of collection channel | = | 5.536 | m | (R2) |
| Invert level of Highest point of collection channel | = | 5.561 | m | (R2) |
| Consider free fall | = | 0.05 | m | (R1) |
| Water level in raw water channel upstream | = | 5.486 | m | (R2) |

(Considering no loss in the channel, as the length is very small)

| | | | | |
|---|---|---|---|---|
| Water depth in Channel | = | 0.83 | m | (R1) |
| Invert level of water channel | = | 4.656 | m | (R2) |

**3 STILLING CHAMBER**

| | | | | |
|---|---|---|---|---|
| Size of stilling chamber | = | 4.4x 4.4 x 4.1 Depth | | (R1) |
| Water level | = | 5.486 | m | (R2) |

| | | | | | |
|---|---|---|---|---|---|
| Hence loss for direction change in stilling chamber due to baffle wall | | | | | |
| Considering opening of size at the bottom | = | 4 m X 1.2 m | | | |
| Flow | = | | 0.793 | | |
| Velocity | = | | 0.6 | m/sec | |
| Therefore, Velocity Head | = | v2/2g | | | |
| | = | | 0.018 | | |
| | = | | 0.025 | m | (selected) (R1) |
| K value for change in direction | = | 2*0.5 | | | |
| | = | | 1 | | |
| Loss of Change in direction | = | | 0.025 | | |
| Now TWL at outlet of stilling chamber | = | | 5.461 | | (R2) |
| Invert level | = | | 1.361 | m | (R2) |

**4 STILLING CHAMBER TO FLASH MIXER THROUGH PARSHALL FLUME**

| | | | | | |
|---|---|---|---|---|---|
| Flow | = | | 0.793 | m3/sec | |
| Velocity | = | | 0.6 | m/sec | |
| Ha | = | | 0.72 | (as per process calculation) | |
| Hb | = | | 0.504 | | |
| Therefor head loss in parshell flume | = | | 0.216 | m | |
| Top water level | = | | 5.461 | | (R2) |
| Invert level in flume upstream | = | | 4.741 | | (R2) |
| Top water level in flume down stream | = | | 5.245 | | (R2) |
| Water depth in flume downstream channel | = | | 1.51 | m | |
| Invert level in flume downstream | = | | 3.735 | m | (R2) |
| Note: As the channel length is very small, head loss through the channel from parshall flume to Flash mixer is negligible. | | | | | |
| Consider free fall to flash mixer | = | | 0.095 | m | (R1) |
| Top water level in flash mixer | = | | 5.150 | m | (R2) |
| Depth of flash mixer | = | | 4 | m | |
| Invert level in flash mixer | = | | 1.150 | m | (R2) |

**5 FLASH MIXER TO CLARIFLOCCULATOR**

| | | | | | |
|---|---|---|---|---|---|
| Pipe loss | | | | | |
| Design flow | = | | 1427 | m3/hr | |
| | = | | 0.396 | m3/sec | |
| Velocity | = | | 0.800 | m/sec | |
| Pipe dia | = | | 0.794 | | |
| | = | | 800 | mm | |
| a Entrance loss | = | 0.5V*V/2g | | | |
| | = | | 0.016 | m | |
| b Exit loss | = | V*V/2g | | | |
| | = | | 0.033 | m | |
| c Bend loss | = | K*V*V*n/2*g | | | |
| | = | | 0.037 | m | |
| d Line loss | = | 4*f*l*V*V/2*g*d | | | |
| where, | | | | | |
| f: friction co efficient | = | | 0.01 | | |
| l: length | = | | 40 | m | |
| V: velocity | = | | 0.8 | m/sec | |
| d: dia of pipe | = | | 0.8 | m | |
| Line loss | = | | 0.065 | m | |
| e Loss due to exit in port | | | | | |
| Considered port size 0.3m X 0.5m, 6 nos. | | | | | |
| Velocity | = | | 0.440 | m/sec | |
| Velocity head | = | | 0.010 | m | |

| | | | | | |
|---|---|---|---|---|---|
| | Loss in port (V) | = | 0.62*(2*g*h)^1/2 | | |
| | 0.440 | = | 0.62*(2*9.81*h)^1/2 | | |
| | h | = | 0.026 | m | |
| f | Loss in Exit | | | | |
| | K value for exit | = | 1 | | |
| | Loss in Exit | = | 0.010 | m | |
| g | Loss in change in direction | | | | |
| | K value for change in direction | = | 1 | | |
| | Loss in change in direction | = | 0.010 | m | |
| h | Loss in central shaft considered as negligible. | | | | |
| | Total head loss | = | 0.197 | m | |
| | Provided | = | 0.400 | m | |
| | Water level in Clariflocculator | = | 4.750 | m | R2 |
| | SWD of clarifier | = | 4.500 | m | |
| | Invert level in clarifier | = | 0.250 | m | R2 |

**6 LOSS THROUGH ORIFICE**

Provided 318 nos. of submerged orifice at C/C 375 mm by way of 50 mm OD PVC pipe orifice to give 46 mm dia orifice

| | | | | |
|---|---|---|---|---|
| Area of orifice | = | 0.002 | m2 | |
| Flow | = | 0.396 | m3/sec | |
| Flow through each orifice | = | 0.001 | m3/sec | |
| Velocity | = | 0.750 | m/s | |
| Flow velocity through orifice (V) | = | 0.62*(2*g*h)^1/2 | | |
| 0.7504 | = | 0.62*(2*9.81*h)^1/2 | | |
| h | 0.074668 | (say 0.08m) | | |
| Considered free fall for orifice | = | 0.05 | m | |
| Top water level in launder | = | 4.620 | m | |

7 **CLARIFLOCCULATOR LAUNDER**

For launder design, considered half of the launder circumference for half of the flow and other half of the launder for the other half flow.

| | | | | |
|---|---|---|---|---|
| Q | = | 0.198 | m3/sec | |
| Velocity considered | = | 0.6 | m/sec | |
| Width of launder | = | 0.8 | m | |
| Depth of launder | = | 0.6 | m | R2 |

By using Manning's Formula
V= 1/n X (r)2/3 X (S)½
Where,
S = Slope of Hydraulic gradient.
V = Velocity in mps
n = Manning's Co-efficient of Roughness = 0.014
r = Hydraulic radius in meters. (A/P)

| | | | | |
|---|---|---|---|---|
| A | = | 0.48 | m2 | |
| Perimeter (P) | = | 2 | m | |
| r | = | 0.24 | m | |
| S | = | 0.0005 | m | (i.e. 1 in 2113) |
| Half length of the launder | = | 60.602 | m | |
| Loss in launder | = | 0.0287 | m | |
| S provided | = | 0.05 | m | (R1) |
| Top water level in launder (highest) | = | 4.620 | m | R2 |
| Top water level in launder (lowest) | = | 4.570 | m | R2 |
| Water depth in launder | = | 0.6 | | |
| Invert level in launder (lowest) | = | 3.970 | m | R2 |

| | | | | |
|---|---|---|---|---|
| Invert level in launder (Highest) | = | 4.020 | | R2 |
| **8 GATE AT OUTLET OF THE CLARIFLOCCULATOR** | | | | |
| Gate size | = | 800 mm X 800 mm | | |
| Flow | = | 0.3964 | m3/sec | |
| Sludge quanity from each clarifier | = | 29.1500 | | |
| Velocity | = | 0.6 | m/sec | |
| Losses in gate | = | KV2/2g | | |
| | = | 0.020 | m | |
| **9 FOR COLLECTING CHANNEL** | | | | |
| Flow | = | 0.387 | m3/sec | (as per process calculation) |
| Total length of the channel 1 | = | 34.630 | m | R2 |
| Velocity assumed | = | 0.600 | m/sec | |
| Area | = | 0.645 | m2 | |
| Width | = | 0.800 | m | |
| Depth | = | 0.810 | m | R2 |
| By using manning formula | | | | |
| V= 1/n X (r)2/3 X (S)½ | | | | |
| Where, | | | | |
| S = Slope of Hydraulic gradient. | | | | |
| V = Velocity in mps | | | | |
| n = Manning's Co-efficient of Roughness = 0.014 | | | | |
| r = Hydraulic radius in meters. (A/P) | | | | |
| A | = | 0.648 | m2 | |
| Perimeter (P) | = | 2.42 | m | |
| r | = | 0.267768595 | m | |
| S | = | 0.0007 | m | (i.e. 1 in 2113) |
| Hence S provided | = | 0.0258 | | |
| Considered | = | 0.03 | m | |
| Free fall considered | = | 0.140 | m | R2 |
| Top water level in collecting channel | = | 4.380 | m | R2 |
| Water depth in channel | = | 0.810 | m | |
| Invert level in collective channel | = | 3.570 | m | R2 |

Now,

| | | | | |
|---|---|---|---|---|
| Total length of the channel 2 | = | 10.380 | m | |
| S Provided | = | 0.008 | | |
| Considered | = | 0.03 | | |
| Free fall considered | = | 0.140 | | R2 |
| Top water level in collecting channel | = | 4.380 | | |
| Water depth in channel | = | 0.810 | | |
| Invert level in collective channel | = | 3.570 | m | |

## 10 COMMON CHANNEL LEADING TO CWST

| | | | | |
|---|---|---|---|---|
| Flow | = | 0.774 | m3/sec | |
| Velocity | = | 0.6 | m/sec | |
| Area required | = | 1.290 | m2 | |
| Depth | = | 0.8 | m | R2 |
| Width | = | 1.613 | m | R2 |

By using manning formula
V= 1/n X (r)2/3 X (S)½
Where,
S = Slope of Hydraulic gradient.
V = Velocity in mps
n = Manning's Co-efficient of Roughness = 0.014
r = Hydraulic radius in meters. (A/P)

| | | | | |
|---|---|---|---|---|
| A | = | 1.290 | | |
| Perimeter (P) | = | 4.025 | | |
| r | = | 0.321 | | |
| S | = | 0.0003 | (i.e. 1 in 3125) | |
| | | | | |
| Length of the launder | = | 20 | m | |
| Hence S | = | 0.006 | m | |
| | | | | |
| Considered | = | 0.1 | m | |
| Top water level in connecting channel | = | 4.280 | m | R2 |
| Water depth in channel | = | 0.8 | m | |
| Invert level in channel | = | 3.480 | m | R2 |

## 11 ENTRY IN CWST

Head loss for Entry to each compartment

| | | | | |
|---|---|---|---|---|
| Flow | = | 0.390 | m3/sec | (as per process calculation) |
| Velocity | = | 0.600 | m/sec | |
| Area required | = | 0.65 | m2 | |
| Width | = | 1.300 | m | |
| Depth | = | 0.500 | m | |
| | | | | |
| Free fall considered | = | 0.261 | m | |
| | | | | |
| Loss in exit | = | 0.018 | m | |
| | | | | |
| **Loss in gate** | | | | |
| Width of gate | = | 1.000 | m | |
| Depth of gate | = | 0.800 | m | |
| Loss in gate | = | 0.020 | m | |
| Total loss | = | 0.300 | m | |
| | | | | |
| Top water level in connecting channel | = | 3.980 | m | R2 |
| Invert level in channel | = | 3.480 | m | R2 |

## 11 SLUDGE HANDLING SYSTEM

### CLARIFLOCCULATOR TO SLUDGE SUMP

| | | | | | |
|---|---|---|---|---|---|
| Pipe loss | | | | | |
| Design flow | = | | 29 | m3/hr | |
| | = | | 0.008 | m3/sec | |
| Pipe provided | = | | 0.15 | m | |
| Velocity | = | | 0.456 | | |
| A Sluice valve loss at the telescopic arrangement | | | | | |
| Sluice valve size | = | | 150 | mm | |
| Loss | = | K*V*V/2g | | | |
| | = | | 0.003 | m | |
| B Entrance loss | = | 0.5*V*V/2g | | | |
| | = | | 0.005 | m | |
| C Bend loss | = | K*V*V/2g | | | |
| | = | | 0.012 | m | |
| D Line loss | = | 4fLV2/2gd | | | |
| | = | | 0.283 | m | |
| F Loss in exit | = | | 0.024 | m | |
| Total head loss required | = | | 0.327 | m | |
| | = | | 0.35 | m | |
| Top water level in clariflocculator | = | | 4.750 | m | R2 |
| Bottom of sludge pipe at bottom of the clariflocculator | = | | -2.250 | m | R2 |
| Considered slope of 1:500 | | | | | |
| For 100m length of sludge pipe slop is 0.24m. | | | | | |
| However slop considered as 0.15m | | | | | |
| Hence invert level of Sludge sump pipe entry | = | | -2.400 | m | R2 |
| Head provided | = | | 7.150 | m | >0.35m required |
| Depth of sludge sump | = | | 2.2 | m | (R1) |
| Free board | = | | 0.45 | m | (R1) |
| Bottom level of sludge sump | = | | -5.050 | m | R2 |

NOTE:
RL 9.5M i.e FGL (-)0.500 FOR PTP AREA CORRESPONDS TO EL(+/-)0.00M.

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FIRST ANGLE PROJECTION

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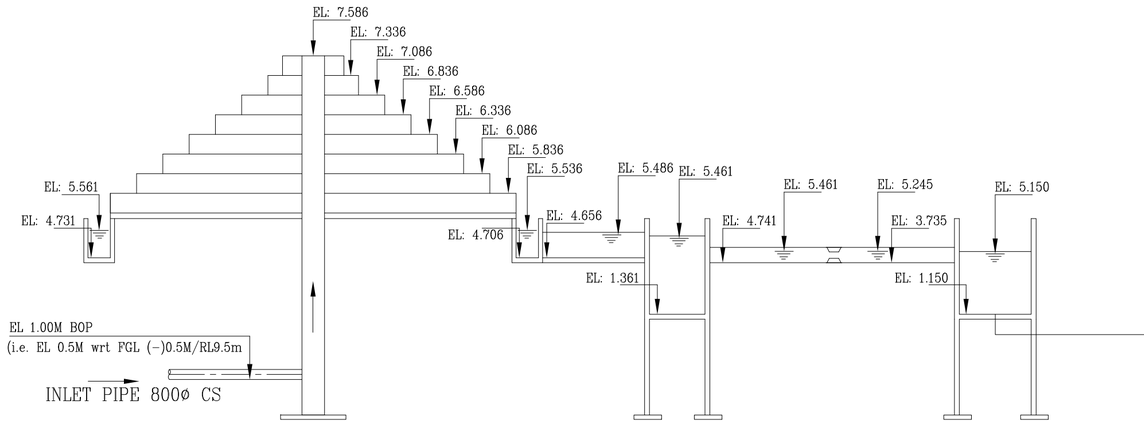
DRAWING NO.

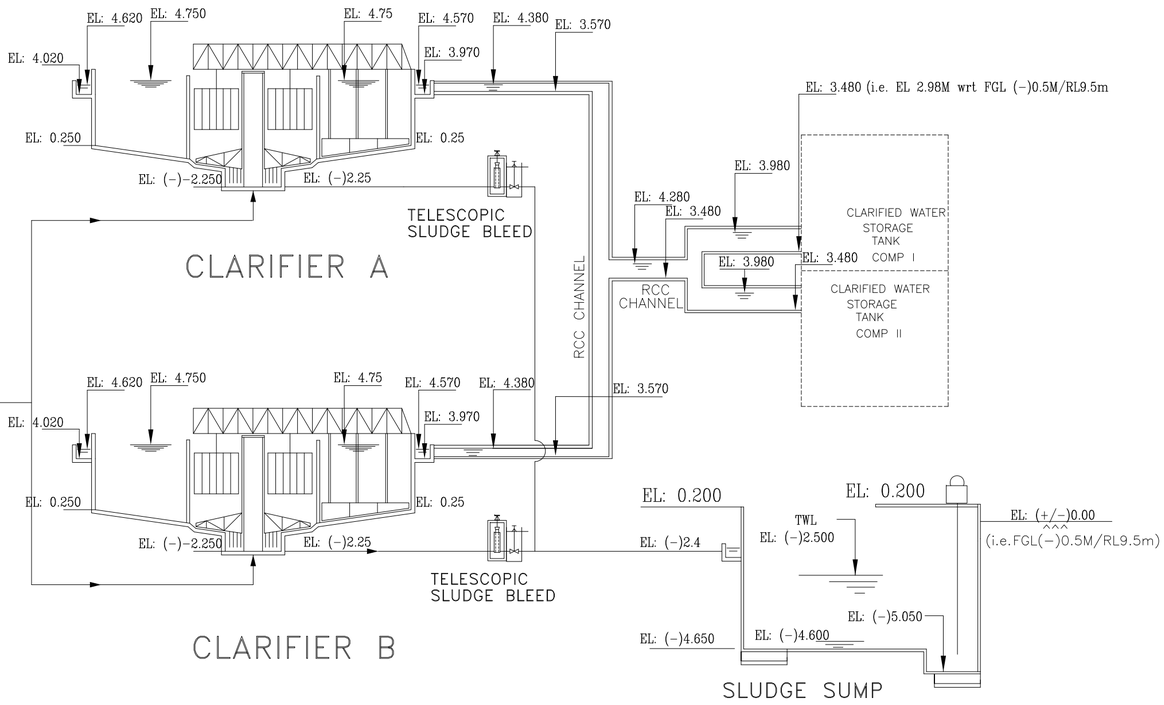
CUSTOMER'S DRAWING NO.




AERATOR

STILLING CHAMBER

FLASH MIXER




NOTES:
1. ALL ELEVATION MARKED IN METER.
2. RL 9.5M i.e FGL (−)0.500 FOR PTP AREA CORRESPONDS TO EL(+/−)0.00M IN THIS DRG.

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

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LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

JOB NO. 412
STATUS CONTRACT
DISTRIBUTION
TO
No.OFF

| REV | DATE | ALTD | CHD | APPD |
|---|---|---|---|---|
| 00 | 06.06.18 | FN | MI | AA |
| 01 | 15.06.18 | FN | MI | AA |

| DEPT CODE | | NAME | SIGN | DATE |
|---|---|---|---|---|
| MAX | DRN | FAISAL N | FN | 29-11-18 |
| | DESN | FAISAL N | FN | 29-11-18 |
| | CHD | MUAZZAM I | MI | 29-11-18 |
| | APPD | ASLAM A | AA | 29-11-18 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17

BHEL DOC NO.
PE-V0-412-158-A003

TITLE HYDRAULIC FLOW DIAGRAM

DEPT. SCALE

SIGN

DATE

OGBL DOC NO.
OGBL/OC-983/HFDLC/PTP/18/302

SHEET 6 OF 6 REV 2

SIZE-A1

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: FN | REV | DATE | ALTERED: FN |
|---|---|---|---|---|---|
| 00 | 08-03-18 | CHECKED: MI | 01 | 09-05-18 | CHECKED: MI |

STATUS : CONTRACT

JOB NO.: 412

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2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

# PROCESS SIZING CALCULATIONS OF PRETREATMENT PLANT

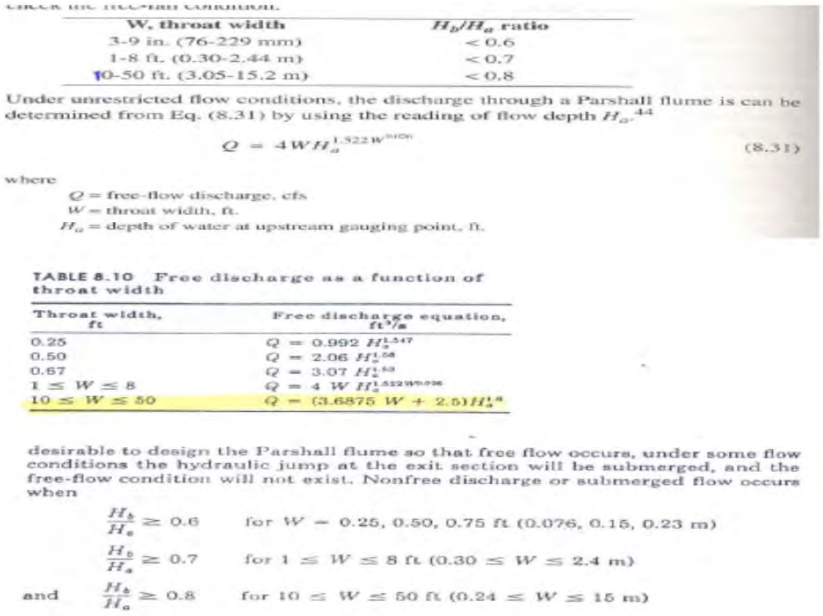
| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | FAISAL N | FN | 18-06-18 |
| CHKD | MUAZZAM I | MI | 18-06-18 |
| APPD | ASLAM A | AA | 18-06-18 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17

| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. PE-V0-412-158-A004 | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/PSC/PTP/18/303 | 02 |
| DATE | | | | | | | | NO. OF SHEETS 9 EXCLUDING COVER PAGE | |

| | PROCESS SIZING CALCULATIONS FOR PRE TREATMENT PLANT | | |
|---|---|---|---|
| | CLIENT: BHARAT HEAVY ELECTRICALS LIMITED | | |
| | PROJECT: 2X660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT | | |
| | PACKAGE: PRE TREATMENT PLANT | | |
| | BHEL DOC NO-PE-V0-4012-158-A004 | | |
| | OTOKLIN DOC NO-OGBL/OC-983/PSC/PTP/18/303 | | |
| | | | |
| **1** | **CASCADE AERATOR** | | |
| | No of units | No. | 1.00 |
| | Design Flow | cum/hr | 2378 |
| | Design Flow with 20% over loading | cum/hr | 2854 |
| | Design Flow | cum/sec | 0.6606 |
| | Surface flow rate | m2/(m3/hr) | 0.0450 |
| | Area required (A) | m2 | 107.0234 |
| | Number of Steps | No. | 7 |
| | Velocity of Inlet pipe | m/sec | 0.9700 |
| | Inlet pipe area | m2 | 0.6811 |
| | Diameter of inlet pipe | **mm** | 931.4534 |
| | Diameter of inlet pipe considered | **mm** | 1000.0000 |
| | Wall thickness considered | **mm** | 150.0000 |
| | Area for inlet pipe and wall thickness (B) | m2 | 1.3267 |
| | Total ara required [(A) + (B)] | m2 | 108.35 |
| | Diameter of bottom tray | m | 12.9 |
| | Tread of cascade | m | 0.83 |
| | Riser of cascade | m | 0.25 |
| | Dia of 1st tray | m | 2.96 |
| | Dia of 2nd tray | m | 4.62 |
| | Dia of 3rd tray | m | 6.28 |
| | Dia of 4th tray | m | 7.94 |
| | Dia of 5th tray | m | 9.60 |
| | Dia of 6th tray | m | 11.26 |
| | Dia of 7th tray | m | 12.9 |
| | **Collecting Channel/Launder** | | |
| | For uniform collection half flow has been consdiered | | |
| | Inside Dia | m | 12.9 |
| | Velocity Through channel | m/sec | 0.60 |
| | Flow Through channel | cum/hr | 1426.98 |
| | Width (considerd) | m | 0.80 |
| | SWD of channel | m | 0.83 |
| | Free board | m | 0.30 |
| | | | |
| **2** | **COLLECTING CHANNEL (COMBINED)** | | |
| | Design Flow | cum/hr | 2853.96 |
| | Velocity Through channel | m/sec | 0.60 |
| | Width (considered) | m | 1.60 |
| | SWD of channel | m | 0.83 |
| | Channel size (provided) [WXD] | m | 1.6x(0.83+0.3 FB) |
| | | | |
| **3** | **STILLING CHAMBER** | | |
| | Design Flow | cum/hr | 2853.96 |
| | Retention time | Sec | 60.00 |
| | Volume | Cum | 47.57 |
| | Volume (provided) | Cum | 79.38 |
| | Width (considered) | m | 4.40 |

| | | | |
|---|---|---|---|
| | Depth (considered) | m | 4.10 |
| | Length | m | 4.40 |
| | Length (selected) | m | 4.40 |
| | Stilling Chamber size (LxWxD) | m | 4.4x4.4x(4.1+0.3 FB) |
| | Baffle wall opening depth required | m | 0.33 |
| | Baffle wall opening depth considered | m | 1.20 |
| | Baffle wall opening size (provided) (LXD) | m | 4 x 1.20 |
| | | | |
| **4** | **RAW WATER CHANNEL WITH PARSHALL FLUME** | | |
| | Design Flow | cum/hr | 2853.96 |
| | No of Channel | No | 1.00 |
| | Velocity Through channel | m/sec | 0.60 |
| | Area | m2 | 1.32 |
| | Width (Considered) | m | 1.00 |
| | Depth | m | 1.32 |
| | Channel size (WxD) | m | 1x(1.32+0.3 FB) |
| | Parshall Flume Throat width (Wp) | mm | 600.00 |
| | Formula to calculate flow: Q=4WpxHa^(1.522xW^0.026), Where, Q= Flow in ft3/sec, Wp=width of throat in ft, Ha= Depth of flow in upstream of the flume at 1/3rd point in ft. [Reference: THE IMPROVED VENTURI FLUME by RALPH L. PARSHALL] | | |
| | Flow | cuft/sec | 28.54 |
| | Parshall Flume Throat width (Wp) | ft | 1.97 |
| | Ha | ft | 2.37 |
| | Ha | m | 0.72 |
| | Hb (Depth of down stream)= 0.7xHa | m | 0.50 |
| | Head Loss (Ha-Hb) | mm | 216.33 |
| | Up stram Channel size (WxD)xL | m | 1x(1.32+0.3 FB) x 2.25 |
| | Down stram Channel size (WxD)xL | m | 1x(1.51+0.3 FB) x 3.2 |
| | Prashall flume (WxD)xL | m | 1x(1.4+0.3 FB) x 2.3 |



| W, throat width | $H_b/H_a$ ratio |
|---|---|
| 3-9 in. (76-229 mm) | < 0.6 |
| 1-8 ft. (0.30-2.44 m) | < 0.7 |
| 10-50 ft. (3.05-15.2 m) | < 0.8 |

Under unrestricted flow conditions, the discharge through a Parshall flume is can be determined from Eq. (8.31) by using the reading of flow depth $H_a$.[44]

$$Q = 4WH_a^{1.522W^{0.026}} \quad (8.31)$$

where
$Q$ = free-flow discharge, cfs
$W$ = throat width, ft.
$H_a$ = depth of water at upstream gauging point, ft.

TABLE 8.10 Free discharge as a function of throat width

| Throat width, ft | Free discharge equation, $ft^3/s$ |
|---|---|
| 0.25 | $Q = 0.992\ H_a^{1.547}$ |
| 0.50 | $Q = 2.06\ H_a^{1.58}$ |
| 0.67 | $Q = 3.07\ H_a^{1.53}$ |
| $1 \le W \le 8$ | $Q = 4\ W\ H_a^{1.522W^{0.026}}$ |
| $10 \le W \le 50$ | $Q = (3.6875\ W + 2.5)H_a^{1.6}$ |

desirable to design the Parshall flume so that free flow occurs, under some flow conditions the hydraulic jump at the exit section will be submerged, and the free-flow condition will not exist. Nonfree discharge or submerged flow occurs when

$\frac{H_b}{H_a} \ge 0.6$ for $W = 0.25, 0.50, 0.75$ ft (0.076, 0.15, 0.23 m)

$\frac{H_b}{H_a} \ge 0.7$ for $1 \le W \le 8$ ft ($0.30 \le W \le 2.4$ m)

and $\frac{H_b}{H_a} \ge 0.8$ for $10 \le W \le 50$ ft ($0.24 \le W \le 15$ m)

| | | | |
|---|---|---|---|
| | | | |
| **5** | **FLASH MIXER** | | |
| | Number | No | 1.00 |
| | Design Flow | cum/hr | 2853.96 |
| | Retention time | Sec | 60.00 |
| | Volume | Cum | 47.57 |
| | Volume (provided) | Cum | 77.50 |
| | Width (considered) | m | 4.40 |

| | | | |
|---|---|---|---|
| | Depth (considered) | m | 4.00 |
| | Length | m | 4.40 |
| | Length (selected) | m | 4.40 |
| | Flash Mixer size (LxWxD) | m | 4.4x4.4x(4+0.5 FB) 2 |
| | | | |
| **6** | **PIPE LINE FROM FLASH MIXER TO EACH CLARIFIER** | | |
| | Number | No | 2.00 |
| | Design Flow in each line | cum/hr | 1426.98 |
| | Velocity | m/sec | 1.00 |
| | Pipe dia required | m | 0.710 |
| | Pipe Dia Selected | m | 0.80 |
| | | | |
| **7** | **CLARIFLOCCULATOR** | | |
| | Number | | 2.00 |
| | Design Flow in each clarifier (inlet) | cum/hr | 1189.15 |
| | Inlet water (Raw water) TSS | ppm | 500.00 |
| | Outlet water (clarified water) TSS | ppm | 10.00 |
| | Sludge Consistency | % | 2.00 |
| | Sludge generated per clarifier | cum/hr | 29.15 |
| | Sludge blow off (must be less than 3%) | % | 2.45 1 |
| | Flow at each clarifier outlet | cum/hr | 1160.00 |
| | As per tender the outlet of each calarifier | cum/hr | 1160.00 |
| | Hence, sludge generated | cum/hr | 29.15 |
| | Water inlet at each Clarifier | cum/hr | 1189.15 |
| | **Flocculator Design** | | |
| | Retention time | min | 30.00 |
| | SWD | m | 4.50 |
| | Volume | Cum | 594.57 |
| | Area required (A) | Sqm | 132.13 |
| | Internail Dia of Central Shaft | m | 1.00 |
| | Outer dia of central shaft | m | 1.40 |
| | Area of central shaft (B) | Sqm | 1.54 |
| | Total Area required (A)+(B) | Sqm | 133.67 |
| | Dia required | m | 13.05 |
| | Dia Provided | m | 13.10 |
| | Wall thickness of Flocculation ozne | mm | 150.00 |
| | Area ocupied by flocculator (C ) | Sqm | 137.82 |
| | **Clarifier Design** | | |
| | Rise rate | cum/sqm/hr | 1.20 |
| | Design flow | cum/hr | 1189.15 |
| | Clarifier area (D ) | Sqm | 990.96 |
| | Total area required (C ) + (D) | Sqm | 1128.77 |
| | Diameter required | m | 37.92 |
| | Diameter selected | m | 38.00 |
| | Retention time time in flocculator zone | min | 30.59 |
| | Retention time time in clarifier zone | min | 225.00 |
| | Weir loading (must be 300 cum/m/day) | cum/m/day | 239.19 |
| | **Launder Design** | | |
| | For uniform collection half flow has been consdiered. | | |
| | Design flow with 20% over loading for hydraulic | cum/hr | 1426.98 |
| | TSS during overloading (Tentative for calculation) | ppm | 30.00 |
| | Sludge Generated during over loading | cum/hr | 33.58 |
| | Quantity of clarified water during over loading | cum/hr | 1393.39 |
| | Design in launder (1/2 flow) | cum/hr | 696.70 |

| | | | |
|---|---|---|---|
| | Design in launder (1/2 flow) | cum/sec | 0.19 |
| | Velocity | m/sec | 0.40 |
| | Area | Sqm | 0.48 |
| | Width (Considered) | m | 0.80 |
| | Depth | m | 0.60 |
| | Launder size provided (WXD) | m | 0.8x0.6+0.3 FB |
| | | | |
| | **OPENING SIZE OF SLOT FROM CENTRAL COLUMN TO FLOCCULATION ZONE** | | |
| | Velocity considered | m/sec | 1.00 |
| | Pipe size required with 20% overlaoding | m | 0.8 |
| | Pipe Size Provided | m | 1.0 |
| | Number of Slot provided | No | 4.00 |
| | Area required for each slot | sqm | 0.10 |
| | Size of each slot provided | mm x mm | 750 x 300 |
| | Area of each slot provided | mm x mm | 0.23 |
| | | | |
| | **OPENING SIZE OF UNDERPASS OF WATER SLOT FROM FLOCCULATION ZONE TO CLARIFICATION ZONE.** | | |
| | Velocity considered | m/sec | 0.60 |
| | Area required | sqm | 0.66 |
| | Opening height required | mm | 16.06 |
| | Opening height provided | mm | 462.00 |
| | | | |
| | **POWER CALCULATION FOR FLOCCULATOR PADDLE** | | |
| | Power input for Flocculator (P=(G^2)μV | | |
| | Velocity Gradient (G) | 1/Sec | 40.00 |
| | Dynamic Viscocity (μ) | Pascal | 0.00089 |
| | Volume of flocculator zone (V) | cum | 594.57 |
| | Power (P) | watt | 846.67 |
| | Number of flocculator | No | 4.00 |
| | Motor Rating (MR)=Power/(E1xE2XE3XE4)/Number of Floculator | Watt | |
| | E1 (Eff of coupling between drive and RG box) | % | 85.00 |
| | E2 (Eff of Reduction Gear Box) | % | 85.00 |
| | E3 (Eff of Coupling between R.G.Box & Agitator) | % | 85.00 |
| | E4 (Eff of Efficiency of Drive Motor) | % | 85.00 |
| | Motor Rating (MR) requried | Watt | 405.49 |
| | Motor Rating (MR) provided | kW | 0.75 |
| | | | |
| **8** | **CHANNEL (FROM CLARIFLOCCULATOR TO COMMON CHANNEL).** | | |
| | Design flow with 20% over loading for hydraulic | cum/hr | 1393.39 |
| | Design flow with 20% over loading for hydraulic | cum/sec | 0.39 |
| | Velocity | m/sec | 0.60 |
| | Area required | sqm | 0.65 |
| | Width (considered) | m | 0.80 |
| | Depth | m | 0.81 |
| | Size of Cahnnel provided (WxD) | m | 0.8x(0.81+0.3 FB) |
| | | | |
| **9** | **COMMON CHANNEL** | | |
| | Design flow with 20% over loading for hydraulic | cum/hr | 2786.79 |
| | Design flow with 20% over loading for hydraulic | cum/sec | 0.77 |
| | Velocity | m/sec | 0.60 |
| | Area required | sqm | 1.29 |
| | Width (considered) | m | 0.80 |
| | Depth | m | 1.61 |

| | | | |
|---|---|---|---|
| | Size of Cahnnel provided (WxD) | m | 0.8x(1.61+0.3 FB) |
| **10** | **INDIVIDUAL CHANNEL TO CWST** | | |
| | Design flow with 20% over loading for hydraulic (half flow) | cum/hr | 1393.39 |
| | Design flow with 20% over loading for hydraulic | cum/sec | 0.39 |
| | Velocity | m/sec | 0.60 |
| | Area required | sqm | 0.65 |
| | Width (considered) | m | 1.30 |
| | Depth | m | 0.50 |
| | Size of Cahnnel provided (WxD) | m | 1.3x(0.5+0.3 FB) |
| **11** | **NaOCl DOSING SYSTEM FOR POTABLE WATER (INTERMITTENT)** | | |
| | Number of Dosing Tank | No | 1.00 |
| | Potable water flow | cum/hr | 10.00 |
| | Storage Time | Hrs | 12.00 |
| | Dosing rate | ppm | 2.00 |
| | 100% NaOCl Required for 12 hours | Kg | 0.24 |
| | Strength of Commerical grade NaOCl (w/v) | % | 6.00 |
| | Volume of tank required | Ltrs | 4.00 |
| | Capcity (as per Tender) | Ltrs | 500.00 |
| | Tank Dia (considered) | m | 0.80 |
| | Tank Height | m | 1.00 |
| | Tank Dimension (Dia x Height) [selected] | m | 0.8x(1.0+0.3 FB) |
| | Dosing pump Number | No | 2 (1W+1S) |
| | Pump Capcity (as per Tender) | LPH | 5.00 |
| | Pump Head (Refer Head Calulation) | MWC | 10.00 |
| **12** | **FeCl3 DOSING SYSTEM FOR CLARIFIER** | | |
| | Number of Dosing Tank | No | 3 (1w+2s) |
| | Storage Time of each tank | Hrs | 12.00 |
| | Strength of Chemical solution in tank (w/v) | % | 10.00 |
| | Dosing rate | ppm | 40.00 |
| | Total Flow of water in clarifier | cum/hr | 2378.30 |
| | Volume of each tank | Cum | 11.42 |
| | Size of tank (Considered) | m | 2.83 X2.83 |
| | Height of Tank | m | 1.43 |
| | Tank Dimension (L X W X H) [selected] | m | 2.83x2.83x(1.43+0.3 FB+0.1DZ) |
| | Dosing pump Number | No | 2 (1W+1S) |
| | Pump Capcity required | LPH | 951.32 |
| | Pump Capacity Selected | LPH | 2000.00 |
| | Pump Head (Refer Head Calulation) | M | 10.00 |
| | | | |
| **13** | **POLYMER DOSING SYSTEM FOR CLARIFIER** | | |
| | Number of Dosing Tank | No | 2 (1w+1s) |
| | Storage Time of each tank | Hrs | 12.00 |
| | Strength of Chemical solution in tank (w/v) | % | 0.50 |
| | Dosing rate | ppm | 1.00 |
| | Total Flow of water in clarifier | cum/hr | 2378.30 |
| | Volume of each tank | Cum | 5.71 |
| | Size of tank (Considered) | m | 2 X 2 |
| | Height of Tank | m | 1.43 |
| | Tank Dimension (L X W X H) [selected] | m | 2.0x2.0x(1.43+0.3 FB+0.1DZ) |
| | Dosing pump Number | No | 2 (1W+1S) |
| | Pump Capcity required | LPH | 475.66 |
| | Pump Capacity Selected | LPH | 1000.00 |
| | Pump Head (Refer Head Calulation) | M | 10.00 |
| | | | |
| **14** | **LIME DOSING SYSTEM FOR CLARIFIER** | | |

| | | | |
|---|---|---|---|
| | Number of Dosing Tank | No | 2 (1w+1s) |
| | Storage Time of each tank | Hrs | 12.00 |
| | Strength of Chemical solution in tank (w/v) | % | 5.00 |
| | Dosing rate | ppm | 10.00 |
| | Total Flow of water in clarifier | cum/hr | 2378.30 |
| | Volume of each tank | Cum | 5.71 |
| | Size of tank (Considered) | m | 2 X 2 |
| | Height of Tank | m | 1.43 |
| | Tank Dimension (L X W X H) [selected] | m | 2.0x2.0x(1.43+0.3 FB+0.1DZ) |
| | Dosing pump Number | No | 2 (1W+1S) |
| | Pump Capcity required | LPH | 475.66 |
| | Pump Capacity Selected | LPH | 1000.00 |
| | Pump Head (Refer Head Calulation) | M | 10.00 |
| | | | |
| **15** | **SLUDGE SUMP** | | |
| | Sludge generated due to chemical dosing (Density=1.2 kg/m3) (A) | cum/hr | 0.05 |
| | Sludge due to TSS (B) | cum/hr | 58.30 |
| | Total Sludge flow [(A)+(B)] | cum/hr | 58.35 |
| | Number of Sludge sump | No | 1.00 |
| | Compartment of Sludge sump | No | 2.00 |
| | Sludge Storage time in each compartment | Hr | 5.00 |
| | Volume of each compartment required | cum | 291.49 |
| | Volume of each compartment selected as per tender | cum | 300.00 |
| | Sludge sump Depth (considered) | m | 2.00 |
| | Area for sludge sump | sqm | 150.00 |
| | Length of sludge sump (considered) | m | 15.00 |
| | Width of sludge sump | m | 10.00 |
| | Compartment dimension (each) [LxWXD] | m | 15x10x2 |
| | Total size of the sludge sump [LxWXD] | m | 15x20x2 |
| | Dimension of Inlet Pit [LxWXD] | m | 3x1.5x2.0 |
| | Dimension of Pump Pit [LxWXD] | m | 6.5x2.5x2.5 |
| | | | |
| **16** | **PUMP HEAD CALCULATION** | | |
| **A** | **SLUDGE TRANSFER PUMP** | | |
| | Number of pump | No | 2W+1S |
| | Capacity of Pump | Cum/Hr | 500.00 |
| | Consider Pump discharge Velocity | M/Sec | 2.20 |
| | Dia of Pipe Require | M | 0.28 |
| | Dia of Pipe Consider | M | 0.40 |
| | Velocity in the Pipe line | M/Sec | 1.11 |
| | Static Head Considered | M | 5.00 |
| | Effective Length of Pipe line | M | 350.00 |
| | (Considering 10% extra on actual pipe length) | | |
| | Loss in Pipe line | | |
| | Consider C - value | | 150.00 |
| | J = 6.815 x (V/C)^1.852 x D^ -1.167 | M/M | 0.00 |
| | Head Loss | M | 0.78 |
| | Number of fittings/bends/etc | No | 15.00 |
| | Head Loss due to fittings (0.18 m per fittings for 300 NB pipe) | M | 2.70 |
| | Consider 10% margine as per TS | M | 3.83 |
| | Total Head Loss | M | 8.83 |
| | Consider Pump Head | M | 12.00 |
| | | | |
| **B** | **NaOCl DOSING PUMP** | | |

| | | | |
|---|---|---|---|
| | Number of pump | No | 1W+1S |
| | Capacity of Pump | Cum/Hr | 0.0050 |
| | Consider Pump discharge Velocity | M/Sec | 1.50 |
| | Dia of Pipe Require | M | 0.0011 |
| | Dia of Pipe Consider | M | 0.0250 |
| | Velocity in the Pipe line | M/Sec | 0.0028 |
| | Static Head Considered | M | 5.00 |
| | Effective Length of Pipe line | M | 350.00 |
| | (Considering 10% extra on actual pipe length) | | |
| | Loss in Pipe line | | |
| | Consider C - value | | 150.00 |
| | J = 6.815 x (V/C)^1.852 x D^ -1.167 | M/M | 0.0000 |
| | Head Loss | M | 0.0003 |
| | Number of fittings/bends/etc | No | 10.00 |
| | Head Loss due to fittings (0.32 m per fittings for 25 NB pipe) | M | 3.20 |
| | Consider 10% margine as per TS | M | 3.5203 |
| | Total Head Loss | M | 8.5203 |
| | Consider Pump Head | M | 10.00 |
| | | | |
| **C** | **FeCl3 DOSING PUMP** | | |
| | Number of pump | No | 1W+1S |
| | Capacity of Pump | Cum/Hr | 2.0000 |
| | Consider Pump discharge Velocity | M/Sec | 1.50 |
| | Dia of Pipe Require | M | 0.0217 |
| | Dia of Pipe Consider | M | 0.0400 |
| | Velocity in the Pipe line | M/Sec | 0.4423 |
| | Static Head Considered | M | 5.00 |
| | Effective Length of Pipe line | M | 30.00 |
| | (Considering 10% extra on actual pipe length) | | |
| | Loss in Pipe line | | |
| | Consider C - value | | 150.00 |
| | J = 6.815 x (V/C)^1.852 x D^ -1.167 | M/M | 0.0060 |
| | Head Loss | M | 0.1802 |
| | Number of fittings/bends/etc | No | 10.00 |
| | Head Loss due to fittings (0.29 m per fittings for 40 NB pipe) | M | 2.90 |
| | Consider 10% margine as per TS | M | 3.3882 |
| | Total Head Loss | M | 8.3882 |
| | Consider Pump Head | M | 10.00 |
| | | | |
| **D** | **POLYMER DOSING PUMP** | | |
| | Number of pump | No | 1W+1S |
| | Capacity of Pump | Cum/Hr | 1.0000 |
| | Consider Pump discharge Velocity | M/Sec | 1.50 |
| | Dia of Pipe Require | M | 0.0154 |
| | Dia of Pipe Consider | M | 0.0250 |
| | Velocity in the Pipe line | M/Sec | 0.5662 |
| | Static Head Considered | M | 5.00 |
| | Effective Length of Pipe line | M | 30.00 |
| | (Considering 10% extra on actual pipe length) | | |
| | Loss in Pipe line | | |
| | Consider C - value | | 150.00 |
| | J = 6.815 x (V/C)^1.852 x D^ -1.167 | M/M | 0.0164 |
| | Head Loss | M | 0.4926 |
| | Number of fittings/bends/etc | No | 10.00 |

| | | | |
|---|---|---|---|
| | Head Loss due to fittings (0.32 m per fittings for 25 NB pipe) | M | 3.20 |
| | Consider 10% margine as per TS | M | 4.0619 |
| | Total Head Loss | M | 9.0619 |
| | Consider Pump Head | M | 10.00 |
| | | | |
| **E** | **LIME DOSING PUMP** | | |
| | Number of pump | No | 1W+1S |
| | Capacity of Pump | Cum/Hr | 1.0000 |
| | Consider Pump discharge Velocity | M/Sec | 1.50 |
| | Dia of Pipe Require | M | 0.0154 |
| | Dia of Pipe Consider | M | 0.0400 |
| | Velocity in the Pipe line | M/Sec | 0.2212 |
| | Static Head Considered | M | 5.00 |
| | Effective Length of Pipe line | M | 30.00 |
| | (Considering 10% extra on actual pipe length) | | |
| | Loss in Pipe line | | |
| | Consider C - value | | 150.00 |
| | J = 6.815 x (V/C)^1.852 x D^ -1.167 | M/M | 0.0017 |
| | Head Loss | M | 0.0499 |
| | Number of fittings/bends/etc | No | 10.00 |
| | Head Loss due to fittings (0.29 m per fittings for 40 NB pipe) | M | 2.90 |
| | Consider 10% margine as per TS | M | 3.2449 |
| | Total Head Loss | M | 8.2449 |
| | Consider Pump Head | M | 10.00 |
| | | | |
| **17** | **BLOWER SIZING** | | |
| | Number of Blower | No | 1W+1S |
| | total Capacity of Sludge Sump | cum | 600.00 |
| | Total surface area of sludge sump | sqm | 300.00 |
| | Air Mixing rate considered (0.01 to 0.015 m3/min/m2) | cum/hr/sqm | 0.90 |
| | Capacity of Blower required | cum/hr | 270.00 |
| | Capacity of Blower (selected) | cum/hr | 300.00 |
| | Head selected | m | 4.00 |
| | | | |
| **18** | **AREA REQUIRED FOR CHEMICAL HOUSE FOR CHEMICAL STORAGE** | | |
| **A** | **NaOCl Storage** | | |
| | Chemical storage required for | days | 30.00 |
| | Chemical consumption per day | Ltrs/day | 8.00 |
| | Chemical consumption per month | Ltrs/month | 240.00 |
| | Chemical available in carboys | kg | 50.00 |
| | Density of commercial grade chemical | gm/cc | 1.10 |
| | Density of commercial grade chemical | kg/cum | 1100.00 |
| | Chemnical requriement per month | kg/month | 73.33 |
| | Number of carboys per month | Nos | 1.47 |
| | Size of each carboy (45x35 cm) | sqm | 0.23 |
| | Area selected | sqm | 0.25 |
| | | | |
| **B** | **FeCl3 Storage** | | |
| | Chemical storage required for | days | 30.00 |
| | Chemical consumption per day | kg/day | 2283.17 |
| | Chemical consumption per month | kg/month | 68494.97 |
| | Chemical available in carboys | kg | 50.00 |
| | Number of carboys per month | Nos | 1370 |
| | Size of each carboy (45x35 cm) | sqm | 215.76 |

| | | | |
|---|---|---|---|
| | Area selected | sqm | 240.00 |
| | | | |
| **C** | **Polymer Storage** | | |
| | Chemical storage required for | days | 30.00 |
| | Chemical consumption per day | kg/day | 57.08 |
| | Chemical consumption per month | kg/month | 1712.37 |
| | Chemical available in carboys | kg | 50.00 |
| | Number of carboys per month | Nos | 34 |
| | Size of each carboy (45x35 cm) | sqm | 5.39 |
| | Area selected | sqm | 6.00 |
| | | | |
| **C** | **Lime Storage** | | |
| | Chemical storage required for | days | 30.00 |
| | Chemical consumption per day | kg/day | 570.79 |
| | Chemical consumption per month | kg/month | 17123.74 |
| | Chemical available in bag | kg | 50.00 |
| | Number of bag per month | Nos | 342 |
| | Size of each carboy (50x25 cm) | sqm | 42.81 |
| | Area selected | sqm | 50.00 |
| | | | |
| **19** | **OVERHEAD CLARIFIED WATER STORAGE TANK** | | |
| | Number | No | 1.00 |
| | Water required for chemical preparation per day (considering volume of each tank) | cum | 45.66 1 |
| | Flushing water required for dosing line per day (assume) | cum | 2.00 |
| | Total water required with 20% margin | cum | 57.20 |
| | Tank height (selected) | m | 2.00 |
| | Tank length and width | m | 5.3 |
| | Tank dimension (LxWxD) | m | 1 5.3x5.3x(2.0+0.3 FB) |

| 2x660 MW ENNORE SEZ STPP | | | | | |
|---|---|---|---|---|---|
| Sub vendor Items and Inspection Category approval to BHEL/PEM for Pre Treatment Plant - Vendor Name - M/s Otaklin Global Business Limited | | | | | |
| This is Annexure to Lr.No.CE/P I /SE/E/T & H (P)/EE6/E/P/AEE/M/F/Ennore SEZ STPP/D 62 /19 dt 07.01.19 | | | | | |
| SUB VENDOR LIST AND INSPECTION CATEGORY (Document No: PE-V0-412-158-A006- **R1)** | | | | | |
| **SR. NO.** | **ITEM** | **Inspn Cat** | **SUPPLIERS** | **PLACE** | **TANGEDCO approval for Ennore SEZ** |
| 1 | **ATMOSPHERIC/STORAGE TANKS** | **CAT-II** | OTOKLIN GLOBAL BUSINESS LTD. | MUMBAI | Approved. |
| | | | JASMINO POLYMERTECH | AMBERNATH | Approved. |
| 2 | **PRESSURE VESSELS** | **CAT-II** | OTOKLIN GLOBAL BUSINESS LTD. | AMBERNATH | Approved. |
| | | | JASMINO POLYMERTECH | NAVI MUMBAI | Approved. |
| 3 | **AIR BLOWERS** | **CAT-II** | KAY INTERNATIONAL | NEW DELHI / | Approved. |
| | | | EVEREST BLOWERS | - | Approved. |
| | | | SWAN PNEUMATIC | - | Approved. |
| 4 | **METERING PUMPS AND PRV** | **CAT-I** | VK PUMPS | NASIK | Approved. |
| | | | MILTON ROY INDIA | CHENNAI | Approved. |
| | | | SWELLORE | AHMEDABAD | Approved. |
| | | | DENCIL | - | Approved. |
| | | | POSITIVE METERING PUMPS | - | Approved. |
| | | | METACHEM | MUMBAI | Not Approved |
| 5 | **AGITATOR** | **CAT-II** | REMI PEOCESS PLANT & M/C | MUMBAI | Approved. |
| | | | FIBRE & FIBRE | MUMBAI / SILVASA | Approved. |
| | | | CEECONS | CHENNAI | Approved. |
| | | | OTOKLIN GLOBAL BUSINESS LTD. | MUMBAI | Approved. |
| 6 | **VERTICAL CENTRIFUGAL PUMPS** | **CAT-I** | FLOWMORE LTD. | - | Approved. |
| | | | FLOWSERVE INDIA CONTROLS PVT. LTD. | - | Approved. |
| | | | JYOTI LTD. | - | Approved. |
| | | | WILO MATHER & PLATT PUMPS PVT. LTD. | - | Approved. |
| | | | SULZER PUMPS INDIA LTD. | - | Approved. |

2x660 MW ENNORE SEZ STPP

Sub vendor Items and Inspection Category approval to BHEL/PEM for Pre Treatment Plant - Vendor Name - M/s Otaklin Global Business Limited

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SUB VENDOR LIST AND INSPECTION CATEGORY (Document No: PE-V0-412-158-A006- **R1**)

| SR. NO. | ITEM | Inspn Cat | SUPPLIERS | PLACE | TANGEDCO approval for Ennore SEZ |
|---|---|---|---|---|---|
| | | | KISHORE PUMPS | - | Approved. |
| | | | MATHER & PLAN PUMPS LTD. | - | Approved. |
| | | | KIRLOSKAR BROS. LTD | - | Approved. |
| | | | WPIL LIMITED | - | Approved. |
| 7 | COATING & WRAPPING MATERIAL TAPE | CAT-III | IWL LTD. | CHENNAI | Approved. |
| | | | AR LAMINATORS | - | Approved. |
| | | | OTOKLIN GLOBAL BUSINESS LTD. | - | Approved. |
| 8 | CLARIFIER/CLARIFLOCCULATOR/THICKNER MECHANISM | CAT-II | WTE INFRA PROJECTS PVT LTD | PUNE | Approved. |
| | | | CLEAR WATER | - | Approved. |
| | | | TRIVENI N | - | Approved. |
| | | | METAL FABRICATORS | - | Approved. |
| | | | A.V. VALVES LTD | AGRA | Approved. |
| | | | TECHNO VALVE | MUMBAI | Approved. |
| | | | H.SARKER AND COMPANY | HOWRAH | Approved. |
| | | | BDK | - | Approved. |
| | | | FLUID LINE | - | Approved. |
| 9 | SS GATE/GLV/NRV/BALL VALVE | CAT-II | KIRLOSKAR | - | Approved. |
| | | | KSB | - | Approved. |
| | | | MICON VALVES | - | Approved |
| | | | GM ENGINEERING | - | Approved |
| | | | CRESCENT VAVLES MFG.CO.PVT.LTD. | - | Approved. |
| | | | VALTECH INDUSTRIES | - | Approved. |
| | | | HAWA VALVES | - | Approved. |
| | | | VENUS PUMPS AND ENGG. WORKS | - | Approved. |

2x660 MW ENNORE SEZ STPP

Sub vendor Items and Inspection Category approval to BHEL/PEM for Pre Treatment Plant - Vendor Name - M/s Otaklin Global Business Limited

This is Annexure to Lr.No.CE/P I /SE/E/T & H(P)/EE6/E/P/AEE/M/F/Ennore SEZ STPP/D 62 /19 dt 07.01.19

SUB VENDOR LIST AND INSPECTION CATEGORY (Document No: PE-V0-412-158-A006- R1)

| SR. NO. | ITEM | Inspn Cat | SUPPLIERS | PLACE | TANGEDCO approval for Ennore SEZ |
|---|---|---|---|---|---|
| | | | FOURESS ENGG. INDIA LTD. | - | Approved. |
| | | | LEADER VALVES LTD. | JALANDHAR | Approved. |
| 10 | ELECTRIC MOTOR | CAT-III | BHARAT BIJLEE | MUMBAI | Approved. |
| | | | SIEMENS | MUMBAI | Approved. |
| | | | CGL | - | Approved. |
| | | | GE- POWER | | Approved. |
| | | | ABB | - | Approved. |
| | | | NGEF | | Approved. |
| | | | KIRLOSKAR ELECTRIC CO. LTD | | Approved. |
| | | | ALSTOM | | Approved. |
| | | | MARATHON | KOLKATA | Approved. |
| 11 | SS BUTTER-FLY VALVE | Cat II | ADVANCE VALVES PVT. LTD. | NOIDA | Approved. |
| | | | TECHNO VALVE | MUMBAI | Approved. |
| | | | INSTRUMENTATION LTD. | PALAKKAD | Approved. |
| | | | WEIR BDK VALVES- A UNIT OF WEIR INDIA PVT. LTD. | NEW DELHI | Approved. |
| | | | LEADER | - | Approved. |
| | | | FLUIDELINE | - | Approved. |
| | | | AV VALES | - | Approved. |
| | | | KISRLOSKER | - | Approved. |
| | | | MICON VALVES | - | Not Approved |
| | | | GM ENIGNEERING | - | Not Approved |
| | | | VENUS PUMPS AND ENGINEERING WORKS | - | Approved. |

2x660 MW ENNORE SEZ STPP

Sub vendor Items and Inspection Category approval to BHEL/PEM for Pre Treatment Plant - Vendor Name - M/s Otaklin Global Business Limited

This is Annexure to Lr.No.CE/P I /SE/E/T & H (P)/EE6/E/P/AEE/M/F/Ennore SEZ STPP/D 712/19 dt 07.01.19

SUB VENDOR LIST AND INSPECTION CATEGORY (Document No: PE-V0-412-158-A006- **R1)**

| SR. NO. | ITEM | Inspn Cat | SUPPLIERS | PLACE | TANGEDCO approval for Ennore SEZ |
|---|---|---|---|---|---|
| | | | CRESCENT VAVLES MFG.CO.PVT.LTD. | - | Approved. |
| | | | HAWA ENGINEERS | - | Approved. |
| | | | FOURESS ENGG. INDIA LTD. | - | Approved. |
| 12 | **SS DIAPHRAGM VALVE** | **CAT-II** | WEIR BDK | HUBLI | Approved. |
| | | | CRANE FLOW PROCESS | SATARA | Approved. |
| | | | PROCON VALES | MUMBAI | Approved. |
| | | | HAWA ENGINEERS | AHMEDABAD | Approved. |
| | | | ADVANCE VALVES PVT. LTD. | - | Approved. |
| | | | TECHNO VALVE | - | Approved. |
| | | | INSTRUMENTATION LTD. | - | Approved. |
| | | | LEADER | - | Approved. |
| | | | AV VALES | - | Approved. |
| | | | KISRLOSKER | - | Approved. |
| | | | VENUS PUMPS AND ENGINEERING WORKS | | Approved. |
| | | | CRESCENT VAVLES MFG.CO.PVT.LTD. | - | Approved. |
| 13 | **PRESSURE GAUGE** | **CAT-III** | PYRO ELECTRIC | - | Approved. |
| | | | AN INSTRUMENT | - | Approved. |
| | | | GIC | - | Approved. |
| | | | GLUCK | - | Approved. |
| | | | INDFOSS | - | Approved. |
| | | | WAREE | - | Approved. |
| | | | WIKA | - | Approved. |
| | | | H GURU | - | Approved. |
| | | | KRONE MARSHALL PVT LTD | PUNE | Approved. |

| 2x660 MW ENNORE SEZ STPP | | | | | |
|---|---|---|---|---|---|
| Sub vendor Items and Inspection Category approval to BHEL/PEM for Pre Treatment Plant - Vendor Name - M/s Otaklin Global Business Limited | | | | | |
| This is Annexure to Lr.No.CE/P I /SE/E/T & H (P)/EE6/E/P/AEE/M/F/Ennore SEZ STPP/D702/19 dt 07.01.19 | | | | | |
| SUB VENDOR LIST AND INSPECTION CATEGORY (Document No: PE-V0-412-158-A006- R1) | | | | | |
| **SR. NO.** | **ITEM** | **Inspn Cat** | **SUPPLIERS** | **PLACE** | **TANGEDCO approval for Ennore SEZ** |
| 14 | **CHAIN PULLEY BLOCK** | **CAT-III** | UNIVERSAL HOIST | - | Approved. |
| | | | HERCULES HOISTS LTD. | RAIGAD | Approved. |
| | | | LIFTING EQUIPMENTS AND ACCESSORIES | DELHI | Approved. |
| | | | AVON CRANE | - | Approved. |
| | | | WMI | - | Approved. |
| | | | CONSOLIDATED HOISTS PVT LTD | PUNE | Approved. |
| | | | REVA INDUSTRIES LTD | - | Approved. |
| | | | GRIP ENGG | FARIDABAD | Approved. |
| 15 | **ELECTRIC HOIST** | **CAT-III** | AVON CRANES PVT.LTD | - | Approved. |
| | | | HERCULES HOISTS LTD | - | Approved. |
| | | | LIFTING EQUIPMENT & ACCESSORIES | - | Approved. |
| | | | REVA INDUSTRIES LTD | - | Approved. |
| | | | CONSOLIDTED HOIST PVT LTD | - | Approved. |
| | | | GRIP ENGRS | - | Approved. |
| | | | UNIVERSAL HOIST, | - | Approved. |
| 16 | **PRESSURE SWITCH** | **CAT-III** | SWITZER | - | Approved. |
| | | | INDFOSS , | - | Approved. |
| | | | PYRO ELECTRIC | - | Approved. |
| | | | E&H | - | Approved. |
| | | | ABB | - | Approved. |
| | | | GIC | - | Approved. |
| | | | ABB | - | Approved. |
| | | | YOKOGAWA | - | Approved. |

2x660 MW ENNORE SEZ STPP

Sub vendor Items and Inspection Category approval to BHEL/PEM for Pre Treatment Plant - Vendor Name - M/s Otaklin Global Business Limited

This is Annexure to Lr.No.CE/P I /SE/E/T & H (P)/EE6/E/P/AEE/M/F/Ennore SEZ STPP/D762/19 dt 07.01.19

SUB VENDOR LIST AND INSPECTION CATEGORY (Document No: PE-V0-412-158-A006- **R1**)

| SR. NO. | ITEM | Inspn Cat | SUPPLIERS | PLACE | TANGEDCO approval for Ennore SEZ |
|---|---|---|---|---|---|
| 17 | **PRESSURE TRANSMITTER** | **CAT-II** | V AUTOMAT | - | Not approved |
| | | | HONEYWELL | - | Approved. |
| | | | EMERSON PROCESS MANAGEMENT | - | Approved. |
| | | | SCIENTIFIC DEVICES | - | Not approved |
| | | | FUJI ELECTRIC | - | Approved. |
| 18 | **LEVEL GAUGE** | **CAT-III** | SBEM | - | Approved. |
| | | | CHEMTROL | - | Approved. |
| | | | PUNE TECHTROL | - | Approved. |
| | | | LEVCON | - | Approved. |
| | | | MAGNETROL | - | Approved. |
| | | | E&H | - | Approved. |
| 19 | **LEVEL TRANSMITTER** | **CAT-II** | PUNE TECHTROL | - | Not approved |
| | | | SIEMENS | - | Approved. |
| | | | EMERSON PROCESS MANAGEMENT (I) LTD | - | Approved. |
| | | | ABB | - | Approved. |
| | | | SCIENTIFIC DEVICES | - | Not approved |
| | | | V AUTOMAT | - | Not approved |
| 20 | **FLOW TRANSMITTERS** | **CAT-II** | E & H | - | Approved. |
| | | | KHRONE MARSHALL | - | Approved. |
| | | | EMERSON | - | Approved. |
| | | | ABB | - | Approved. |
| | | | HONEYWELL | - | Approved. |
| | | | YOKOGAWA | - | Approved. |

| 2x660 MW ENNORE SEZ STPP | | | | | |
|---|---|---|---|---|---|
| Sub vendor Items and Inspection Category approval to BHEL/PEM for Pre Treatment Plant - Vendor Name - M/s Otaklin Global Business Limited | | | | | |
| This is Annexure to Lr.No.CE/P I /SE/E/T & H (P)/EE6/E/P/AEE/M/F/Ennore SEZ STPP/D/62/19 dt 07.01.19 | | | | | |
| SUB VENDOR LIST AND INSPECTION CATEGORY (Document No: PE-V0-412-158-A006- **R1)** | | | | | |
| **SR. NO.** | **ITEM** | **Inspn Cat** | **SUPPLIERS** | **PLACE** | **TANGEDCO approval for Ennore SEZ** |
| | | | YIL | BANGALORE | Approved. |
| | | | SIEMENS | THANE | Approved. |
| | | | FUJI | CHINA | Approved. |
| | | | HONEYWELL | USA/PUNE | Approved. |
| 21 | **ANALYSERS (pH, TURBIDITY,TDS,** RESIDUAL **CHLORINE ,OIL.** | **CAT-II** | ABB | - | Approved. |
| | | | DKK | - | Approved. |
| | | | ROSEMOUNT | - | Approved. |
| | | | HACH INDIA | - | Approved. |
| 22 | **JUNCTION BOX** | **CAT-III** | FLEXPRO ELECTRICALS PVT. LTD. | GUJARAT | Approved. |
| | | | K.S.INSTRUMENTS PVT.LTD. | BANGALORE | Approved. |
| | | | SUCHITRA INDUSTRIES | BANGALORE | Approved. |
| | | | OTOKLIN GLOBAL BUSINESS LTD. | - | Approved. |
| | | | BALIGA LIGHTING EQUIPMENT PVT. LTD | | Approved. |
| | | | CONTROLWELL INDIA PVT LTD. | | Approved. |
| | | | SHRENIK & COMPANY | AHMEDABAD | Approved. |
| 23 | **MS PLATES** | **CAT-III** | SAIL | - | Approved. |
| | | | ESSAR STEEL | - | Approved. |
| | | | TISCO | - | Approved. |
| | | | RINL | - | Approved. |
| | | | JINDAL | - | Approved. |
| | | | LLOYD | - | Approved. |
| | | | ISPAT | - | Approved. |
| | | | JSW | - | Approved. |
| | | | INDIAN IRON & STEEL CO. LTD | - | Approved. |

2x660 MW ENNORE SEZ STPP

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SUB VENDOR LIST AND INSPECTION CATEGORY (Document No: PE-V0-412-158-A006- **R1**)

| SR. NO. | ITEM | Inspn Cat | SUPPLIERS | PLACE | TANGEDCO approval for Ennore SEZ |
|---|---|---|---|---|---|
| | | | ITC | - | Approved. |
| 24 | **MS PIPES (IS: 1239 & 3589)** | **CAT-III** | SURYA ROSHNI | - | Approved. |
| | | | INDUS | - | Approved. |
| | | | MAHARASHTRA TUBES | - | Approved. |
| | | | JINDAL | - | Approved. |
| | | | SAIL | - | Approved. |
| | | | AJANTA | - | Approved. |
| | | | BST | - | Approved. |
| | | | JAIN TUBES | - | Approved. |
| | | | TATA | - | Approved. |
| | | | SAIL - ROURKELA | - | Approved. |
| | | | TISCO | JAMSHEDPUR | Approved. |
| | | | RATNAMANI | - | Approved. |
| 25 | **SAFETY SHOWER** | **CAT-III** | UNICARE | - | Approved. |
| | | | MOHAN INDUSTRIES | - | Approved. |
| | | | SUPER SAFETY SERVICES | - | Approved. |
| | | | TOBIT ENGINEERS | | Approved. |
| | | | SAFETY UMBRELLA | | Approved. |
| | | | HIREN INDUSTRIAL CORPORATION | | Approved. |
| | | | NATIONAL SAFETY SOLUTION | | Approved. |
| | | | UNIQUE SAFETY SERVICES | | Approved. |
| | | | OTOKLIN GLOBAL BUSINESS LTD. | - | Approved. |

| 2x660 MW ENNORE SEZ STPP | | | | | |
|---|---|---|---|---|---|
| Sub vendor Items and Inspection Category approval to BHEL/PEM for Pre Treatment Plant - Vendor Name - M/s Otaklin Global Business Limited | | | | | |
| This is Annexure to Lr.No.CE/P I /SE/E/T & H (P)/EE6/E/P/AEE/M/F/Ennore SEZ STPP/D762/19 dt 07.01.19 | | | | | |
| SUB VENDOR LIST AND INSPECTION CATEGORY (Document No: PE-V0-412-158-A006- **R1**) | | | | | |
| **SR. NO.** | **ITEM** | **Inspn Cat** | **SUPPLIERS** | **PLACE** | **TANGEDCO approval for Ennore SEZ** |
| 26 | **TANK &FITTINGS (FRP)** | **CAT-III** | INDUSTRIAL SERVICE | KOLKATA | Approved. |
| | | | SUNRISE | BARODA | Approved. |
| | | | GANDHI & ASSOCIATES | AHMEDABAD | Approved. |
| | | | MODERN EQUIPMENTS | CHENNAI | Approved. |
| | | | EAGLE PLAST | PUNE | Approved. |
| | | | OMEGA PLAST | MUMBAI | Approved. |
| | | | GLOBAL COMPOSITE | - | Approved. |
| | | | EPP | - | Approved. |
| | | | CHEMICAL PROCESS & EQUIPMENT PVT LTD | - | Approved. |
| | | | J.R FIBRE INDUSTRIES | - | Approved. |
| | | | DENCIL | | Approved. |
| | | | WTE INFRA PROJECTS PVT LTD | | Approved. |
| | | | METAL FABRICATORS | | Approved. |
| | | | THERMOSET POLYPRODUCTS | | Approved. |
| | | | BSF FRP INDUSTRIES | | Approved. |
| | | | OTOKLIN GLOBAL BUSINESS LTD | - | Approved. |
| 27 | **SLUICE GATE** | **CAT-II** | JASH ENGINEERING | KOLKATA | Approved. |
| | | | | | Approved. |
| | | | YASHWANT INDUSTRIES | - | Approved. |
| 28 | **PLUG VALVE** | **CAT-II** | AUDCO | - | Approved. |
| | | | LEADER | - | Approved. |
| | | | DEZURIK | - | Not approved |
| | | | MICON VALVES (INDIA) PVT.LTD | MUMBAI | Approved. |
| | | | LEADER | - | Approved. |

2x660 MW ENNORE SEZ STPP

Sub vendor Items and Inspection Category approval to BHEL/PEM for Pre Treatment Plant - Vendor Name - M/s Otaklin Global Business Limited

This is Annexure to Lr.No.CE/P I /SE/E/T & H (P)/EE6/E/P/AEE/M/F/Ennore SEZ STPP/D 762/19 dt 07.01.19

SUB VENDOR LIST AND INSPECTION CATEGORY (Document No: PE-V0-412-158-A006- **R1**)

| SR. NO. | ITEM | Inspn Cat | SUPPLIERS | PLACE | TANGEDCO approval for Ennore SEZ |
|---|---|---|---|---|---|
| 29 | **PAINT** | **CAT-III** | ASIAN PAINTS (I) LTD. | - | Approved. |
| | | | BERGER PAINTS INDIA LTD | - | Approved. |
| | | | GOODLASS NEROLAC | - | Approved. |
| | | | JENSON & NICHOLSON (I) LTD | - | Approved. |
| | | | CDC CARBOLINE | - | Approved. |
| | | | SHALIMAR PAINTS LTD. | - | Approved. |
| 30 | **MOTORISED ACTUATOR** | **CAT-II** | ROTARK | - | Approved. |
| | | | AUMA | - | Approved. |
| | | | LIMITORK | - | Approved. |
| 31 | **RUBBER LINING** | **CAT-III** | TEMSEC | KOLKATA | Approved. |
| | | | RISHI INDUSTRIES | | Approved. |
| 32 | **Y-TYPE STRAINER/STRAINER** | **CAT-III** | OTOKLIN GLOBAL BUSINESS LTD. | MUMBAI | Not approved |
| | | | GRAND PRIX | NEW DELHI | Approved. |
| | | | JAYPEE | NEW DELHI | Approved. |
| | | | GREAVES COTTON | MUMBAI | Approved. |
| | | | FILTERATION ENGINEERS | MUMBAI | Approved. |
| | | | BHATIA ENGINEERING CO. | DELHI | Approved. |

## 2x660 MW ENNORE SEZ STPP

Sub vendor Items and Inspection Category approval to BHEL/PEM for Pre Treatment Plant - Vendor Name - M/s Otaklin Global Business Limited

This is Annexure to Lr.No.CE/P I /SE/E/T & H (P)/EE6/E/P/AEE/M/F/Ennore SEZ STPP/D 762/19 dt 9.01.19

SUB VENDOR LIST AND INSPECTION CATEGORY (Document No: PE-V0-412-158-A006- **R1)**

| SR. NO. | ITEM | Inspn Cat | SUPPLIERS | PLACE | TANGEDCO approval for Ennore SEZ |
|---|---|---|---|---|---|
| 33 | **DUPLEX STRAINER** | **CAT-III** | JAYPEE INDUSTRIES PVT LTD | NEW DELHI | Approved. |
| | | | MULTITEX FILTRATION ENGINEERS LTD | NEW DELHI | Approved. |
| | | | OTOKLIN GLOBAL BUSINESS LTD. | MUMBAI | Approved. |

Note:

Category I – Quality Plan approval & Physical Inspection by TANGEDCO as agreed in the Quality Plan are envisaged. Based on Inspection/Inspection Test Report approval, TANGEDCO will issue MDCC.

Category II – Quality Plan approval & Physical Inspection by BHEL as agreed in the Quality Plan are envisaged. Test Reports to be submitted by BHEL & got it approved by TANGEDCO before the issuance of MDCC by TANGEDCO.

Category III - Quality Plan approval & Physical Inspection by TANGEDCO are not envisaged. MDCC to be obtained from TANGEDCO Based on submission of Certificate of Compliance (COC) by BHEL.

CHIEF ENGINEER/PROJECTS I

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

# CONTROL PHILOSOPHY OF PRE TREATMENT PLANT

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | BILAL S | BS | 14-10-19 |
| CHKD | MUAZZAM I | MI | 14-10-19 |
| APPD | ASLAM A | AA | 14-10-19 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | PE-V0-412-158-A007 | 02 |
| DATE | | | | | | | | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/CP/PTP/18/306 | |

NO. OF SHEETS 10 EXCLUDING COVER PAGE

| OTOKLIN GLOBAL BUSINESS LIMITED | CONTROL PHILOSOPHY | | | |
|---|---|---|---|---|
| LOI NO: - PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018 | | PROJECT DOC NO:- PE-V0-412-158-A007 | | |
| CLIENT | **M/s. BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/CP/PTP/18/306 | | Rev No:- 02 |
| PROJECT | **2X660 MW ENNORE SEZ STPP PRE TREATMENT PLANT** | MADE BY BS | CHKD BY MI | APPD BY AA |

**The Control Philosophy for the Pre Treatment has following sections listed below**

- Reference Drawings.
- General Description of Pre treatment Plant
- Control & Monitoring philosophy for Pre Treatment Plant
- Drive Details

**REFERANCE DRAWINGS:**

P & I diagrams & Layouts for the reference are listed below.

| **Sr.No** | Drawing Title | P & ID Number | **Revision No** |
|---|---|---|---|
| 01 | P & ID for Pretreatment Plant | PE-V0-412-158-A001 | Rev–04 |
| 02 | Control System for Mechanical Auxiliary Packages | PE-DM-412-145-I900 | |
| 03 | Drive Control Philosophy | PE-DM-412-145-I002 | |

**General Description**

The Pre-Treatment Plant (PTP) shall be operated and controlled from DDCMIS (Bhel Scope) Control System, 2 Nos. OWS, 1 No. Operating cum engineering station with 1 No. A3/A4 size colour LJP shall be provided by Contractor. Control desk with coloured Mimic with the status of drives including ON, OFF, TRIP indication of respective motors/pumps , H.W. Annunciator, P.B. Ammeters, parameters Indicators, recorders and indication Lamps, Ammeters shall also be provided by Contractor .

The plant / unit will have 2 modes of operation to be selected from the HMI:

1. **Service**: The plant will operate as per the pre-set flows till the occurrence of some abnormal condition / achievement of desired output as detailed elsewhere specific to individual units. The respective unit will be stopped only if so required by the operator.

1 (a) **In Semi auto mode**: Particular equipment chemical dosing system, valves and pumps can be selected in sequence and initiated by the operator depending upon the requirement comprising safety interlocks.

.

1 (b) **In Manual mode**: Selection of equipment's, chemical dosing system, drives, valves for the operation can be selected & operated manually by the operator from the OWS.

2. **Plant Shutdown**: In case plant shut down is required in certain situations, the plant control will be done to ensure safe shutdown of the plant. Similarly, for plant start-up, the pumps / valves will be operated sequentially to ensure that the plant operates smoothly and the outlet quality is not affected.

**PRE-TREATMENT SYSTEM:-**

Incoming water is treated by Pre-treatment system to produce clarified water suitable for various application. A brief description of Pre-treatment plant is as below.

**STILLING CHAMBER (SC):-**

Raw water shall be first passed through a Stilling chamber through cascade aeration at inlet flow control station turbulence of water will be dampened out. Stilling chamber shall be in RCC construction with suitable detention time. The flow of water entering stilling chamber is measured through flow transmitter (90GBD01CF001). The Raw water is supplied to the cascade aerator (CA) through motorized valve (90GBD01AA001 &90GBD01AA002). The motorized valve is provided limit switches for valve ON/OFF feedback. Hand wheel is also provided to (90GBD01AA001). to operate the valve manually, if required. By pass line with manual valve is provided.Manual valve is provided with limit switches for valve ON/OFF feedback. Bypass line will be selected manually if main line is in maintenance mode.

Chlorine solution is dosed in the stilling chamber for disinfection purpose.

**PARSHALL FLUME (PF):-**

The water from the stilling chamber is passed through the parshall flume. Parshall flume is a flow measurement device with measurement strips on the side wall of the RCC parshall flume. Flow transmitter (90GBD02CF001) is also provided in the parshall flume for monitoring the feed flow rate at OWS.

**Flash Mixer (FM):-**

The water from the Parshall Flume is passed through the Flash Mixer where the water is distributed to the Clarifiers. The pretreatment chemicals like PE, FeCl3&Lime are dosed in Flash Mixer.

**CLARIFIER:-**

Pre-conditioned water from distribution chamber is fed to Clarifier. A RCC constructed open tank of specific volume is provided. In the Clarifier mixing, flocculation and sedimentation is done in a single tank.

The rotating scrapper of clarifier moves the settled solids or sludge to the center of the clarifier for removal.The clarified water flow rises to the upward and water is removed by collection launder and into the clarified water storage tank by gravity.

A portion of the settled sludge is periodically drawn off by opening the bleed valve or telescopic valve in the telescopic sludge arrangement.

**CLARIFIED WATER STORAGE TANK (CWST):-**

This is a RCC tank of suitable capacity to store clarified water from the Clarifier. Level transmitter (90GBD10CL001) is provided in Compartment –I and Level Transmitter (90GBD10CL002) is provided in Compartment –II of Clarified water storage tank.

**DOSING SYSTEM:-**

Raw water contains turbid and suspended particles in varying proportion, which can be coagulated and flocculated by dosing suitable Coagulant FeCl3 and flocculants. After coagulant dosing; pH of feed water may reduce. For effective coagulation; pH of water is required to be raised, for which lime dosing system is provided.
Dosage rate of pretreatment chemicals shall be decided based on the jar test at site.

**FeCL3 Dosing System:-**

FeCl3 Dosing tank is provided with two numbers of level transmitter for Level measurement (90GBN61CL001, 90GBN62CL001 and 90GBN63CL001) indicating continuous flow. The FeCl3 Dosing pumps 90GBN64AP001/002 (1W+1S) in interlocked with continuous level of 3 Nos dosing tanks. Operator will initiate FeCl3 dosing tank-filling step. Agitator operation will be manually but it will not “RUN” at Low-level in the Dosing tank. There will be facility for tank selection on OWS. At a time, only one tank can be selected.

FeCl3 will be dosed from the FeCl3 measuring Tank as supplied by FeCl3 Dosing Pump for clarifier A/B Dosing rate of FeCl3 will be manually. The stroke shall be continuously adjustable to give a capacity variation 10-100% range while the Pumps along with electric motor drive are running. Adjustment of capacity shall be done by manually (micrometric adjusting type) locally.

Pumps and the Agitators can be operated in the following modes
Semi Auto
Manual

Motorized Agitators:

For each agitator, first selection is LOCAL/REMOTE and same is available in OWS

Two PBs – START & STOP are available on OWS

For each pump, first selection is LOCAL/REMOTE and same is available on OWS
Two PBs – START & STOP are available on OWS

Start permissive for the FeCl3 Dosing pumps (90GBN64AP001/90GBN64AP002) are:
Level of the selected tank sensed by LT (90GBN61CL001, 90GBN62CL001 and 90GBN63CL001 is not low.
Start permissive for the FeCl3 Dosing tank Agitator (90GBN61AM001/90GBN62AM001/ 90GBN63AM001) are: Level of the selected tank sensed by LT (90GBN61CL001, 90GBN62CL001 and 90GBN63CL001 is not low.

Trip permissive for the FeCl3 Dosing pumps (90GBN64AP001/90GBN64AP002) are:
Level of the selected tank sensed by LT 90GBN610CL001, 90GBN62CL001 and 90GBN63CL001 is low.

Trip permissive for the FeCl3 Dosing tank Agitator (90GBN61AM001/90GBN62AM001/ 90GBN63AM001) are:
Level of the selected tank sensed by LT 90GBN610CL001, 90GBN62CL001 and 90GBN63CL001 is low.

Pressure of pump at discharge header is low sensed by PT (90GBN65CP001) Pump will trip and alarm will be raised

Pressure Transmitter (90GBN65CP001) is provided on common discharge for Transmitting Signal to DDCMIS.
Tank level not low shall be permissive for starting pumps. Standby pump auto starts when working pump trips and discharge header pressure is low . Running pump will stop in case of tank level low low. Standby Pump shall not start if the running pump trips because of low-low level.

**Lime Dosing System:-**

Lime Dosing tank is provided with two numbers of level transmitter for Level measurement (90GBN71CL001, 90GBN72CL001) indicating continuous flow. The Lime Dosing pumps 90GBN73AP001/002 (1W+1S) in interlocked with continuous level of 2 Nos dosing tanks. Operator will initiate Lime dosing tank-filling step. Agitator operation will be manually but it will not “RUN” at Low-level in the Dosing tank. There will be facility for tank selection on OWS. At a time, only one tank can be selected.

Lime will be dosed from the Lime measuring Tank as supplied by Lime Dosing Pump for clarifier A/B Dosing rate of Lime will be manually. The stroke shall be continuously adjustable to give a capacity variation 10-100% range while the Pumps along with electric motor drive are running. Adjustment of capacity shall be done by manually (micrometric adjusting type) locally.

Pumps and the Agitators can be operated in the following modes:

Semi Auto
Manual

Motorized Agitators:

For each agitator, first selection is LOCAL/REMOTE and same is available in OWS Two PBs – START & STOP are available on OWS

For each pump, first selection is LOCAL/REMOTE and same is available on OWS Two PBs – START & STOP are available on OWS

Start permissive for the Lime Dosing pumps (90GBN73AP001/002) are: Level of the selected tank sensed by LT (90GBN71CL001, 90GBN72CL001) is not low.
Start permissive for the Lime Dosing tank Agitator (90GBAA01AM004/90GBAA01M005) are: Level of the selected tank sensed by LT (90GBN71CL001, 90GBN72CL001) is not low.

Trip permissive for the Lime Dosing pumps (90GBN73AP001/90GBN73AP002) are: Level of the selected tank sensed by LT (90GBN71CL001, 90GBN72CL001) is low.

Trip permissive for the Lime Dosing Agitator (90GBAA01AM004/90GBAA01M005) are: Level of the selected tank sensed by LT (90GBN71CL001, 90GBN72CL001) is low.

Pressure of pump at discharge header is low sensed by PT (90GBN75CP001) pump will trip and alarm will be generated

Pressure Transmitter (90GBN75CP001) is provided on common discharge for Transmitting Signal to DDCMIS.
Tank level not low shall be permissive for starting pumps. Standby pump auto starts when working pump trips and discharge header pressure is low. Running pump will stop in case of tank level low low. Standby Pump shall not start if the running pump trips because of low-low level.

**Polyelectrolyte Dosing System:-**

Poly Electrolyte Dosing tank is provided with two numbers of level transmitter for Level measurement (90GBN81CL001, 90GBN82CL001) indicating continuous flow. The Poly Electrolyte Dosing pumps 90GBN83AP001/002 (1W+1S) in interlocked with continuous level of 2 Nos dosing tanks. Operator will initiate Poly Electrolyte dosing tank-filling step. Agitator operation will be manually but it will not “RUN” at Low-level in the Dosing tank. There will be facility for tank selection on OWS. At a time, only one tank can be selected.

Poly Electrolyte will be dosed from the Poly Electrolyte measuring Tank as supplied by Poly Electrolyte Dosing Pump for clarifier A/B Dosing rate of Poly Electrolyte will be manually. The stroke shall be continuously adjustable to give a capacity variation 10-100% range while the Pumps along with electric motor drive are running. Adjustment of capacity shall be done by manually (micrometric adjusting type) locally.

Pumps and the Agitators can be operated in the following modes:
Semi Auto

Manual

Motorized Agitators:

For each agitator, first selection is LOCAL/REMOTE and same is available in OWS Two PBs – START & STOP are available on OWS

For each pump, first selection is LOCAL/REMOTE and same is available on OWS Two PBs – START & STOP are available on OWS

Start permissive for the Poly Electrolyte Dosing pumps (90GBN83AP001/002) are: Level of the selected tank sensed by LT (90GBN81CL001, 90GBN82CL001) is not low.
Start permissive for the Poly Electrolyte Dosing tank Agitator (90GBN81AM001/90GBN82M001) are:Level of the selected tank sensed by LT (90GBN81CL001, 90GBN82CL001) is not low.

Trip permissive for the Poly Electrolyte Dosing pumps (90GBN83AP001/90GBN83AP002) are: Level of the selected tank sensed by LT (90GBN81CL001, 90GBN82CL001) is low.

Trip permissive for the Poly Electrolyte Dosing tank Agitator (90GBN81AM001/90GBN82M001) are: Level of the selected tank sensed by LT (90GBN81CL001, 90GBN82CL001) is low.

Pressure of pump at discharge header is low sensed by PT (90GBN85CP001) pump will trip and alarm will be generated

Pressure Transmitter (90GBN85CP001) is provided on common discharge for Transmitting Signal to DDCMIS.
Tank level not low shall be permissive for starting pumps. Standby pump auto starts when working pump trips and discharge header pressure is low . Running pump will stop in case of tank level low low. Standby Pump shall not start if the running pump trips because of low-low level.

**Sodium Hypochlorite (NaOCL) Dosing System:**

NaOCL Dosing tank is provided with two numbers of level transmitter for Level measurement (90GBN91CL001) indicating continuous flow. The NaOCL Dosing pumps 90GBN92AP001/002 (1W+1S) in interlocked with continuous level of 1 Nos dosing tanks. Operator will initiate NaOCL Dosing tank-filling step. Agitator operation will be manually but it will not “RUN” at Low-level in the Dosing tank. There will be facility for tank selection on OWS. At a time, only one tank can be selected.

NaOCL will be dosed from the NaOCL measuring Tank as supplied by NaOCL Dosing Pump for Potable water system dosing will be done manually. The stroke shall be continuously adjustable to give a capacity variation 10-100% range while the Pumps along with electric motor drive are running. Adjustment of capacity shall be done by manually (micrometric adjusting type) locally.

Pumps and the Agitators can be operated in the following modes:

Semi Auto
Manual

Motorized Agitators:

For each agitator, first selection is LOCAL/REMOTE and same is available in OWS Two PBs – START & STOP are available on OWS

For each pump, first selection is LOCAL/REMOTE and same is available on OWS Two PBs – START & STOP are available on OWS

Start permissive for the NaOCL Dosing pumps (90GBN92AP001/002) are: Level of the selected tank sensed by LT (90GBN91CL001) is not low.
Start permissive for the NaOCL Dosing tank Agitator (90GBN91AM001) are: Level of the selected tank sensed by LT (90GBN91CL001) is not low.

Trip permissive for the NaOCL Dosing pumps (90GBN92AP001/90GBN92AP002) are: Level of the selected tank sensed by LT (90GBN91CL001) is low.

Trip permissive for the NaOCL Dosing tank Agitator (90GBN91AM001) are: Level of the selected tank sensed by LT (90GBN91CL001) is low.

Pressure of pump at discharge header is low sensed by PT (90GBN95CP001) pump will trip and alarm will be generated

Pressure Transmitter (90GBN95CP001) is provided on common discharge for Transmitting Signal to DDCMIS.

Tank level not low shall be permissive for starting pumps. Standby pump auto starts when working pump trips and discharge header pressure is low . Running pump will stop in case of tank level low low. Standby Pump shall not start if the running pump trips because of low-low level.

## OVERHEAD CLARIFIED WATER STORAGETANK:-

One no Clarified water overhead tank has been provided to store Clarified water from Service Waterupto High level of the tank, as the valve being the float type, hence it will automatically Open and Close. Further, Tank level can be monitored through level transmitter 90GBN60CL001.

## SLUDGE HANDLING SYSTEM:-

### Clarifier Sludge Sump:-

Sludge Drain/overflow (i.e. from Clarifier, Recirculation line etc.) has been collected in Clarifier sludge sump for further Treatment process. Sludge disposal pumps (90GBS41AP001/90GBS42AP001/90GBS43AP001) provided for disposal of sludge. Manual

type recirculation valve is provided in order to bypass some flow back to sludge sump if needed .Level transmitter (90GBS50CL001&90GBS50CL002) provided for continuous measuring the level of clarifier sludge sump. For air agitation of sludge 2 nos air blowers (90GBS31AN001&90GBS32AN001) are provided.

Sludge sump is provided with Level Transmitters (LT) for high level alarm and low level tripping of Sludge Disposal pumps. The common header of sludge transfer pumps are provided with Pressure Transmitter (GBS42CP001). During running condition when the pressure in the common discharge drops, the running pump (GBS41/42/43AP001) is tripped with alarm and the stand by pump is started.

There will be facility for pump selection on OWS. At a time, only one pump can be selected

Sludge transfer pumps (P1-A/B/C) are to be operated from:

1. Local.

2. Remote

First selection is remote or local.

For remote operation, there are two PBs available on the OWS – START and STOP.

Sludge Transfer Pumps (2W + 1S) discharge valve (90GBS41AA001/90GBS42AA001/90GBS43AA001) shall open when pump is in start status and individual pump discharge pressure (90GBS41CP101/90GBS42CP101/90GBS43CP101) is high

Pump discharge valve (90GBS41AA001/90GBS42AA001/90GBS43AA001) shall close when pump is in stop status and individual pump discharge pressure (90GBS41CP101/90GBS42CP101/90GBS43CP101) is low

A) The start permissive for this pump is
1. Level not LOW in sludge pit (90GBS50CL001 & 90GBS50CL002)
B) Pumps will trip in case
1. Level LOW in sludge pit (LT- 90GBS50CL001&90GBS50CL002))
2. Pressure of pump at discharge header is low sensed by PT (90GBS45CP001) and alarm will be generated.

Tank level not low shall be permissive for starting pumps. Standby pump auto starts when working pump trips and discharge header pressure is low. Running pump will stop in case of tank level low low. Standby Pump shall not start if the running pump trips because of low-low level.

**Air Blower**

Two no. of air blowers (GBD31AN001/GBD32AN001) (1w+ 1S) have been provided for to keep sludge in sludge sump in suspension. The Pressure Switch (GBS40CP101) provided at

common Header of Sludge Transfer Pump. If Pressure exceed beyond set point Blower will "TRIP". The operation of these air blowers shall be manual.

Standby blower starts when working blower trips and discharge pressure is low. Running Blower will trip in case pressure of the common discharge header is sensed high by PS (90GBS40CP101)

**B. Control Philosophy for Motorized Valve –**

Motorized valve with Integral starters will be suitable for open/close operation locally. Auto/manual operation (start/stop) shall be performed from DDCMIS at control room. Permissive & trip condition will be displayed on operator screen. Remote control commands (start/stop) will be generated in DDCMIS and issued as per requirement.

Following signal exchange will take place between actuator &DDCMIS.

1. Valve Open command.
2. Valve Close command.
3. Actuator Disturbance
4. Valve position feedback (4-20 mA.) for control valve only.
5. Valve status feedback -Open.
6. Valve status feedback – Close.

.

The DDCMIS based system considered in the philosophy mentioned above identifies control of some drives as an interlock feature (indicated in the P & ID) and rest will be manual-based only. Indications like on/off, trip and instrument high, low alarm or trip is considered and will be available in the Local control panel.

## DRIVE DETAILS:-

The list of such drives is given in a table below.

| Sr.No | Tag.No | Description |
|---|---|---|
| 1 | 90GBD01AA001 | Raw WTR Inlet to AERATOR |
| **2** | 90GBD01AA002 | Raw WTR Inlet to AERATOR |
| **3** | 90GBS41AA001 | Sludge Transfer PMP-A Discharge Valve |
| **4** | 90GBS42AA001 | Sludge Transfer PMP-B Discharge Valve |
| **5** | 90GBS43AA001 | Sludge Transfer PMP-C Discharge Valve |
| **6** | 90GBN61AM001 | FeCl3- Dosing Tank-A Agitator Motor |
| **7** | 90GBD02AM001 | Flash Mixer Motor |
| **8** | 90GBN62AM001 | FeCl3- Dosing Tank-B Agitator Motor |
| **9** | 90GBN63AM001 | FeCl3- Dosing Tank-C Agitator Motor |

| | | |
|---|---|---|
| **10** | 90GAA01AM004 | Lime- Dosing Tank-A Agitator Motor |
| **11** | 90GAA01AM005 | Lime- Dosing Tank-B Agitator Motor |
| **12** | 90GBN81AM001 | PE- Dosing Tank-A Agitator Motor |
| **13** | 90GBN82AM001 | PE- Dosing Tank-B Agitator Motor |
| **14** | 90GBN91AM001 | NaOCl- Dosing Tank Agitator Motor |
| **15** | 90GBS41AP001 | Sludge Transfer PMP-A |
| **16** | 90GBS42AP001 | Sludge Transfer PMP-B |
| **17** | 90GBS43AP001 | Sludge Transfer PMP-C |
| **18** | 90GBN64AP001 | FeCl3- Dosing Pump-A |
| **19** | 90GBN64AP002 | FeCl3- Dosing Pump-B |
| **20** | 90GBN73AP001 | Lime- Dosing Pump-A |
| **21** | 90GBN73AP002 | Lime- Dosing Pump-B |
| **22** | 90GBN83AP001 | PE- Dosing Pump-A |
| **23** | 90GBN83AP002 | PE- Dosing Pump-B |
| **24** | 90GBN92AP001 | NaOCl- Dosing Pump-A |
| **25** | 90GBN92AP002 | NaOCl- Dosing Pump-B |
| **26** | 90GBS31AN001 | Air Blower -A |
| **27** | 90GBS32AN001 | Air Blower -B |

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

# BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

TECHNICAL DATASHEET FOR VERTICAL CENTRIFUGAL PUMPS OF PRE TREATMENT PLANT

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | ALOYSIUS | AF | 22-02-19 |
| CHKD | MUAZZAM I | MI | 22-02-19 |
| APPD | ASLAM A | AA | 22-02-19 |

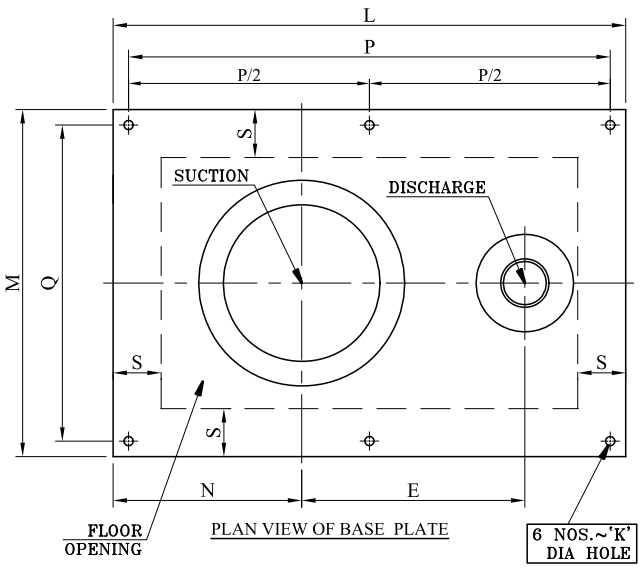
BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | PE-V0-412-158-A008 | 2 |
| DATE | | | | | | | | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/TDS/CP/PTP/18/307 | |

NO. OF SHEETS 5 EXCLUDING COVER PAGE

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF VERTICAL CENTRIFUGAL PUMP FOR PT PLANT | | |
|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LIMITED | BHEL DOC NO.: PE-V0-412-158-A008 | REV NO:- 2 |
| PROJECT | PRE TREATMENT PLANT | OTOKLIN DOC NO:- OGBL/OC-983/TDS/CP/PTP/18/307 | |
| | | MADE BY AF / CHKD BY MI / APPD BY AA | |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | PROJECT: 2x660 MW ENNORE SEZ STPP | |

| Sr No. | Description | | |
|---|---|---|---|
| 1 | Service | Sludge Transfer Pumps | |
| 2 | KKS REF No | 90GBS41AA001/ 90GBS42AA001 / 90GBS43AA001 | |
| 3 | Discharge (m3/ hr.) | 500 m3/hr | |
| 4 | Head Required At Delivery Flange in Mtrs | 12 Mtrs | |
| 5 | Total Bowl Head In Mtrs | 16.25 Mtrs. | (R1) |
| 6 | Qty. Required | 3 Nos. (2W + 1S) | |
| 7 | Type of Pump | Vertical Centrifugal Non clog Sump pump ( Non clog type Impeller ) | |
| 8 | Shut off Head. | 30.50 Mtrs. | (R1) |
| 9 | Pump Speed RPM | 1450 RPM( Nominal ) | |
| 10 | Bowl Efficiency | 74% | (R1) |
| 11 | Specific Gravity. | 1.03 | |
| 12 | NPSHR | 5.5 Mtrs | |
| 13 | Bowl Input | 30.79 KW | |
| 14 | Maximum Kw in full range | 31.14 KW | (R1) |
| 15 | Motor recommended (VSS) - TEFC - IE 2 - Vertical Flange Mounted | 37 KW / 50 HP / 1450 RPM ( Rated ) IE2 -S1-TEFC | |
| 16 | **Sump Depth** | 4.35 Mtrs | |
| 17 | Minimum Submergence | 550 MM | (R1) |
| 18 | Type of Lubrication | Oil Lubrication | |
| 19 | Design Code / Testing Code | IS5120 / IS 9137 / HIS | |
| 20 | Suction Condition | Submerged & Flooded | |
| 21 | Motor - VSS | Vertical Flange Mounted , amb 45 Deg C , Continuous Rating ( s1 ) , Power Supply 415 V / 3P / 50 HZ - As per TANGEDCO Approved Vendor List | |
| | **M O C** | | |
| 22 | Suction Bell /Casing / St Box | ASTMA 890 Gr 4A ( Duplex SS ) | (R2) |
| 23 | Impeller | ASTMA 890 Gr 4A ( Duplex SS ) | (R2) |
| 24 | Wearing Ring ( If Applicable ) | Duplex SS 2205 UNS 31803 | |
| 25 | Column Pipe /Delivery Pipe | Duplex SS | |
| 26 | Pump shaft /Line Shaft / Head Shaft | UNS S 31803 Duplex SS ASTMA 276 | (R2) |
| 27 | Shaft sleeve | UNS S 31803 Duplex SS ASTMA 276 | (R2) |
| 28 | Line Shaft Couplings | UNS S 32750 Duplex SS | (R2) |
| 29 | Shaft Sealing | Impregnated Teflon Gland Packing | |
| 30 | Fasteners | SS 316 L | |
| 31 | Strainer | SS 316 L | |
| 32 | Painting | As per approved painting specification | |
| 33 | Make | Flowmore | |




## PUMP PARTICULARS

| QTY. | FIGURE | SIZE | STAGE | SPEED |
|---|---|---|---|---|
| 03 Nos. | 5414B AWS | 200x200 (8"x8") DEL.-250 (10") | SINGLE | 1470 R.P.M. |

| CAPACITY OF EACH PUMPS | HEAD | PUMP INPUT (Sp. Gr. 1.03) | EFFICIENCY |
|---|---|---|---|
| 500 $M^3/hr.$ | 16.25 Mtrs. | 30.79 K.W. | 74% |

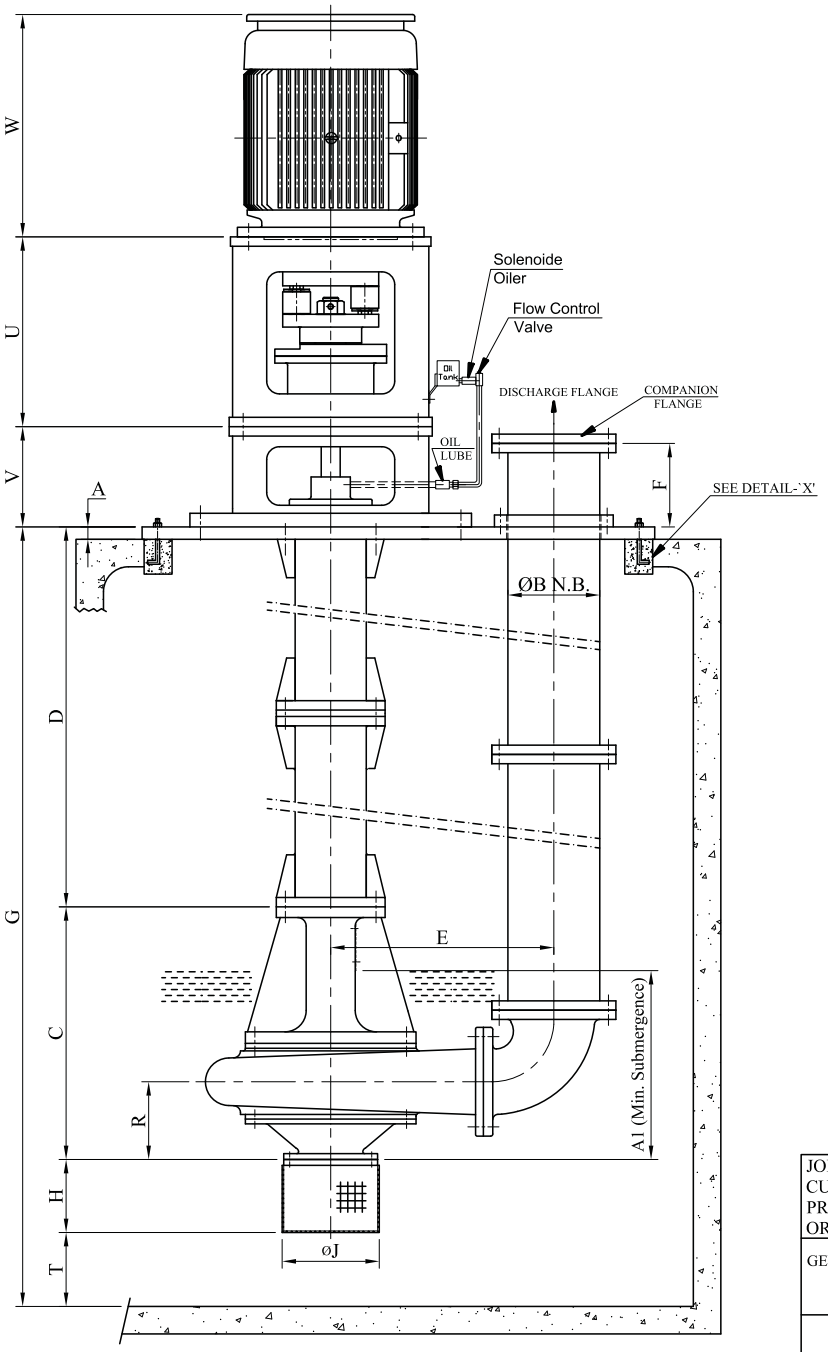
## MOTOR PARTICULARS

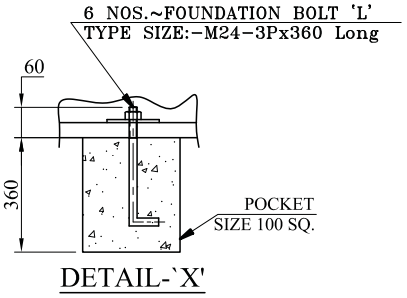
| MAKE | POWER | SPEED | FRAME |
|---|---|---|---|
| CGL | 37 K.W | 1470 R.P.M. | ND 225 S |

| VOLTS | PHASES | FREQUENCY | TYPE OF CONSTRUCTION |
|---|---|---|---|
| 415±10% | THREE | 50 HZ. | V.S.S. |

NOTE:-
1. DIMENSIONS ARE IN MM. UNLESS OTHERWISE SPECIFIED.
2. DIRECTION OF PUMP ROTATION:- ***COUNTER CLOCKWISE*** WHEN LOOKING FROM TOP.
3. STATIC LOAD (PUMP SET WITH MOTOR) = 2100 KGS. (APPROX.)
4. DYNAMIC LOAD (PUMP SET WITH MOTOR) = 2600 KGS. (APPROX.)

| DISCHARGE FLANGE DETAILS AS PER ANSI B16.5, 150 LBS | |
|---|---|
| DISCHARGE FLANGE | :- 250 N.B. |
| FLANGE O.D. | :- 406.4 |
| P.C.D. | :- 362 |
| NO. OF HOLES | :- 12 |
| DIA. OF HOLES | :- 25.4 |



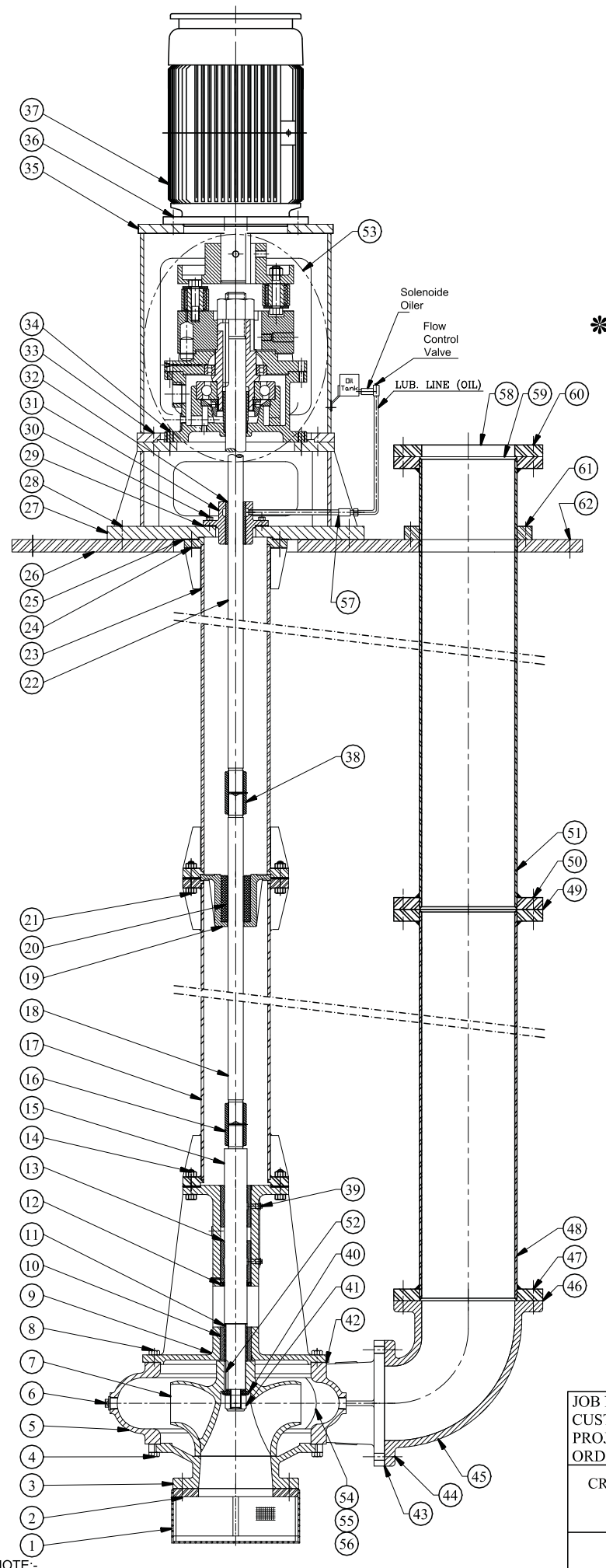




DETAIL-`X'

| | | | |
|---|---|---|---|
| A | 36 | P | 1650 |
| B | 250 | Q | 1050 |
| C | 823 | R | 233 |
| D | 3028 | S | 200 |
| E | 692 | T | 300 |
| F | 250 | U | 480 |
| G | 4386 | V | 250 |
| H | 235 | W | 790 |
| J | 355 | A1 | 550 |
| K | 28 | | |
| L | 1800 | | |
| M | 1200 | | |
| N | 580 | | |

JOB NAME :- SLUDGE TRANSFER PUMPS.,
CUSTOMER :- M/s. OTOKLINE GLOBAL BUSINESS LIMITED.,
PROJECT :- A/c. TANGEDCO - ENNORE STPP.
ORDER NO. :- 004A/OC-983/18-19., Dt.:-10.12.2018.

| GENERAL ARRANGEMENT DRAWING FOR VERTICAL SUMP PUMP | | NAME | DATE |
|---|---|---|---|
| | DRN. | HEMANT | 09.02.2019 |
| | SCALE N.T.S. CHD. | D.K.S. | 09.02.2019 |
| | APPD. | P.K.S. | 09.02.2019 |
| FLOWMORE LIMITED NEW DELHI | DRAWING NO. GA-SALE19013938 10 | | REV. 0 |




| S.NO. | DESCRIPTION | QTY. | MATERIAL |
|---|---|---|---|
| 62 | L-TYPE FOUNDATION BOLT WITH NUT | 6 | M.S. |
| 61 | HEX. HD. CAP SCREW | 4 | S.S.-316 L |
| 60 | HEX. HD. BOLT WITH NUT | 12 | S.S.-316 L |
| 59 | GASKET | 1 | RUBBER |
| 58 | COMPANION FLANGE | 1 | DUPLEX S.S. |
| 57 | LUBRICATION PIPE ASSY. | 1 | S.S.-316+ALUM. |
| ✻ 56 | HEX. HD. BOLT WITH NUT | 6 | S.S.-316 L |
| ✻ 55 | GASKET | 1 | RUBBER |
| ✻ 54 | VOLUTE HAND HOLE COVER | 1 | ASTM A890, Gr-4A (DUPLEX S.S.) |
| 53 | T. S. ASSY. | 1 | REFER DRG. NO.- TSA-SALE19013938-10 |
| 52 | KEY FOR IMPELLER | 1 | S.S.-316 L |
| 51 | DISCHARGE PIPE (Top) | 1 | DUPLEX S.S. |
| 50 | HEX. HD. BOLT WITH NUT | 12 | S.S.-316 L |
| 49 | GASKET | 2 | RUBBER |
| 48 | DISCHARGE PIPE (Bottom) | 1 | DUPLEX S.S. |
| 47 | HEX. HD. BOLT WITH NUT | 8 | S.S.-316 L |
| 46 | GASKET | 1 | RUBBER |
| 45 | DISCHARGE ELBOW (200x250) 8"x10" | 1 | DUPLEX S.S. |
| 44 | HEX. HD. BOLT WITH NUT | 8 | S.S.-316 L |
| 43 | GASKET | 1 | RUBBER |
| 42 | GASKET | 2 | RUBBER |
| 41 | IMP. NUT (Nylock) | 1 | S.S.-316 L |
| 40 | IMP. WASHER | 1 | S.S.-316 L |
| 39 | PIPE PLUG | 1 | S.S.-316 L |
| 38 | SHAFT COUPLING | 2 | UNS S 32750 DUPLEX S.S. |
| 37 | MOTOR | 1 | CGL |
| 36 | HEX. HD. BOLT WITH NUT | 8 | S.S.-316 L |
| 35 | MOTOR STOOL | 1 | M.S. FAB. (IS:2062) |
| 34 | HEX. HD. BOLT WITH NUT | 4 | S.S.-316 L |
| 33 | HEX. HD. BOLT WITH NUT | 8 | S.S.-316 L |
| 32 | BRG. BUSH (For Top Tube) | 1 | GFT |
| 31 | TOP TUBE BRG. HOUSING | 1 | ASTM A890, Gr-4A (DUPLEX S.S.) |
| 30 | HEX. HD. CAP SCREW | 6 | S.S.-316 L |
| 29 | GASKET | 1 | RUBBER |
| 28 | STUD BOLT WITH NUT | 4 | S.S.-316 L |
| 27 | MOTOR STAND | 1 | M.S. FAB. (IS:2062) |
| 26 | BASE PLATE | 1 | M.S. (IS:2062) |
| 25 | GASKET | 1 | RUBBER |
| 24 | HEX. HD. CAP SCREW | 12 | S.S.-316 L |
| 23 | TOP COL. PIPE | 1 | DUPLEX S.S. |
| 22 | TOP SHAFT | 1 | UNS S 31803 DUPLEX S.S. ASTM A276 |
| 21 | HEX. HD. BOLT WITH NUT | 16 | S.S.-316 L |
| 20 | COL. BRG. BUSHING | 2 | GFT |
| 19 | COL. BRG. HOUSING | 2 | ASTM A890, Gr-4A (DUPLEX S.S.) |
| 18 | LINE SHAFT | 2 | UNS S 31803 DUPLEX S.S. ASTM A276 |
| 17 | COL. PIPE | 2 | DUPLEX S.S. |
| 16 | SHAFT COUPLING (PUMP) | 1 | UNS S 32750 DUPLEX S.S. |
| 15 | PUMP SHAFT | 1 | UNS S 31803 DUPLEX S.S. ASTM A276 |
| 14 | HEX. HD. BOLT WITH NUT | 12 | S.S.-316 L |
| 13 | BRG. BUSHING FOR FRAME | 1 | GFT |
| 12 | OIL SEAL | 1 | NITRILE RUBBER |
| 11 | SHAFT SLEEVE | 1 | UNS S 31803 DUPLEX S.S. ASTM A276 |
| 10 | PRESSURE REDUCING BUSH | 1 | BRONZE (ASTM B62) |
| 9 | FRAME | 1 | ASTM A890, Gr-4A (DUPLEX S.S.) |
| 8 | HEX. HD. CAP SCREW | 8 | S.S.-316 L |
| 7 | IMPELLER | 1 | ASTM A890, Gr-4A (DUPLEX S.S.) |
| 6 | PIPE PLUG | 1 | S.S.-316 L |
| 5 | VOLUTE | 1 | ASTM A890, Gr-4A (DUPLEX S.S.) |
| 4 | HEX. HD. CAP SCREW | 8 | S.S.-316 L |
| 3 | SUCTION HEAD | 1 | ASTM A890, Gr-4A (DUPLEX S.S.) |
| 2 | STUD BOLT WITH NUT | 4 | S.S.-316 L |
| 1 | STRAINER | 1 | S.S.-316 L |

NOTE: - +VE WIRE OF SOLENOIDE TO BE CONNECTED ANY OF THE PHASE OF MAIN MOTOR AND -VE IS TO BE CONNECTED TO EARTH TERMINAL OF MOTOR

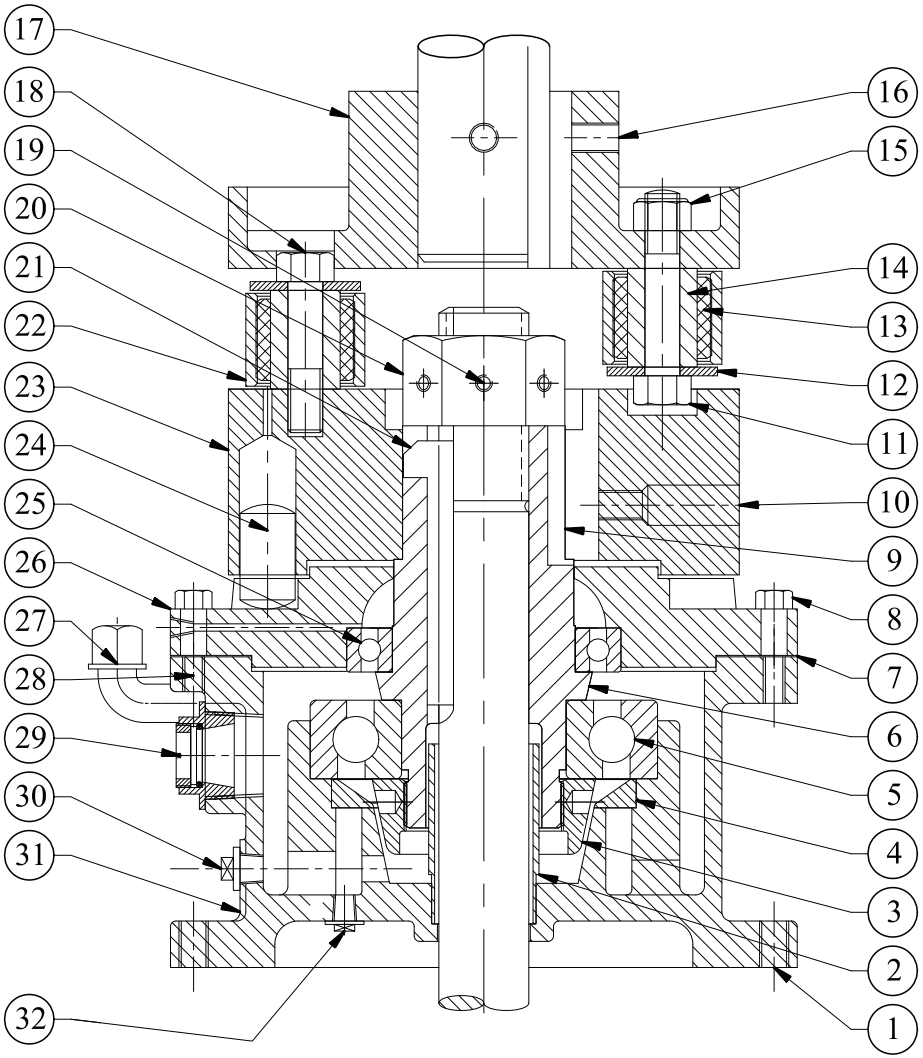
✻ THESE ITEM ARE NOT SHOW IN THIS DRAWING.

| PUMP PARTICULARS | | (QTY.:- 03 Nos.) |
|---|---|---|
| FIG. | – | 5414B AWS |
| SIZE | – | 200x200 (8"x8"), Del.:- 250 (10") |
| STAGE | – | SINGLE |
| TYPE OF LUB. | – | OIL |

NOTE:-
DIRECTION OF ROTATION:- ***COUNTER CLOCK WISE***, WHEN LOOKING FROM TOP.

JOB NAME :- SLUDGE TRANSFER PUMPS.,
CUSTOMER :- M/s. OTOKLINE GLOBAL BUSINESS LIMITED.,
PROJECT :- A/c. TANGEDCO - ENNORE STPP.
ORDER NO. :- 004A/OC-983/18-19., Dt.:-10.12.2018.

| CROSS SECTIONAL DRAWING FOR VERTICAL SUMP PUMP | | | NAME | DATE |
|---|---|---|---|---|
| | | DRN. | HEMANT | 09.02.2019 |
| | SCALE N.T.S. | CHD. | D.K.S. | 09.02.2019 |
| | | APPD. | P.K.S. | 09.02.2019 |
| FLOWMORE LIMITED NEW DELHI | DRAWING NO. CSD-SALE19013938 10 | | | REV. 0 |

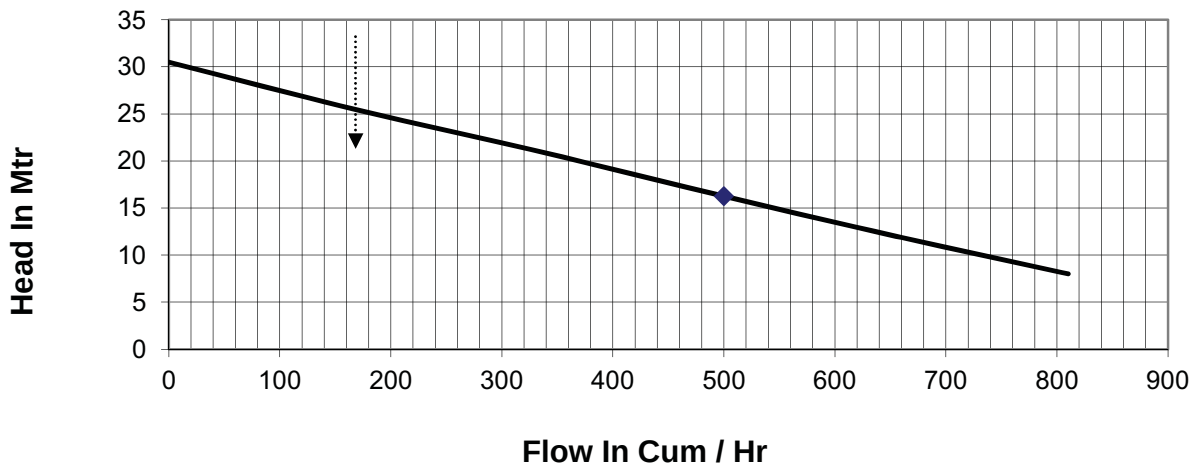


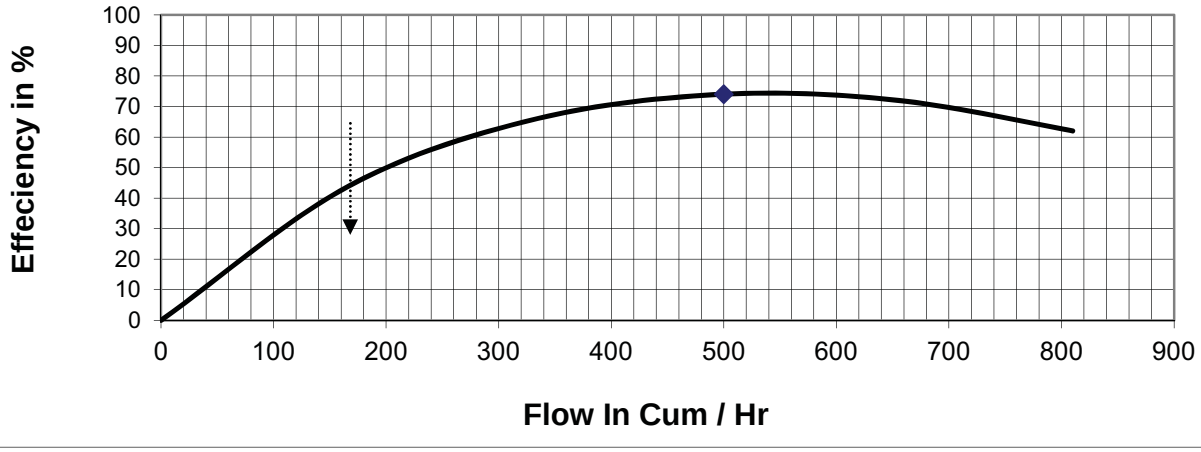

| S. NO. | DESCRIPTION | QTY. | MATERIAL |
|---|---|---|---|
| 32 | PIPE PLUG | 1 | MAL. IRON |
| 31 | THRUST BEARING HOUSING | 1 | C.I. (IS-210, FG-260) |
| 30 | PIPE PLUG | 1 | MAL. IRON |
| 29 | OIL SIGHT WINDOW ASSY. | 1 | —— |
| 28 | DOWEL PIN | 2 | En-8/En-9 |
| 27 | OIL FILL PORT | 1 | MAL. IRON |
| 26 | MOUNTING COVER (RATCHET PLATE) | 1 | CAST STEEL (IS-1030) |
| 25 | RADIAL BEARING (6020 2Z) | 1 | BRG. STEEL (SKF/FAG) |
| 24 | RATCHET PIN | 4 | STEEL |
| 23 | LOWER COUPLING HALF | 1 | CAST STEEL(IS-1030) |
| 22 | LINK | 3 | MAL. IRON |
| 21 | GIB KEY | 1 | EN-8 |
| 20 | ADJUSTING NUT | 1 | MILD STEEL |
| 19 | ALLEN SET SCREW | 1 | S.S.-316 L |
| 18 | HX. HD. BOLT(3/4"NF x 3-1/4"Lg.) | 3 | H.T. STEEL (Gr. 8.8) |
| 17 | UPPER COUPLING HALF | 1 | CAST STEEL (IS-1030) |
| 16 | ALLEN SET SCREW | 2 | S.S.-316 L |
| 15 | NYLOCK NUT | 3 | H.T. STEEL (Gr. 8.8) |
| 14 | PIN BLOCK | 6 | ALUMINIUM |
| 13 | RUBBER BUSH | 6 | RUBBER |
| 12 | RETAINING WASHER | 6 | MILD STEEL |
| 11 | HX. HD. BOLT (3/4" NF X 4"Lg.) | 3 | H.T. STEEL (Gr. 8.8) |
| 10 | ALLEN SET SCREW | 1 | S.S.-316 L |
| 9 | STRAIGHT KEY | 1 | EN-8 |
| 8 | HX. HD. CAP SCREW | 8 | S.S.-316 L |
| 7 | MOUNTING COVER GASKET | 1 | CHAMPION STYLE NO.-59 |
| 6 | THRUST HUB | 1 | CAST STEEL (IS-1030) |
| 5 | ANGULAR CONTACT THRUST BEARING (7318E) | 1 | BRG. STEEL (SKF/FAG) |
| 4 | OIL RETAINER RING | 1 | C.I. (IS-210, FG-260) |
| 3 | OIL RETAINER SLEEVE | 1 | BRONZE (IS-318, LTB-II) |
| 2 | BELTED OIL SLEEVE | 1 | MILD STEEL |
| 1 | HX. HD. CAP SCREW | 4 | S.S.-316 L |

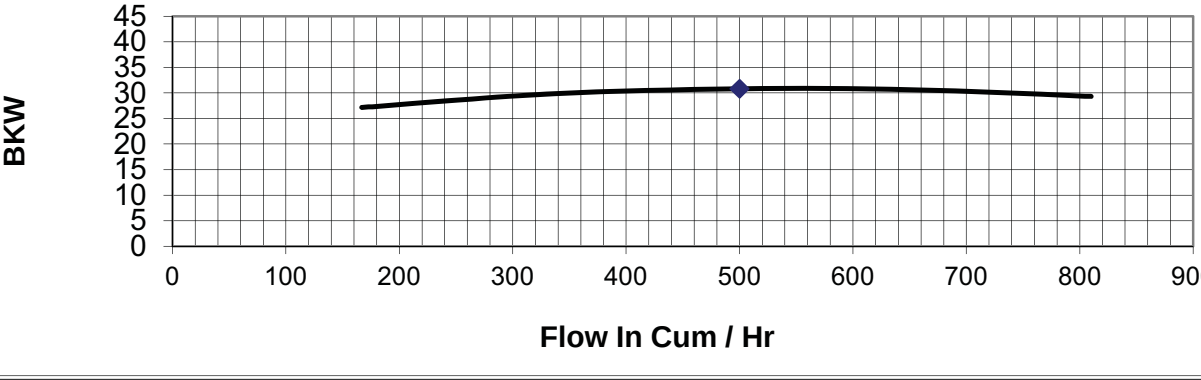
THRUST STAND ASSY. FOR VERTICAL SUMP PUMP

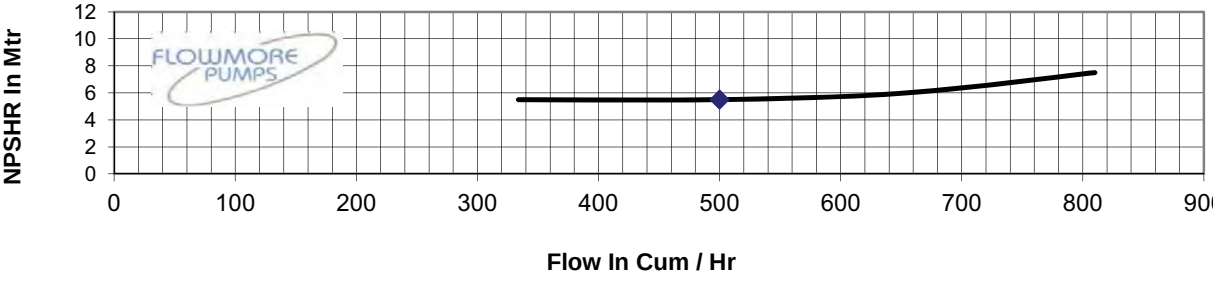
JOB NAME :- SLUDGE TRANSFER PUMPS.,
CUSTOMER :- M/s. OTOKLINE GLOBAL BUSINESS LIMITED.,
PROJECT :- A/c. TANGEDCO - ENNORE STPP.
ORDER NO. :- 004A/OC-983/18-19., Dt.:-10.12.2018.

| CROSS SECTIONAL DRAWING FOR T.S. ASSY. V.T. SUMP PUMP | DPPT CODE | | NAME | DATE |
|---|---|---|---|---|
| | | DRN. | HEMANT | 09.02.2019 |
| | | DGN. | | |
| | | CHD. | D.K.S. | 09.02.2019 |
| | | APPD. | P.K.S. | 09.02.2019 |
| FLOWMORE LIMITED NEW DELHI | DRG. NO. TSA-SALE19013938 10 | | | REV. 0 |




| | | | | | |
|---|---|---|---|---|---|
| **Duty Point**<br>**500 Cum / Hr**<br>**16.25 Mtr BH**<br>**74 % Bowl Eff**<br>**Sp Gr 1.03.** | Customer | **M/S.OTOKLIN G Business Ltd- A/C.BHEL ENNORE PROJECT.** | | | |
| | Suction | 200 MM | Delivery | 10 " - 250 MM | Speed 1470 RPM |
| | FLOWMORE LIMITED., MUMBAI<br>SLUDGE TRANSFER PUMP | | | | PUMP MODEL<br>**AWS 5414B-8"** |
| | OUR W O REF NO : SALE 19013938 10 | | | | **NC-4-0B 8/4.** |

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

# BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

QAP FOR HORIZONTAL / VERTICAL CENTRIFUGAL PUMPS /SCREW PUMP WITH MOTOR OF PRE TREATMENT PLANT

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | ALOYSIUS | AF | 16-07-18 |
| CHKD | MUAZZAM I | MI | 16-07-18 |
| APPD | ASLAM A | AA | 16-07-18 |

| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | PE-V0-412-158-A009 | 0 |
| DATE | | | | | | | | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/QAP/CP/PTP/18/348 | |

NO. OF SHEETS 2 EXCLUDING COVER PAGE

| OTOKLIN GLOBAL BUSINESS LIMITED | OTOKLIN GLOBAL BUSINESS LIMITED<br>R-02 Remi Bizcourt, Off Veera Desai Road, Andheri West,<br>Mumbai 400 053, India | **MANUFACTURING QUALITY PLAN**<br>**ITEM: VERTICAL CENTRIFUGAL PUMP**<br>**SUB-SYSTEM: PRETREATMENT PLANT** | **QP NO.: PE-V0-412-158-A009**<br>**REV.NO.: 00**<br>**DATE: 16-07-2018**<br>**PAGE: 1 OF 2** | PROJECT: 2X660 MW ENNORE SEZ STPP AT ASH DYKE OF NCTPS<br>PACKAGE: PRETREATMENT PLANT<br>CONTRACT NO.: 412<br>MAIN-SUPPLIER: BHEL<br>SUB- CONTRACTOR:- OTOKLIN |
|---|---|---|---|---|

| S.NO | COMPONENT & OPERATIONS | CHARACTERISTICS CHECKED | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | D | AGENCY M | AGENCY C | AGENCY N | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | 10 | | | 11 |
| [1] | **RAW MATERIAL AND BOUGHT OUT COMPONENTS.** | | | | | | | | | | | | |
| 1.1 | CASING | Visual, Dimensional, and Leak Proofness | Major | Visual, Measurement, Hydro Test, MFG. TC. | 100% . One/Heat | Approved Drawing. / Documents | Approved Drawing. / Documents | Mfg. Insp. Report. MFG. TC | ✓ | P | R | R | |
| [2] | **IN PROCESS CONTROLS** | | | | | | | | | | | | |
| 2.1 | IMPELLER | Visual, Dimensional, and AND Dynamic Balancing | Major | Visual, Measurement, Dynamic, Balancing. MFG. TC. | 100% . One/Heat | Approved Drawing. / Documents | Approved Drawing. / Documents | Mfg. Insp. Report. MFG. TC | ✓ | P | R | R | |
| 2.2 | SHAFT & SLEEVES | Visual, Dimensional and Soundness of Shaft DIA >50 mm | Major | Visual, Measurement, Ultrasonic Test of Shaft MFG. TC. | 100% . One/Heat | Approved Drawing. / Documents | Approved Drawing. / Documents | Mfg. Insp. Report. MFG. TC | ✓ | P | R | R | |
| [3] | **FINAL INSPECTION** | | | | | | | | | | | | |
| 3.1 | COMPLETE ARRANGEMENT | Overall Dimension | Major | Measurement | 100% | Approved Drawing. / Documents | Approved Drawing. / Documents | Mfg. Insp. Report. MFG. TC | ✓ | P | W | R | |
| | PERFORMANCE TEST | Capacity VS Power, Capacity VS Efficiency, Capacity VS Total Head, | Major | Witness | 100% | Approved Drawing. / Documents | Approved Drawing. / Documents | Mfg. Insp. Report. MFG. TC | ✓ | P | W | R | Mfgr. To check all the pumps of each model selected randomly shall be offered for testing by job motor. |
| 3.2 | Pump & Accessories with Base Frame | Visual & Dimensional | Measurement | Witness | 100% | Approved GAD | Approved GAD | Insp. Report | ✓ | P | W | R | Manufacturer Compliance Report |
| 3.3 | Painting | Visual | Major | | | As per Appd Doc | As per Appd Doc | I R | ✓ | P | R | R | Compliance Report |
| | Packing | | | | | | | | | | | | Compliance Report |

OTOKLIN GLOBAL BUSINESS LTD. MUMBAI

Bharat Heavy Electricals Limited PPEI Sector-16A NOIDA 201 301 PEM/Mech

| MANUFACTURER / SUBCONTRACTOR | CONTRACTOR |
|---|---|
| SIGNATURE | |

**LEGEND:**
* RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** M: MANUFACTURER/SUB-SUPPLIER
C: SUPPLIER/NOMINATED INSPECTION AGENCY
N: THE OWNER

P - Performing the Test
W - Witnessing the Test
R - Review the Test

FOR THE

**DOC. NO.:**
**REV..... CAT.....**

| OTOKLIN GLOBAL BUSINESS LIMITED | OTOKLIN GLOBAL BUSINESS LIMITED<br>R-02 Remi Bizcourt, Off Veera Desai Road, Andheri West,<br>Mumbai 400 053, India | **MANUFACTURING QUALITY PLAN**<br>**ITEM: HORIZONTAL SCREW PUMP**<br>**SUB-SYSTEM:**<br>**PRETREATMENT PLANT** | **QP NO.: PE-V0-412-158-A009**<br>**REV.NO.: 00**<br>**DATE: 16-07-2018**<br>**PAGE: 2 OF 2** | PROJECT: 2X660 MW ENNORE SEZ STPP AT ASH DYKE OF NCTPS<br>PACKAGE: PRETREATMENT PLANT<br>CONTRACT NO.: 412<br>MAIN-SUPPLIER: BHEL<br>SUB- CONTRACTOR:- OTOKLIN |
|---|---|---|---|---|

| S.NO | COMPONENT & OPERATIONS | CHARACTERISTICS CHECKED | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | D | AGENCY M | AGENCY C | AGENCY N | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | 10 | | | 11 |
| [1] | **RAW MATERIAL AND BOUGHT OUT COMPONENTS** | | | | | | | | | | | | |
| 1.1 | Pump Casing | Physical Properties | Critical | Test & Analysis | One / Heat | Approved Drawing. /Documents | Approved Drawing. /Documents | Material test certificate | ✓ | P | R | R | |
| 1.2 | Rotor | Chemical Properties | Critical | Test & Analysis | One / Heat | Approved Drawing. /Documents | Approved Drawing. /Documents | Material test certificate | ✓ | P | R | R | Physical, Chemical test certificate for shafts per batch and ultrasonic test (for dia ≥ 50 mm) report to be submitted for review. |
| 1.3 | Shaft | Chemical Properties | Critical | Test & Analysis | One / Heat | Approved Drawing. /Documents | Approved Drawing. /Documents | Material test certificate | ✓ | P | R | R | |
| 1.4 | Stator | Dimension | Critical | Visual, Measurement | 1 | Mfr's Drg. | Mfr's Drg. | Certificate of conformance | ✓ | P | R | R | |
| 1.5 | Bearing | Size, Make & No. | Major | Visual, Measurement | 100% | Mfr's Std. | Mfr's Std. | Certificate of conformance | ✓ | P | R | R | |
| [2] | **IN PROCESS CONTROLS** | | | | | | | | | | | | |
| 2.1 | Pump Casing | Dimension, Completeness | Major | Visual, Measurement | 100% | Mfr's Drg. | Mfr's Drg. | Certificate of conformance | ✓ | P | R | R | Manufacturer Compliance Report |
| | | Leak Tightness | Critical | Hydrostatic Test | 100% | hydro test at 1.5 x Discharge pr. for 30 min. | No Leakage | Insp. Report | ✓ | P | R | R | |
| | Machined area of casing & Rotor | Surface Quality | Major | DPT/Visual | 100% | ASTM E165 | No Visual | Certificate of Compliance | ✓ | P | R | R | |
| | All Components | Completeness, Workmanship, Dimension | Major | Visual,Measurement | 100% | Mfrs. Std./Drg. | Mfrs. Std./Drg. | Certificate of Compliance | ✓ | P | R | R | |
| [3] | **FINAL INSPECTION** | | | | | | | | | | | | |
| 3.1 | Pump with job motor | Head Vs Power<br>Head Vs Capacity<br>Head Vs Efficiency | Major | Performance Check | 100% | Appd. Data Sheet | VDMA 24284 Gr II CLII | Insp. Report | ✓ | P | W | R | 1. Only one pump/model to be witness.<br>2. Pump shall be tested at rated speed with Job Motor using water + oil emulsion. |
| 3.2 | Pump with accessories mounted on base frame | Overall Dimensions &Orientation | Major | Visual | 100% | App. GAD | App.GAD | Insp. Report | ✓ | P | W | R | Only one set to be witness |
| 3.2 | Painting | Surface Preparation , Paint shade & DFT | Major | Visual & Measurement | 100% | As per Appd Doc | As per Appd Doc | Cert. of Conformance | ✓ | P | W | R | Compliance Report |
| 3.3 | Packing | - | - | - | - | Std. | Std. | Cert. of Conformance | ✓ | P | R | R | Compliance Report |

| MANUFACTURER / SUBCONTRACTOR | CONTRACTOR |
|---|---|
| SIGNATURE | |

**LEGEND:**

* RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** M: MANUFACTURER/SUB-SUPPLIER — P - Performing the Test

C: SUPPLIER/NOMINATED INSPECTION AGENCY — W - Witnessing the Test

N: THE OWNER — R - Review the Test

FOR THE

**DOC. NO.:**
**REV..... CAT.....**

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: FN | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| 0 | 16.07.2018 | CHECKED: MI | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

# BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

TECHNICAL DATASHEET FOR METERING PUMPS OF PRE TREATMENT PLANT

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | FAISAL | FN | 12-07-19 |
| CHKD | MUAZZAM I | MI | 12-07-19 |
| APPD | ASLAM A | AA | 12-07-19 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

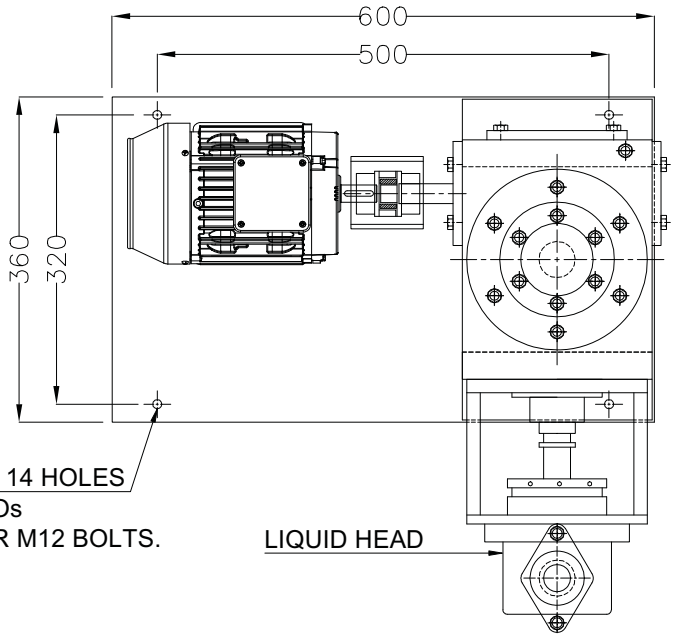
| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | PE-V0-412-158-A010 | 01 |
| DATE | | | | | | | | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/TDS/CP/PTP/18/308 | |

NO. OF SHEETS 16 EXCLUDING COVER PAGE

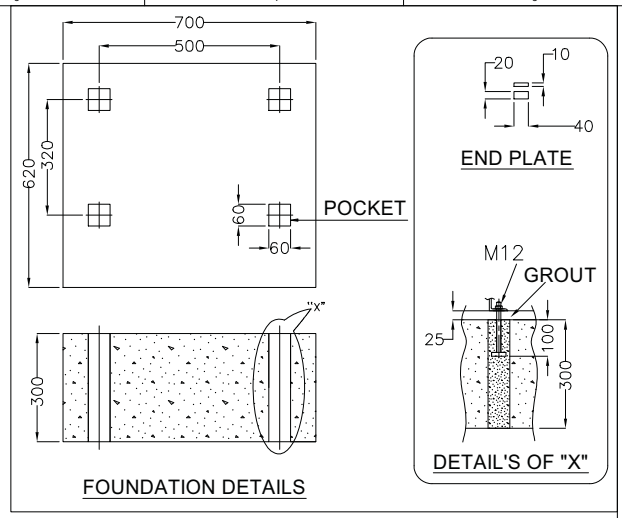
| ® OTOKLIN GLOBAL BUSINESS LIMITED | DATA SHEET OF PE METERING PUMPS | | | |
|---|---|---|---|---|
| LOI NO: - PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018 | | PROJECT DOC NO:- PE-V0-412-158-A010 | | |
| CLIENT | **BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TDS/MP/PTP/18/308 | | Rev No:- 01 |
| PROJECT | 2X660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT | MADE BY FN | CHKD BY MI | APPD BY AA |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | | | |

| Sr. No. | Parameters | Description |
|---|---|---|
| **A** | **TECHNICAL SPECIFICATION** | |
| 1 | Quantity | 2 Nos. (1W+1S) |
| 2 | KKS TAG No. | 90GBN83AP001 & 90GBN83AP002 (R1) |
| 3 | Location# | First floor Chemical House Ref Drg. No. PE-V0-412-158-A035 |
| 4 | Type | Plunger Type (Positive Displacement) |
| 5 | Application | Poly Electrolyte dosing in Flash mixer.(R1) |
| 6 | Rated capacity in LPH | 0-1000 LPH |
| 7 | Total Head in 'm' | 10 m |
| 8 | RPM | 1500 |
| 9 | Recommended Motor/Engine HP | 1 (R1) |
| 10 | Discharge Pressure Kg/cm2 | 1.0 |
| 11 | Hydro test Pressure Kg/cm2 | 1.5 |
| **B** | **MATERIAL OF CONSTRUCTION** | |
| 1 | Liquid Head | SS 316 |
| 2 | Plunger | SS 316 |
| 3 | Valve seat / Cage | SS 316 |
| 4 | Ball/Cone/Plate | SS 316 |
| 5 | Pressure Relief Valve | SS 316 |
| 6 | End Connection | 1” BSP (FM) |
| 7 | Painting | As per approved painting specification. |
| 8 | Make | Positive Metering Pumps. (R1) |
| 9 | Model no | PL 3530 (R1) |
| **C** | **MOTOR DETAILS** | |
| 1 | Type | Pump Enclosed |
| 2 | Enclosure = TEFC | IP – 55/B-3 |
| 3 | Speed in RPM / HP | 1500 / 1 (R1) |
| 4 | Rated Voltage / Phase / Frequency | 415V / 3 / 50 HZ |
| 5 | Make / Model | ABB / 80 |

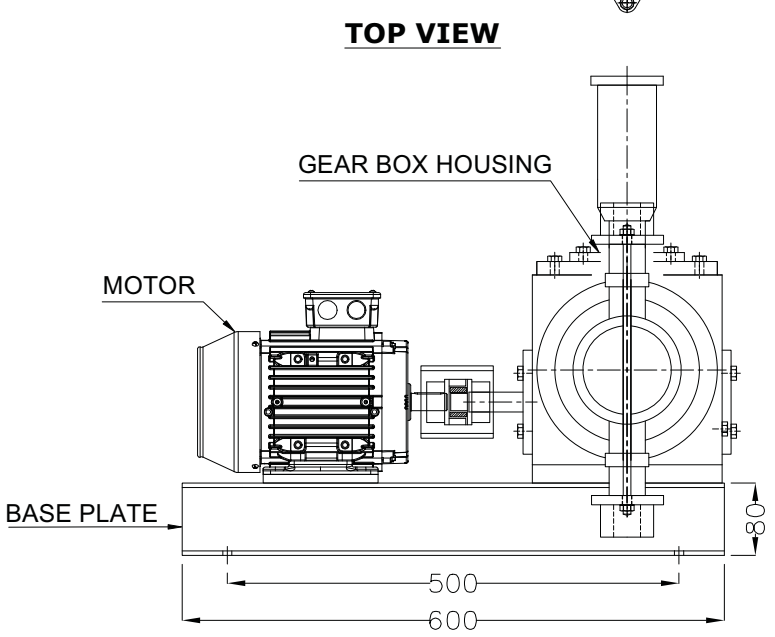
| REV NO : 01 | PREPARED BY: FN | CHKD. & APPD. BY: MI & AA | DATE: 12.07.2019 |
|---|---|---|---|



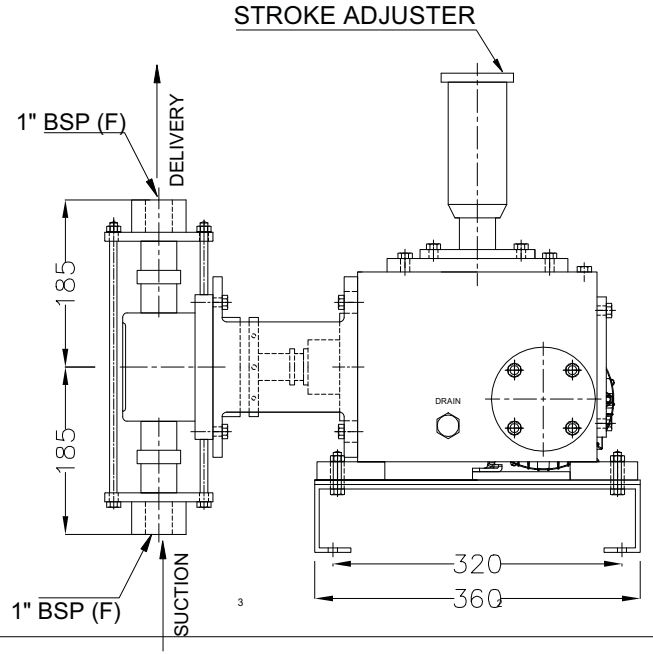

**TOP VIEW**




NOTE:
1.ALL DIMENSIONS ARE IN mm.
2.TOLERANCE FOR ALL DIMENSIONS ARE ±10mm
3.FOUNDATION BOLT SIZE M12mmX150mm




**FRONT VIEW**




**SIDE VIEW**

| TECHNICAL SPECIFICATIONS | | | | | |
|---|---|---|---|---|---|
| CUSTOMER NAME | :- | OTOKLIN GLOBAL BUSINESS LTD. MUMBAI | | | |
| PO NO | :- | 008A / OC -983 / 18-19 | | | |
| OFFER NO. | :- | 8PMP / OFR / DP / 18-19 / 02 / 2137 / R2 | | | |
| LIQUID | :- | 0.1% POLY SOLUTION | | | |
| PUMP TYPE | :- | PLUNGER TYPE PUMP | COUPLING TYPE | :- | FLEXIBLE SPIDER |
| PUMP MODEL | :- | PL3530 | QTY. | :- | 2 No. |
| PUMP WETTED PART MOC | :- | SS316 / CF8M | | | |
| FLOW RATE | :- | 0-1000 LPH | | | |
| DISCHARGE PRESSURE | :- | 1 KG/CM2 | | | |
| STROKE RANGE | :- | 0-100% (MANUAL) | | | |
| MOTOR DESCRIPTION | :- | 1 HP,3Ph,415V±10%,50Hz±5%, 4-POLE,FOOT MOUNTED,STD TEFC, IP55,IE2,NON FLAME PROOF,S1 DUTY,DOL START. | | | |
| END CONNECTION | :- | 1" BSP (F) CONNECTION ON SUCTION SIDE & DISCHARGE SIDE. | | | |

| Z FINAL | 1 | A ACCEPTED WITH COMMENTS | | N NOT ACCEPTABLE | | I FOR INFORMATION | |
|---|---|---|---|---|---|---|---|

**POSITIVE METERING PUMPS (I) PVT.LTD.**

PLOT NO. M8, AMBAD M.I.D.C., , NASIK

| REV | DATE | DESCRIPTION | DRAWN BY | CHECKED BY | APPROVED BY |
|---|---|---|---|---|---|
| R2 | 11.07.2019 | ISSUED FOR APROVAL | SBN | SBN | TSN |
| R1 | 27.06.2019 | ISSUED FOR APROVAL | SPK | SBN | TSN |

| | | | | |
|---|---|---|---|---|
| DRAWING TITLE :- | GA DRAWING | | | |
| DRAWING NO.:- | PMPIPL-GA-PL3530-IR9566-2 | SCALE | SHEET | REV. |
| | | NTS | 01 | R1 |

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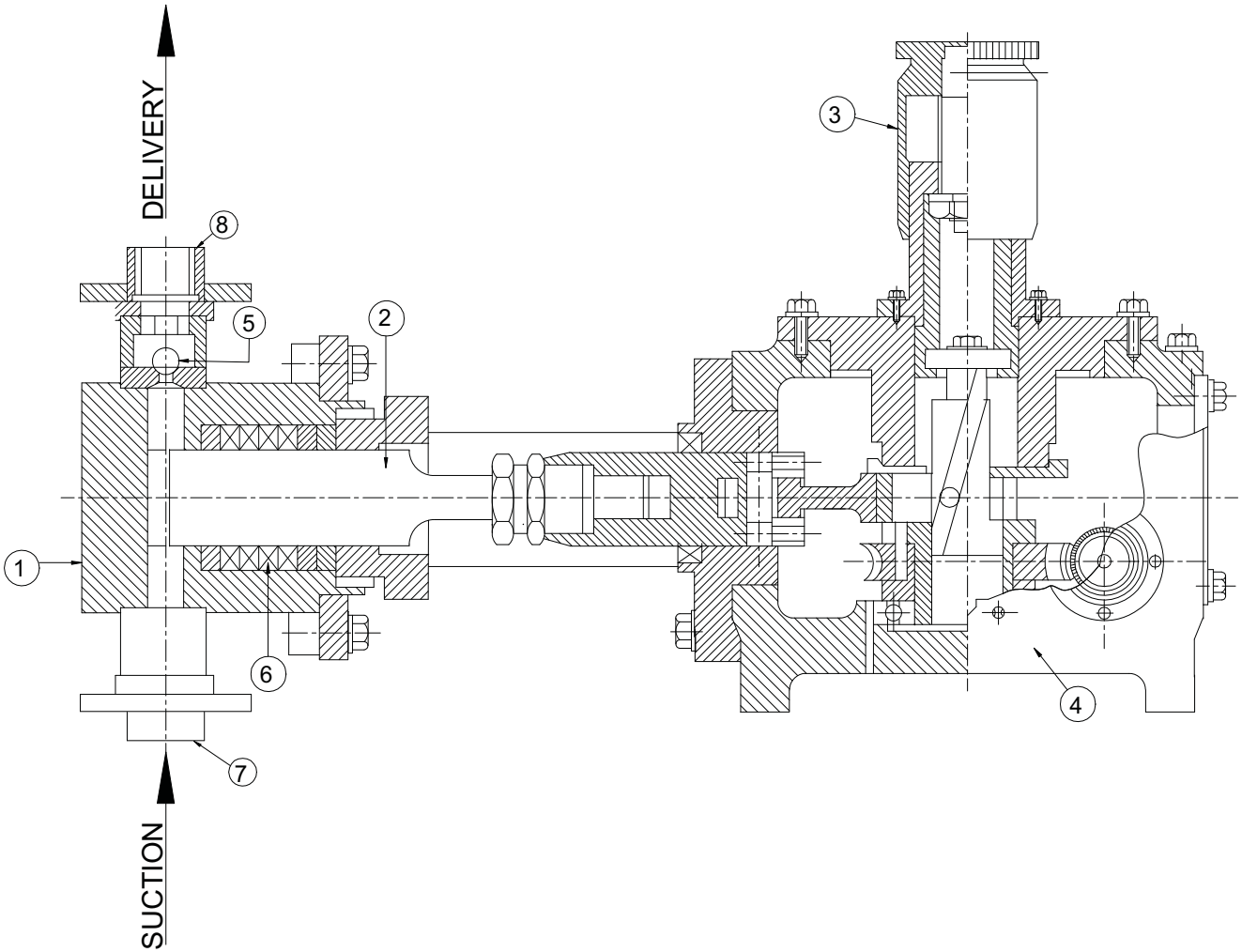
A3-420X297

| | | |
|---|---|---|
| 1. | LIQUID HEAD | SS316/CF8M |
| 2. | PLUNGER | SS316 |
| 3. | STROKE CONTROLLER | C.I. |
| 4. | HOUSING | C.I. |
| 5. | NRV | SS316 |
| 6. | GLAND PACKING. | PTFE |
| 7. | SUCTION Connection | SS316/CF8M |
| 8. | DISCHARGE Connection | SS316/CF8M |

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TECHNICAL SPECIFICATIONS

| | | |
|---|---|---|
| CUSTOMER NAME | :- | OTOKLIN GLOBLE BUSINESS LTD. MUMBAI |
| PO NO | :- | 008A / OC -983 / 18-19 |
| OFFER NO. | :- | BPMP / OFR / DP / 18-19 / 02 / 2137 / R2 |
| LIQUID | :- | 0.1% POLY SOLUTION |

Z FINAL | A ACCEPTED WITH COMMENTS | N NOT ACCEPTABLE | I FOR INFORMATION

**POSITIVE METERING PUMPS (I) PVT.LTD.**

PLOT NO. M8, AMBAD M.I.D.C., , NASIK

| REV | DATE | DESCRIPTION | DRAWN BY | CHECKED BY | APPROVED BY |
|---|---|---|---|---|---|
| R2 | 11.07.2019 | ISSUED FOR APROVAL | SBN | SBN | TSN |
| R1 | 27.06.2019 | ISSUED FOR APROVAL | SPK | SBN | TSN |

| | | | | |
|---|---|---|---|---|
| DRAWING TITLE :- | CS DRAWING | | | |
| DRAWING NO.:- | PMPIPL-CS-PL3530-IR9566-2 | SCALE | SHEET | REV. |
| | | NTS | 02 | R0 |



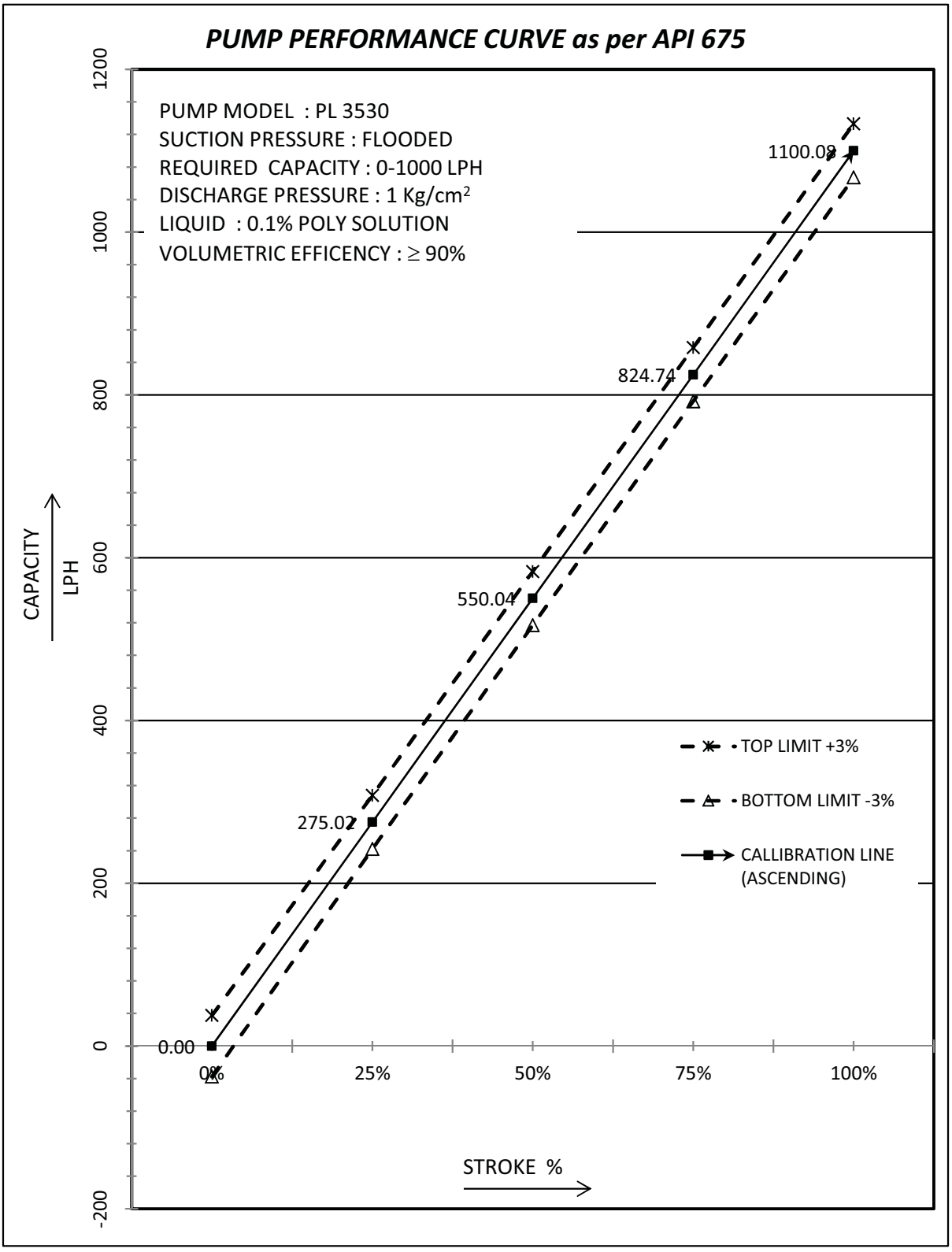
A3-420X297

# POSITIVE METERING PUMPS (I) PVT. LTD.

M-8, MIDC, AMBAD, NASIK - 422 010

Email : sales@positivemetering.com Web: www.positivemetering.com

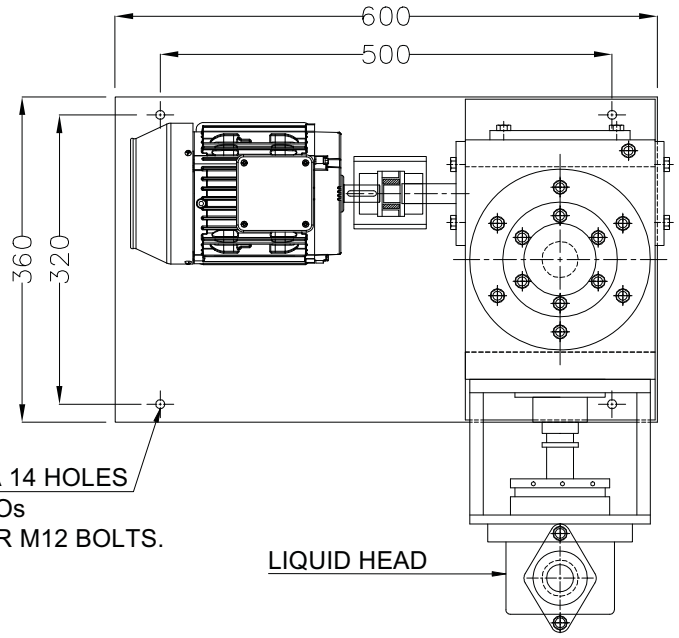

CUSTOMER : OTOKLIN GLOBAL BUSINESS LTD. MUMBAI
PROJECT NAME : BHEL



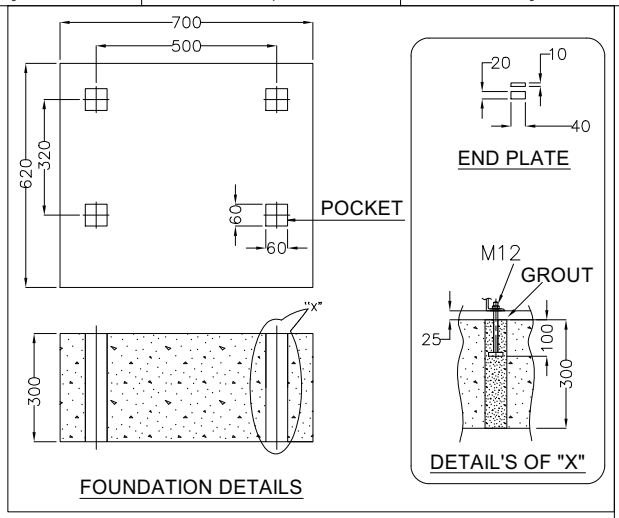
| ® OTOKLIN GLOBAL BUSINESS LIMITED | DATA SHEET OF FECL3 METERING PUMPS | | | |
|---|---|---|---|---|
| LOI NO: - PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018 | | PROJECT DOC NO:- PE-V0-412-158-A010 | | |
| CLIENT | **BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TDS/MP/PTP/18/308 | | Rev No:- 01 |
| PROJECT | 2X660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT | MADE BY FN | CHKD BY MI | APPD BY AA |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | | | |

| Sr. No. | Parameters | Description |
|---|---|---|
| **A** | **TECHNICAL SPECIFICATION** | |
| 1 | Quantity | 2 Nos. (1W+1S) |
| 2 | KKS TAG No. | 90GBN64AP001 & 90GBN64AP002 (R1) |
| 3 | Location# | First floor Chemical House Ref Drg No. PE-V0-412-158-A035 |
| 4 | Type | Plunger Type (Positive Displacement) |
| 5 | Application | FECL3 dosing in Flash mixer. (R1) |
| 6 | Rated capacity in LPH | 0-2000 LPH |
| 7 | Total Head in 'm' | 10 m |
| 8 | RPM | 1500 |
| 9 | Recommended Motor/Engine HP | 1.5 (R1) |
| 10 | Discharge Pressure Kg/cm2 | 1.0 |
| 11 | Hydro test Pressure Kg/cm2 | 1.5 |
| **B** | **MATERIAL OF CONSTRUCTION** | |
| 1 | Liquid Head | Duplex SS |
| 2 | Plunger | Duplex SS |
| 3 | Valve seat / Cage | Duplex SS |
| 4 | Ball/Cone/Plate | Duplex SS |
| 5 | Pressure Relief Valve | Duplex SS |
| 6 | End Connection | 1 ½ ” BSP (FM) |
| 7 | Painting | As per approved painting specification |
| 8 | Make | Positive Metering Pumps(R1) |
| 9 | Model no | PL 3530 (R1) |
| **C** | **MOTOR DETAILS** | |
| 1 | Type | Pump Enclosed |
| 2 | Enclosure = TEFC | IP – 55/B-3 |
| 3 | Speed in RPM / HP | 1500 / 1.5 (R1) |
| 4 | Rated Voltage / Phase / Frequency | 415V / 3 / 50 HZ |
| 5 | Make / Model | ABB/ 90S |

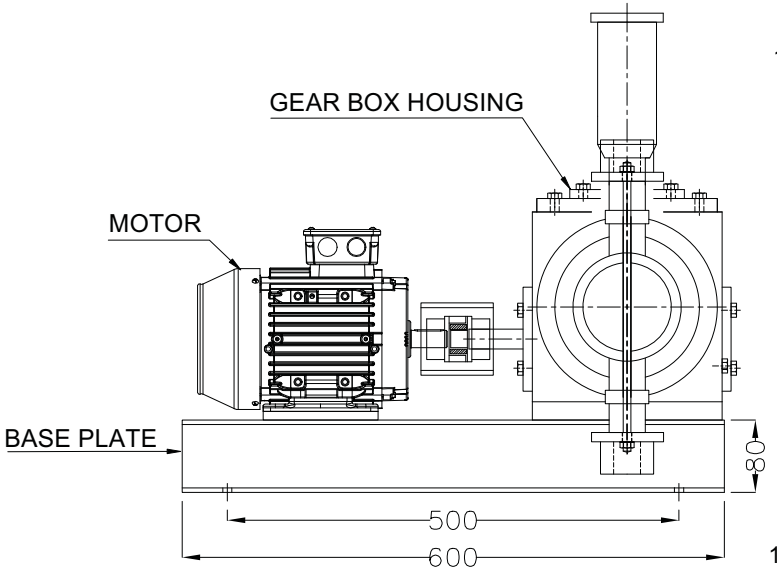
| REV NO : 01 | PREPARED BY: FN | CHKD. & APPD. BY: MI & AA | DATE: 12.07.2019 |
|---|---|---|---|



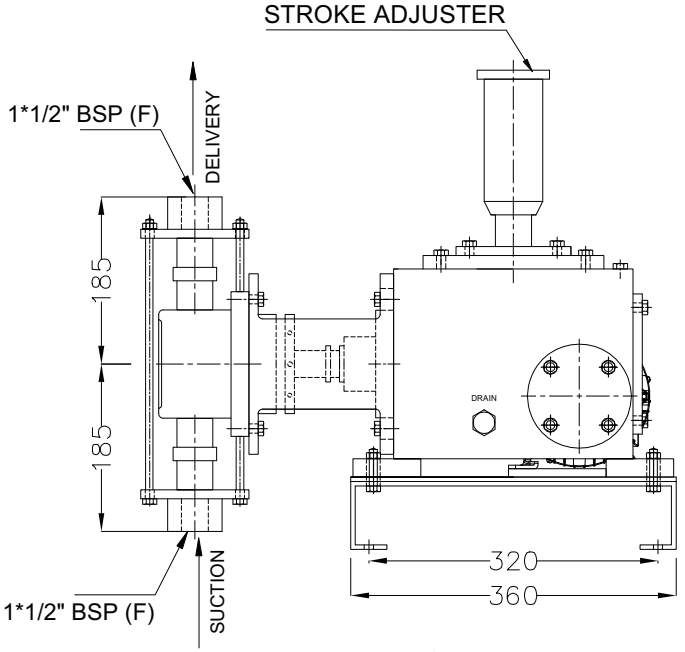

**TOP VIEW**




NOTE:
1.ALL DIMENSIONS ARE IN mm.
2.TOLERANCE FOR ALL DIMENSIONS ARE ±10mm
3.FOUNDATION BOLT SIZE M12mmX150mm




**FRONT VIEW**




**SIDE VIEW**

| REV | DATE | DESCRIPTION | DRAWN BY | CHECKED BY | APPROVED BY |
|---|---|---|---|---|---|
| R2 | 11.07.2019 | ISSUED FOR APROVAL | SBN | SBN | TSN |
| R1 | 27.06.2019 | ISSUED FOR APROVAL | SPK | SBN | TSN |

TECHNICAL SPECIFICATIONS

| | | | | | |
|---|---|---|---|---|---|
| CUSTOMER NAME | :- | OTOKLIN GLOBAL BUSINESS LTD. MUMBAI | | | |
| PO NO | :- | 008A / OC -983 / 18-19 | | | |
| OFFER NO. | :- | 8PMP / OFR / DP / 18-19 / 02 / 2137 / R2 | | | |
| LIQUID | :- | FECL3 | | | |
| PUMP TYPE | :- | PLUNGER TYPE PUMP | COUPLING TYPE | :- | FLEXIBLE SPIDER |
| PUMP MODEL | :- | PL3530 | QTY. | :- | 2 No. |
| PUMP WETTED PART MOC | :- | DUPLEX SS | | | |
| FLOW RATE | :- | 0-2000 LPH | | | |
| DISCHARGE PRESSURE | :- | 1 KG/CM2 | | | |
| STROKE RANGE | :- | 0-100% (MANUAL) | | | |
| MOTOR DESCRIPTION | :- | 1.5 HP,3Ph,415V±10%,50Hz±5%, 4-POLE,FOOT MOUNTED,STD TEFC, IP55,IE2,NON FLAME PROOF,S1 DUTY,DOL START. | | | |
| END CONNECTION | :- | 1*1/2" BSP (F) CONNECTION ON SUCTION SIDE & DISCHARGE SIDE. | | | |

Z FINAL | A ACCEPTED WITH COMMENTS | N NOT ACCEPTABLE | I FOR INFORMATION

**POSITIVE METERING PUMPS (I) PVT.LTD.**

PLOT NO. M8, AMBAD M.I.D.C., , NASIK

| | | | | |
|---|---|---|---|---|
| DRAWING TITLE :- | GA DRAWING | | | |
| DRAWING NO.:- | PMPIPL-GA-PL3530-IR9566-3 | SCALE | SHEET | REV. |
| | | NTS | 01 | R1 |

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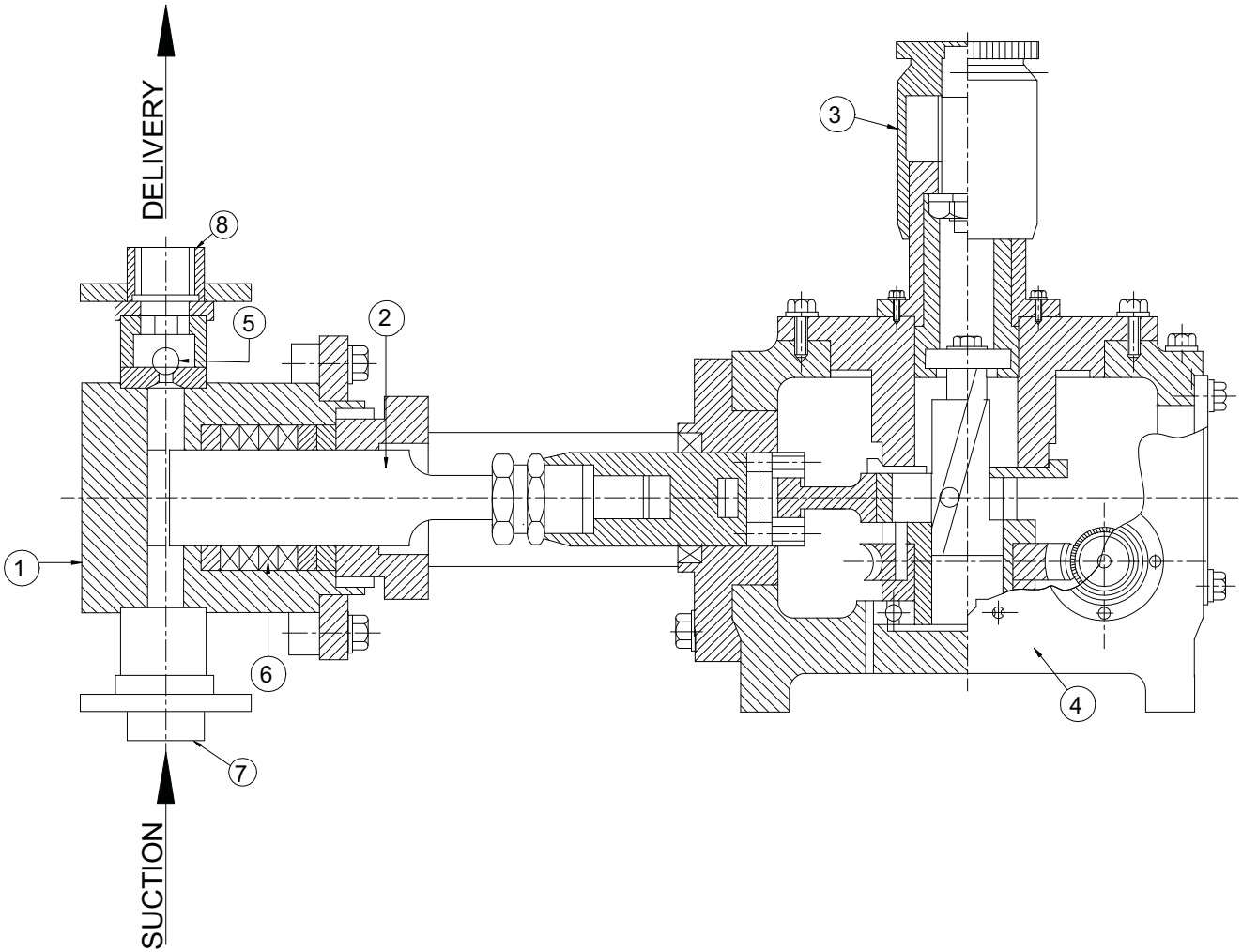
A3-420X297

| | | |
|---|---|---|
| 1. | LIQUID HEAD | DUPLEX SS |
| 2. | PLUNGER | DUPLEX SS |
| 3. | STROKE CONTROLLER | C.I. |
| 4. | HOUSING | C.I. |
| 5. | NRV | DUPLEX SS |
| 6. | GLAND PACKING. | PTFE |
| 7. | SUCTION Connection | DUPLEX SS |
| 8. | DISCHARGE Connection | DUPLEX SS |




TECHNICAL SPECIFICATIONS

| | | |
|---|---|---|
| CUSTOMER NAME | :- | OTOKLIN GLOBAL BUSINESS LTD. MUMBAI |
| PO NO | :- | 008A / OC –983 / 18–19 |
| OFFER NO. | :- | 8PMP / OFR / DP / 18–19 / 02 / 2137 / R2 |
| LIQUID | :- | FECL3 |

| REV | DATE | DESCRIPTION | DRAWN BY | CHECKED BY | APPROVED BY |
|---|---|---|---|---|---|
| R2 | 11.07.2019 | ISSUED FOR APROVAL | SBN | SBN | TSN |
| R1 | 27.06.2019 | ISSUED FOR APROVAL | SPK | SBN | TSN |

TECHNICAL SPECIFICATIONS

| | | |
|---|---|---|
| CUSTOMER NAME | :- | OTOKLIN GLOBLE BUSINESS LTD. MUMBAI |
| PO NO | :- | 008A / OC –983 / 18–19 |
| OFFER NO. | :- | 8PMP / OFR / DP / 18–19 / 02 / 2137 / R2 |
| LIQUID | :- | FECL3 |

Z FINAL | A ACCEPTED WITH COMMENTS | N NOT ACCEPTABLE | I FOR INFORMATION

**POSITIVE METERING PUMPS (I) PVT.LTD.**

PLOT NO. M8, AMBAD M.I.D.C., , NASIK

| | | | | |
|---|---|---|---|---|
| DRAWING TITLE :– | CS DRAWING | | | |
| DRAWING NO.:– | PMPIPL–CS–PL3530–IR9566–3 | SCALE | SHEET | REV. |
| | | NTS | 02 | R1 |

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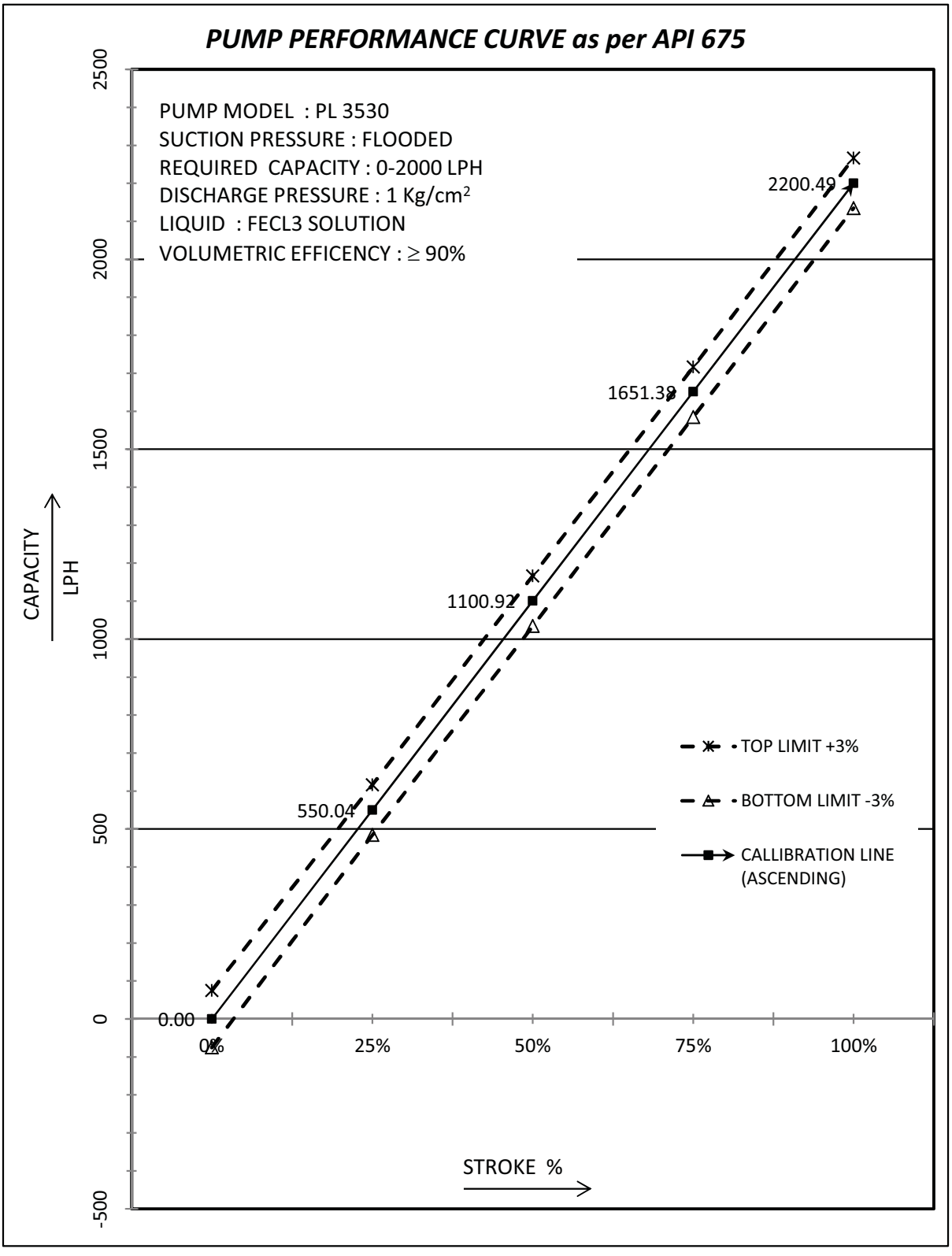
A3–420X297

# POSITIVE METERING PUMPS (I) PVT. LTD.

M-8, MIDC, AMBAD, NASIK - 422 010

Email : sales@positivemetering.com Web: www.positivemetering.com

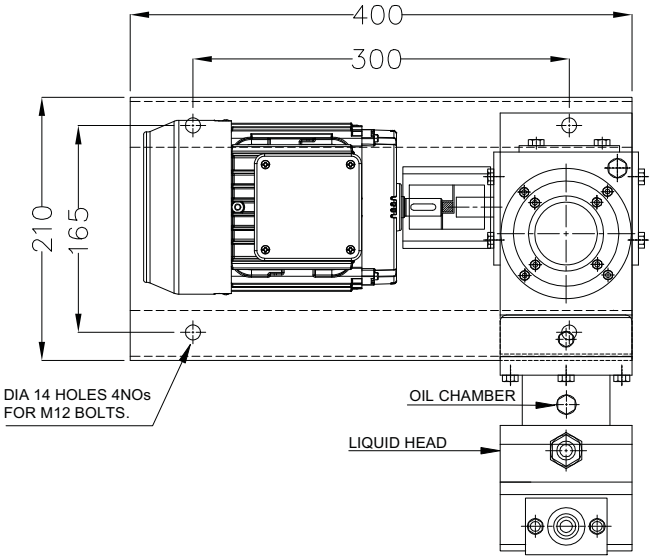

CUSTOMER : OTOKLIN GLOBAL BUSINESS LTD. MUMBAI
PROJECT NAME : BHEL

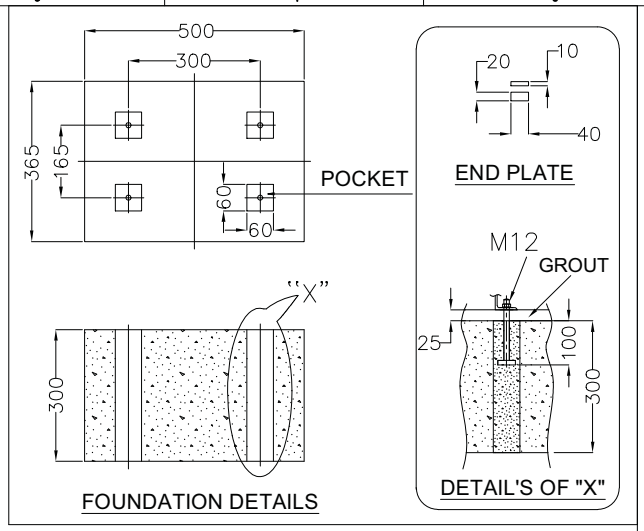


| ® OTOKLIN GLOBAL BUSINESS LIMITED | DATA SHEET OF NaOCl METERING PUMPS | | | |
|---|---|---|---|---|
| LOI NO: - PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018 | | PROJECT DOC NO:- PE-V0-412-158-A010 | | |
| CLIENT | **BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TDS/MP/PTP/18/308 | | Rev No:- 01 |
| PROJECT | 2X660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT | MADE BY FN | CHKD BY MI | APPD BY AA |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | | | |

| Sr. No. | Parameters | Description |
|---|---|---|
| **A** | **TECHNICAL SPECIFICATION** | |
| 1 | Quantity | 2 Nos. (1W+1S) |
| 2 | KKS TAG No. | 90GBN92AP001 & 90GBN92AP002 (R1) |
| 3 | Location# | First floor Chemical House Ref Drg No. PE-V0-412-158-A035 |
| 4 | Type | Diaphragm Type (Positive Displacement) |
| 5 | Application | NaOCl dosing to potable water system. (R1) |
| 6 | Rated capacity in LPH | 0-5 LPH (R1) |
| 7 | Total Head in 'm' | 10 m |
| 8 | RPM | 1500 |
| 9 | Recommended Motor/Engine HP | 0.5 |
| 10 | Discharge Pressure Kg/cm2 | 1.0 |
| 11 | Hydro test Pressure Kg/cm2 | 1.5 |
| **B** | **MATERIAL OF CONSTRUCTION** | |
| 1 | Liquid Head | PTFE |
| 2 | Diaphragm | PTFE |
| 3 | Valve seat / Cage | PTFE |
| 4 | Ball/Cone/Plate | TEFLON |
| 5 | Pressure Relief Valve | SS 316 |
| 6 | End Connection | ½ " BSP (FM) |
| 7 | Painting | As per approved painting specification |
| 8 | Make | Positive Metering Pumps(R1) |
| 9 | Model no | HD 1011/ SZ0 (R1) |
| **C** | **MOTOR DETAILS** | |
| 1 | Type | Pump Enclosed |
| 2 | Enclosure = TEFC | IP – 55/B-3 |
| 3 | Speed in RPM / HP | 1500 / 0.5 (R1) |
| 4 | Rated Voltage / Phase / Frequency | 415V / 3 / 50 HZ |
| 5 | Make /Model | ABB / 71 (R1) |

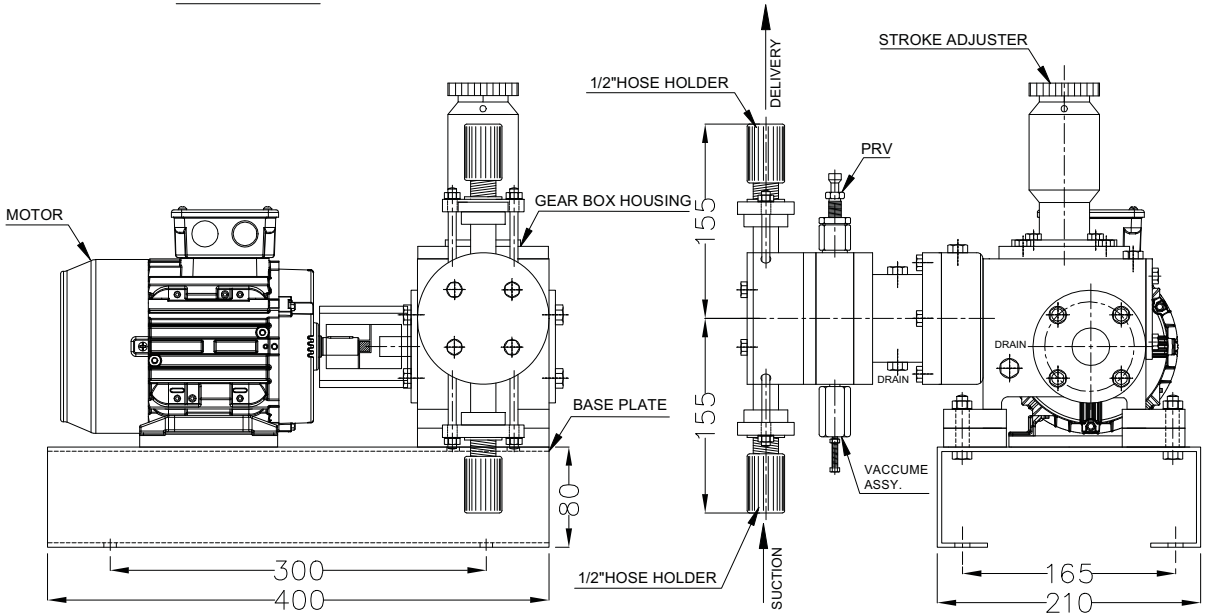
| REV NO : 01 | PREPARED BY: FN | CHKD. & APPD. BY: MI & AA | DATE: 12.07.2019 |
|---|---|---|---|




NOTE:
1.ALL DIMENSIONS ARE IN mm.
2.TOLERANCE FOR ALL DIMENSIONS ARE ±10mm
3.FOUNDATION BOLT SIZE M12mmX150mm

## TOP VIEW

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TECHNICAL SPECIFICATIONS

| | | | | |
|---|---|---|---|---|
| CUSTOMER NAME | :- | OTOKLIN GLOBAL BUSINESS LTD. MUMBAI | | |
| PO NO. | :- | 008A / OC –983 / 18–19 | | |
| OFFER NO. | :- | 8PMP / OFR / DP / 18–19 / 02 / 2137 / R2 | | |
| LIQUID | :- | NAOCL. | | |
| PUMP TYPE | :- | HYDRAULIC DIAPHGRAM | COUPLING | FLEXIBLE SPIDER |
| PUMP MODEL | :- | HD 1011/SZO | QTY. | 2 No. |
| PUMP WETTED PART MOC | :- | PTFE | | |
| FLOW RATE | :- | 0–5 LPH | | |
| DISCHARGEPRESSURE | :- | 1 KG/CM2 | | |
| STROKE RANGE | :- | 0–100% (MANUAL) | | |
| MOTOR DESCRIPTION | :- | 0.5 H.P.,3PHASE,415V±10%,50HZ±5%, 4–POLE,FOOT MOUNTED,STD TEFC,IP55,IE2,NON FLAME PROOF, S1 DUTY,DOL START. | | |
| END CONNECTION | :- | 1/2 " HOSE HOLDER END ON SUCTION & DISCHARGE SIDE. | | |

| Z | | A | | N | | I | |
|---|---|---|---|---|---|---|---|
| FINAL | | ACCEPTED WITH COMMENTS | | NOT ACCEPTABLE | | FOR INFORMATION | |

**POSITIVE METERING PUMPS (I) PVT.LTD.**

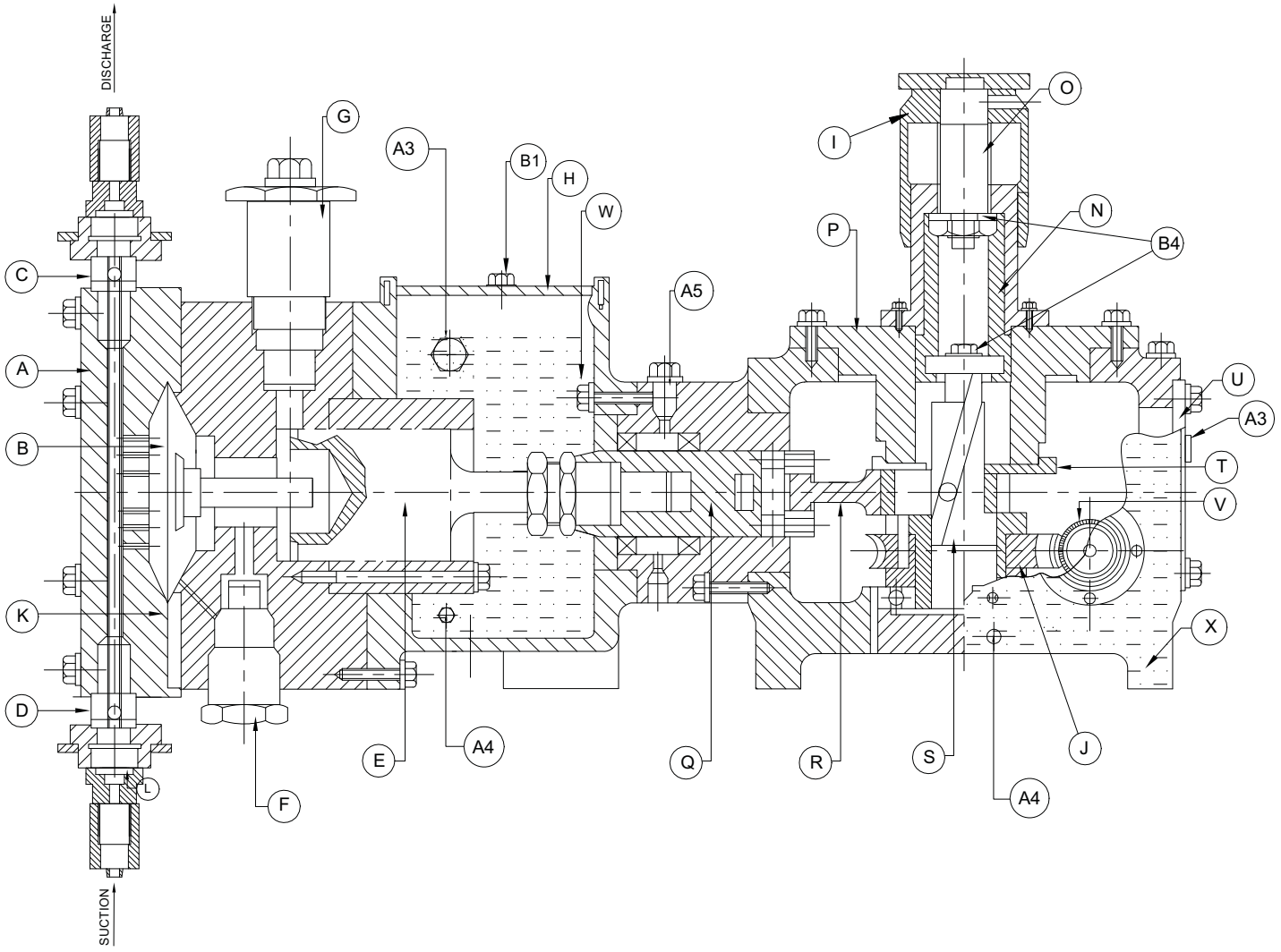
PLOT NO. M8, AMBAD M.I.D.C., , NASIK

| REV | DATE | DESCRIPTION | DRAWN BY | CHECKED BY | APPROVED BY |
|---|---|---|---|---|---|
| R2 | 11.07.19 | ISSUED FOR APPROVAL | SBN | SBN | TSN |
| R1 | 27.06.19 | ISSUED FOR APPROVAL | SPK | SBN | TSN |

| | | | | |
|---|---|---|---|---|
| DRAWING TITLE :- | GA DRAWING | | PUMP MODE:- HD1011_SZO_PP | |
| DRAWING NO.:- | PMPIPL-GA-HD1011-SZO-IR-9566-1 | SCALE | SHEET | REV. |
| PO NO.:- | 008A / OC –983 / 18–19 | NTS | 01 | R 1 |



A3–420X297




| Sr. No. | Description | MOC | Qty. |
|---|---|---|---|
| B4 | CIRCLIPE | EN8 | 01 No. |
| B1 | Oil Filler | -- | 01 No. |
| A5 | Breather Assembly | -- | 01 No. |
| A4 | Oil Drain Plug | -- | 02 Nos. |
| A3 | Oil Level Indicator | -- | 02 Nos. |
| X | OIL 460 Grade | --- | -- |
| W | OIL 20W40 | --- | -- |
| V | Worm Shaft | EN8 | 01 No. |
| U | Back Plate | PP | 01 No. |
| T | Thrust Plate | CI | 01 No. |
| S | Slider | MS | 01 No. |
| R | Ecc. Strap | CI | 01 No. |
| Q | Cross Head | EN8 | 01 No. |
| P | Top Cover | CI | 01 No. |
| O | SL.SCREW | EN8 | 01 No. |
| N | Sl. Guide | MS | 01 No. |
| L/M | End Conne. Suction & Dis. | PTFE | 01 No. Each |
| K | Center Ring | MS | 01 No. |
| J | Worm Wheel | PB 2 | 01 No. |
| I | Stroke Adju. | CI | 01 No. |
| H | Oil Chember | CI | 01 No. |
| G | Inbuilt Pre. Safety Valve | EN8 | 01 No. |
| F | Vaccume Assl. | EN8 | 01 No. |
| E | Plunger | EN8 | 01 No. |
| D | Non Return Valve (Suc.) | PTFE | 01Set |
| C | Non Return Valve (Dis.) | PTFE | 01Set |
| B | Oil Side Diaphragm | PTFE | 01 No. |
| A. | Liquid Head | PTFE | 01 No. |

| TECHNICAL SPECIFICATIONS | | |
|---|---|---|
| CUSTOMER NAME | :- | OTOKLIN GLOBAL BUSINESS LTD. MUMBAI |
| PO NO. | :- | 008A / OC -983 / 18-19 |
| OFFER NO. | :- | 8PMP / OFR / DP / 18-19 / 02 / 2137 / R2 |
| LIQUID | :- | NAOCL. |

| REV | DATE | DESCRIPTION | DRAWN BY | CHECKED BY | APPROVED BY |
|---|---|---|---|---|---|
| R2 | 11.07.19 | ISSUED FOR APPROVAL | SBN | SBN | TSN |
| R1 | 27.06.19 | ISSUED FOR APPROVAL | SPK | SBN | TSN |

Z FINAL | A ACCEPTED WITH COMMENTS | N NOT ACCEPTABLE | I FOR INFORMATION

**POSITIVE METERING PUMPS (I) PVT.LTD.**

PLOT NO. M8, AMBAD M.I.D.C., , NASIK

| | | | |
|---|---|---|---|
| DRAWING TITLE :- | CS DRAWING | PUMP MODE:- HD1011_SZO_PP | |
| DRAWING NO.:- | PMPIPL-CS-HD1011-SZO-IR-9566-1 | SCALE | SHEET / REV. |
| PO NO.:- | 008A / OC -983 / 18-19 | NTS | 02 / R1 |

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A3-420X297

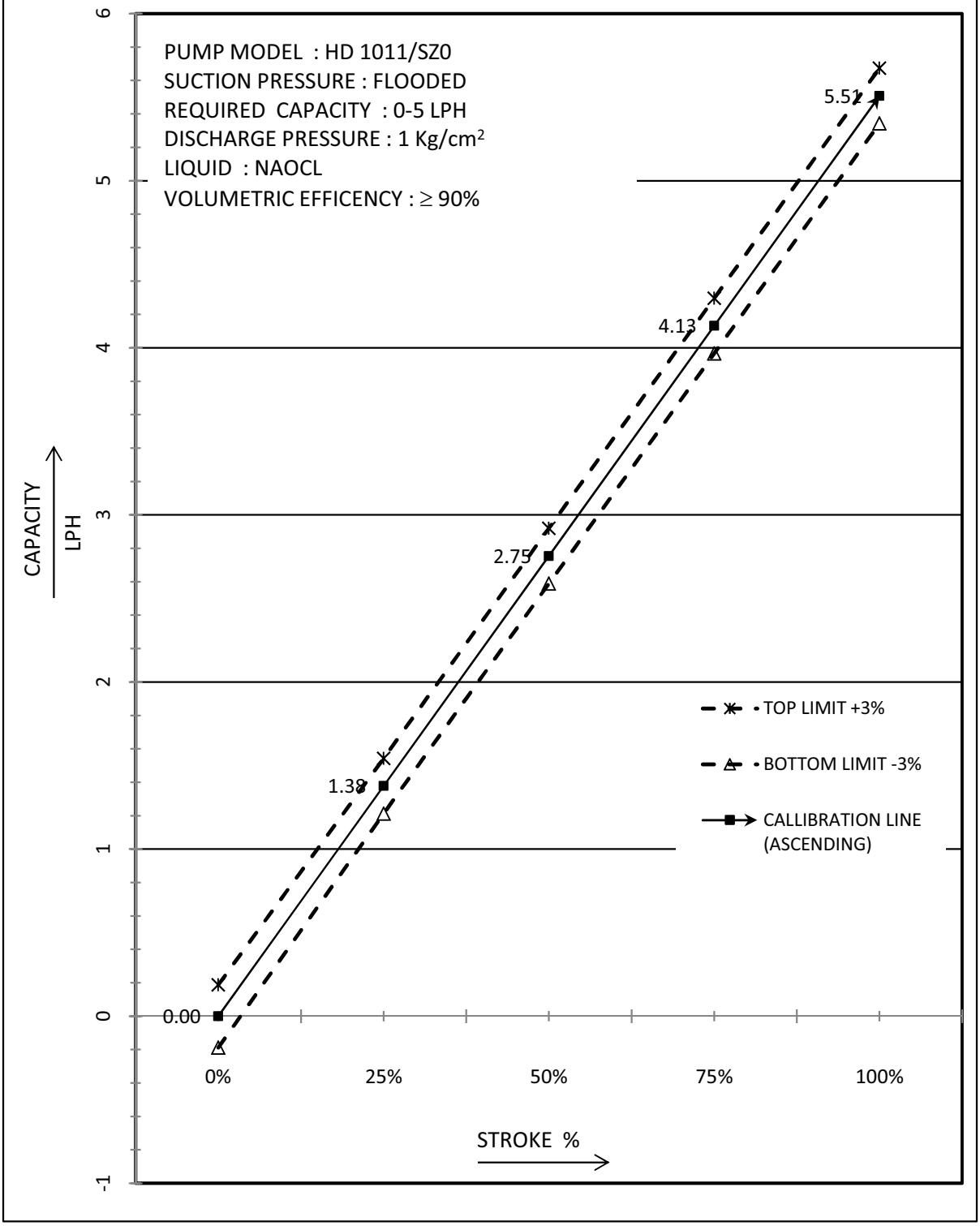
# POSITIVE METERING PUMPS (I) PVT. LTD.

M-8, MIDC, AMBAD, NASIK - 422 010

Email : sales@positivemetering.com Web: www.positivemetering.com


CUSTOMER : OTOKLIN GLOBAL BUSINESS LTD. MUMBAI
PROJECT NAME : BHEL

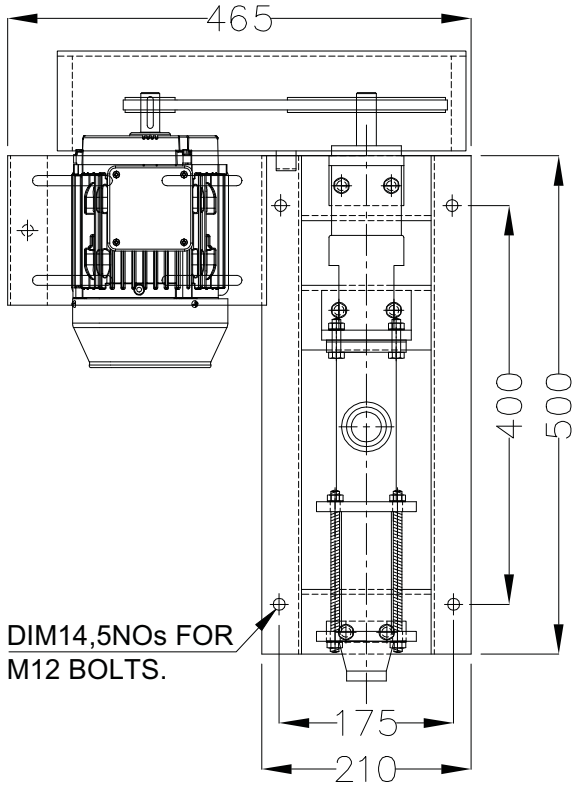
## *PUMP PERFORMANCE CURVE as per API 675*



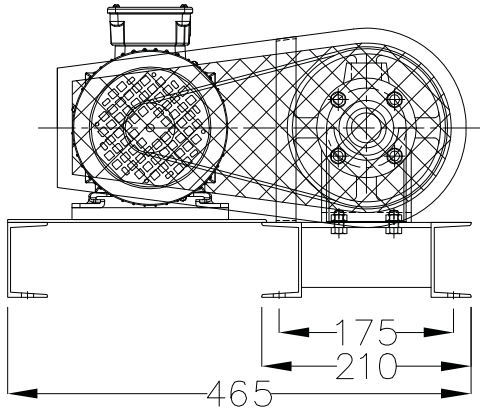
| ® OTOKLIN GLOBAL BUSINESS LIMITED | DATA SHEET OF LIME METERING PUMPS | | | |
|---|---|---|---|---|
| LOI NO: - PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018 | | PROJECT DOC NO:- PE-V0-412-158-A010 | | |
| CLIENT | **BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TDS/MP/PTP/18/308 | | Rev No:- 01 |
| PROJECT | 2X660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT | MADE BY FN | CHKD BY MI | APPD BY AA |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | | | |

| Sr. No. | Parameters | Description |
|---|---|---|
| **A** | **TECHNICAL SPECIFICATION** | |
| 1 | Quantity | 2 Nos. (1W+1S) |
| 2 | KKS TAG No. | 90GBN73AP001 & 90GBN73AP002 (R1) |
| 3 | Location# | First floor Chemical House Ref Drg. No. PE-V0-412-158-A035 |
| 4 | Type | Screw type. (Positive displacement) |
| 5 | Application | Lime dosing to Flash Mixer(R1) |
| 5 | Rated capacity in LPH | 0-1000 LPH |
| 6 | Total Head in 'm' | 10 m |
| 7 | RPM | 350-400 after belt and pulley arrangement(R1) |
| 8 | Recommended Motor/Engine HP | 1 (R1) |
| 9 | Discharge Pressure Kg/cm2 | 1.0 |
| 10 | Hydro test Pressure Kg/cm2 | 1.5 |
| **B** | **MATERIAL OF CONSTRUCTION** | |
| 1 | Stator | Neoprene (R1) |
| 2 | Rotor | SS316 (R1) |
| 3 | Sealing Arrangement | PTFE Gland Packing (R1) |
| 5 | Pressure Relief Valve | SS 316 |
| 6 | End Connection | 1 ” BSP (FM) |
| 7 | Painting | As per approved painting specification |
| 8 | Make | Positive Metering Pumps(R1) |
| 9 | Model no | Sc-20 (R1) |
| **C** | **MOTOR DETAILS** | |
| 1 | Type | Pump Enclosed |
| 2 | Enclosure = TEFC | IP – 55/B-3 |
| 3 | Speed in RPM / HP | 1500 / 1 (R1) |
| 4 | Rated Voltage / Phase / Frequency | 415V / 3 / 50 HZ |
| 5 | Make/Model | ABB / 80 (R1) |

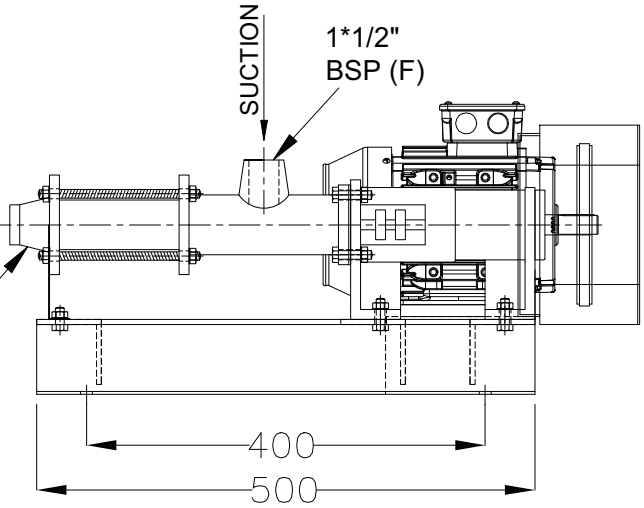
| REV NO : 01 | PREPARED BY: FN | CHKD. & APPD. BY: MI & AA | DATE: 12.07.2019 |
|---|---|---|---|



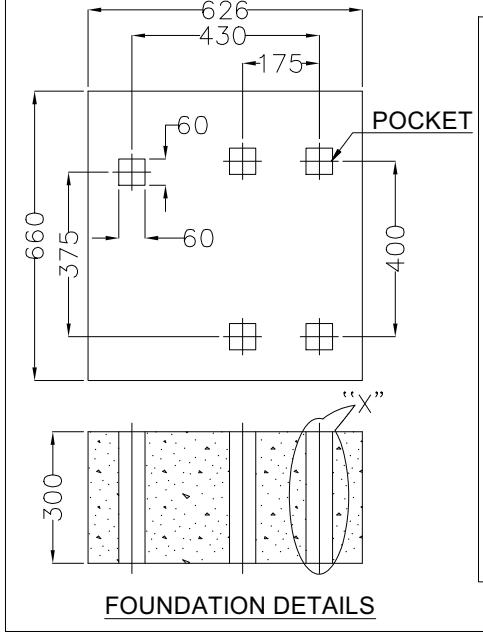

**TOP VIEW**



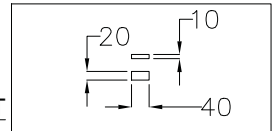

**SIDE VIEW**



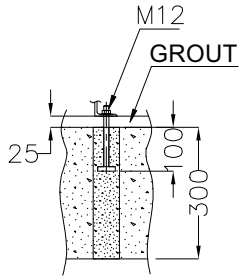

**FRONT VIEW**




FOUNDATION DETAILS




END PLATE




DETAIL'S OF "X"

NOTE:
1.ALL DIMENSIONS ARE IN mm.
2.TOLERANCE FOR ALL DIMENSIONS ARE ±10mm
3.FOUNDATION BOLT SIZE M12mmX150mm

TECHNICAL SPECIFICATIONS

| | | | | | |
|---|---|---|---|---|---|
| CUSTOMER NAME | :- | OTOKLIN GLOBAL BUSINESS LTD.MUMBAI | | | |
| PO NO. | :- | 008A / OC -983 / 18-19 | | | |
| OFFER NO. | :- | 8PMP / OFR / DP / 18-19 / 02 / 2137 /R2 | | | |
| LIQUID | :- | LIME SOLUTION | | | |
| PUMP MODEL | :- | SC 20 | | | |
| MOC | :- | | PUMP TYPE | :- | PROGRESSIVE CAVITY SCREW TYPE |
| STATOR | :- | NEOPRENE | | | |
| ROTOR | :- | SS316 | CAPACITY | :- | 1000 LPH |
| DRIVE TYPE | :- | BELT PULLEY | PRESSURE | :- | 1 KG/CM$^2$ |
| MOTOR DESCRIPTION | :- | 1. H.P.,3PHASE,415V±10%, 50HZ±5%, 4-POLE, FOOT MOUNTED, STD,TEFC,IP55, IE2,NON FLAME PROOF, S1 DUTY, DOL START. | | | |
| END CONNECTION | :- | 1" BSP(F).ON SUCTION & DISCHARGE SIDE. | | | |
| QTY. | :- | 02 No. | | | |

| Z | A | N | I |
|---|---|---|---|
| FINAL | ACCEPTED WITH COMMENTS | NOT ACCEPTABLE | FOR INFORMATION |

**POSITIVE METERING PUMPS (I) PVT.LTD.**

PLOT NO. M8, AMBAD M.I.D.C., , NASIK

| REV | DATE | DESCRIPTION | DRAWN BY | CHECKED BY | APPROVED BY |
|---|---|---|---|---|---|
| R2 | 11.07.19 | ISSUE FOR APPROVAL | SBN | SBN | TSN |
| R1 | 27.06.19 | ISSUE FOR APPROVAL | SPK | SBN | TSN |

DRAWING TITLE :- GA DRAWING — MODEL NO:- SC20

DRAWING NO.:- PMPIPL-GA-SC-20-IR-9566-4 — SCALE: NTS — SHEET: 1 — REV.: R1

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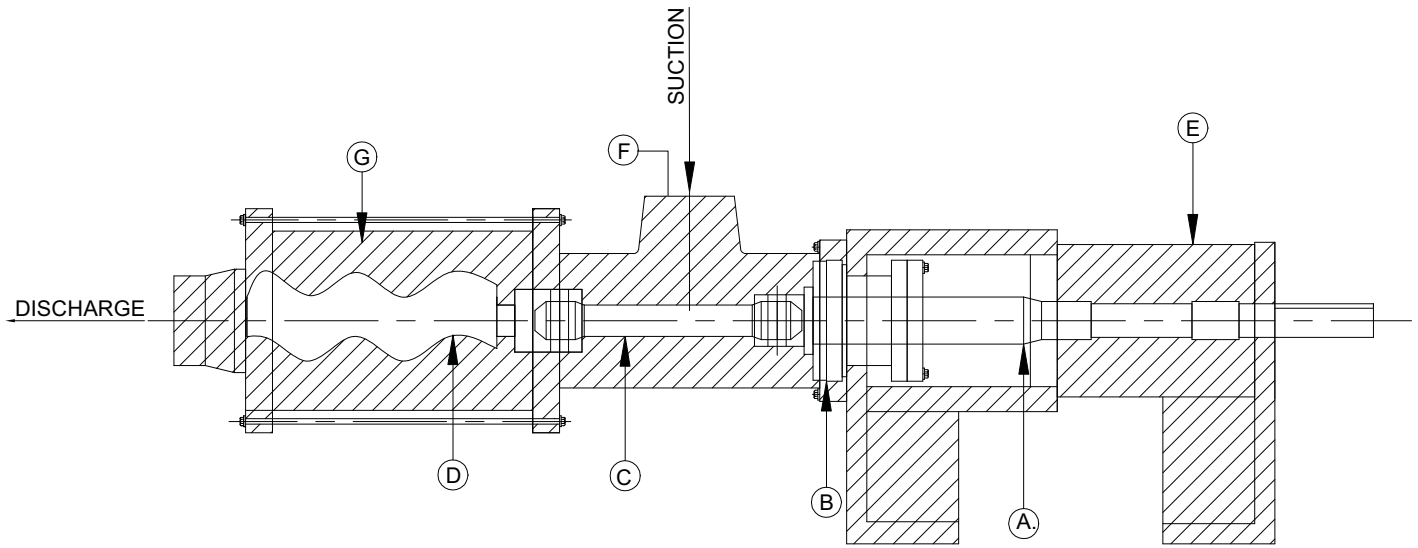
A3–420X297

| Sr. No. | DESCRIPTION | MOC | Qty. |
|---|---|---|---|
| G. | STATOR | NITRILE / NEOPRENE | 02 No. |
| F. | SUC. PIPE | SS316 / CF8M | 02 No. |
| E. | HOUSING | CAST IRON | 02 No. |
| D. | SCREW | SS316 / CF8M | 02 SET |
| C. | CONNECTING ROD | SS316 / CF8M | 02 SET |
| B. | STUFFING BOX | SS316 / CF8M | 02 No. |
| A. | SHAFT | SS316 / CF8M | 02 No. |




TECHNICAL SPECIFICATIONS

| | | |
|---|---|---|
| CUSTOMER NAME | :- | OTOKLIN GLOBAL BUSINESS LTD.MUMBAI |
| PO NO. | :- | 008A /OC -983 / 18-19 |
| OFFER NO. | :- | 8PMP / OFR / DP / 18-19 / 02 / 2137 /R2 |
| LIQUID | :- | LIME SOLUTION |

Z FINAL | A ACCEPTED WITH COMMENTS | N NOT ACCEPTABLE | I FOR INFORMATION

**POSITIVE METERING PUMPS (I) PVT.LTD.**

PLOT NO. M8, AMBAD M.I.D.C., , NASIK

| REV | DATE | DESCRIPTION | DRAWN BY | CHECKED BY | APPROVED BY |
|---|---|---|---|---|---|
| R2 | 11.07.19 | ISSUE FOR APPROVAL | SBN | SBN | TSN |
| R1 | 27.06.19 | ISSUE FOR APPROVAL | SPK | SBN | TSN |

DRAWING TITLE :- CS DRAWING — MODEL NO:- SC2

DRAWING NO.:- PMPIPL-CS-SC-20-IR-9566-4 — SCALE: NTS — SHEET: 2 — REV.: R1

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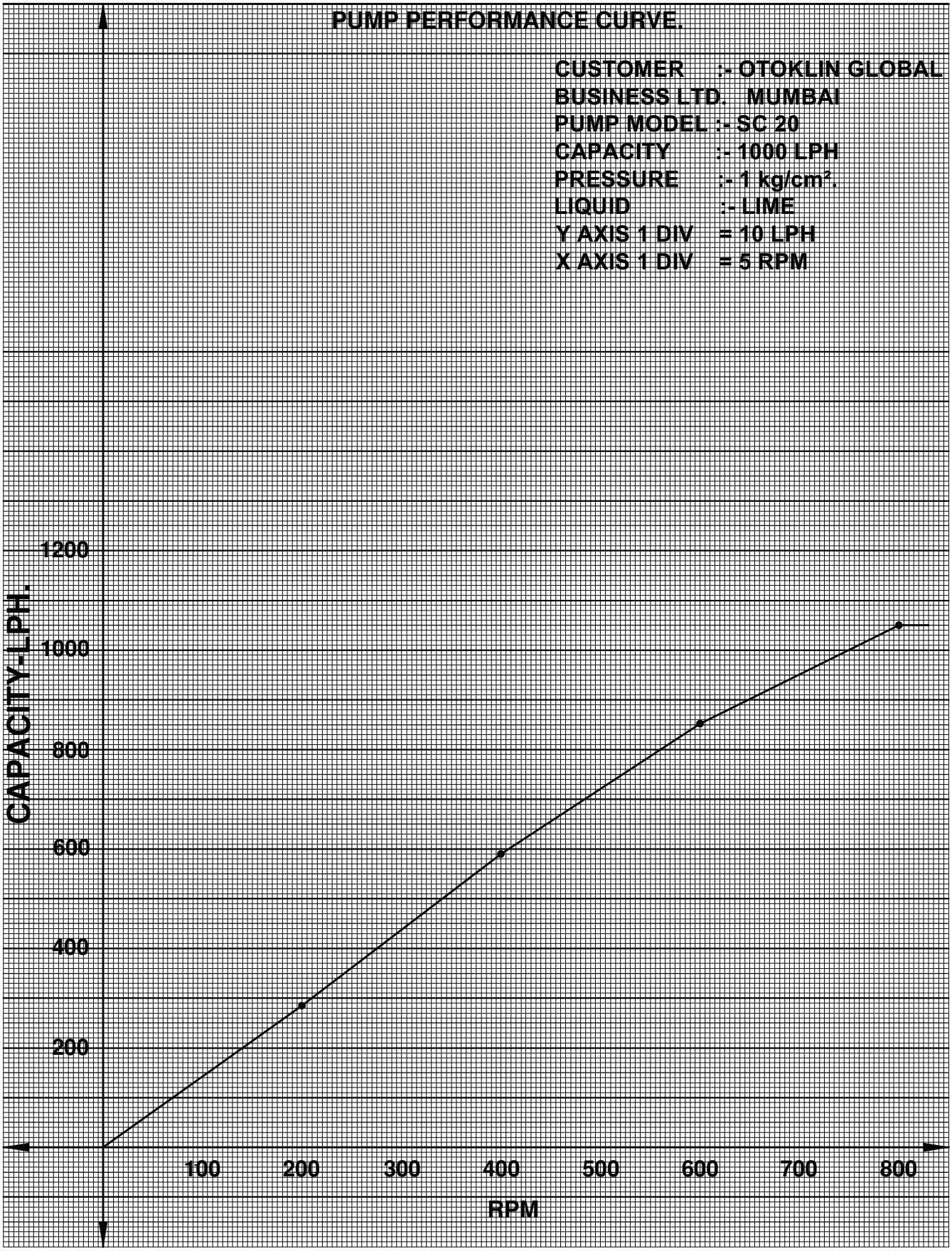
A3–420X297

**POSITIVE METERING PUMP (I) PVT LTD.**

**M-8 MIDC AMBAD ,NASHIK-424010**

**PH-0253-2381993,2381994(FAX-0253-5601441)**

**Email-sales@positivemetering.com Web-www.positivemetering.com**



FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

# BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

QAP FOR METERING PUMPS WITH MOTOR OF PRE TREATMENT PLANT

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | ALOYSIUS | AF | 18-07-19 |
| CHKD | MUAZZAM I | MI | 18-07-19 |
| APPD | ASLAM A | AA | 18-07-19 |

| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. PE-V0-412-158-A011 | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/QAP/MP/PTP/18/349 | 01 |
| DATE | | | | | | | | NO. OF SHEETS 1 EXCLUDING COVER PAGE | |

| OTOKLIN GLOBAL BUSINESS LIMITED | OTOKLIN GLOBAL BUSINESS LIMITED<br>R-02 Remi Bizcourt, Off Veera Desai Road, Andheri West,<br>Mumbai 400 053, India | **MANUFACTURING QUALITY PLAN**<br>**ITEM: METERING PUMP WITH MOTOR**<br>**SUB-SYSTEM: PRETREATMENT PLANT** | **QP NO.: PE-V0-412-158-A011**<br>**REV.NO.: 01**<br>**DATE: 18-07-2019**<br>**PAGE: 1 OF 1** | PROJECT: 2X660 MW ENNORE SEZ STPP AT ASH DYKE OF NCTPS<br>PACKAGE: PRETREATMENT PLANT<br>CONTRACT NO.: 412<br>MAIN-SUPPLIER: BHEL<br>SUB- CONTRACTOR:- OTOKLIN |
|---|---|---|---|---|

| S.NO | COMPONENT & OPERATIONS | CHARACTERISTICS CHECKED | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | M | C | N | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D | 10 | | | 11 |
| [1] | **RAW MATERIAL AND BOUGHT OUT COMPONENTS** | | | | | | | | | | | | |
| 1 | Raw Material (Wetted Parts: Liquid Head, NRV, Plunger & Diaphragm.) | Chemical / Physical Properties | Major | Chemical and Mechanical test | One/Batch | Approved Drawing. /Documents | Approved Drawing. / Documents | Mfg. Insp. Report. MFG. TC | ✓ | P | R | R | For Plastic/ Rubber/pp/ptfe non metallic MTC will be provided |
| | (for Disp. Chamber Housing, worm gear) | Physical properties | | Tesile Strength | One/Batch | Approved Drawing. /Documents | Approved Drawing. / Documents | Mfg. Insp. Report. MFG. TC | ✓ | P | R | R | |
| [2] | **FINAL INSPECTION** | | | | | | | | | | | | |
| 2.1 | Pump | Overall Dimension | Major | Measure | One/Model | DO | DO | IR/TC | ✓ | P | W | W | |
| 2.2 | Performance of pump with Shop / Job motors. | Performance test for pressure, capacity, noise , stroke, power etc.. | Critical | At Stroke 100%,75%,50%,25% & (Vice Versa) | One/Model | DO | DO | PTR | ✓ | P | W | W | Mfgr. Internal test will be conducted 100% |
| | | | | a) Rated capacity<br>b) Linearity ±3%<br>c) Repeatability ±3%<br>d) Steady state accuracy ± 1% | | | | | | | | | |
| | | No Leakage & No Pressure drop | | Hydro test | One/Model | DO | 1.5 times max. allowable operating pressure | PTR | ✓ | P | W | W | Hydrotest hold time 30 mins |
| 2.3 | Motor | Manufactures Test Certificate | Major | Motor routine test | 100% | DO | Approved Drawing. / Documents | MFG. TC | ✓ | P | W | W | |
| 2.4 | Painting | Surface Preparation | Major | Visual & DFT | 100% | As per std. | As per Appd Doc i.e painting specs | IR | ✓ | P | R | R | Compliance Report |
| 2.5 | Packing | | | | | | | | | P | R | R | Compliance Report |

OTOKLIN GLOBAL BUSINESS LTD. MUMBAI

**LEGEND:**
* RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** M: FOR SUB VENDOR OF OTOKLIN. — P - Performing the Test

C: FOR VENDOR (OTOKLIN). — W - Witnessing the Test

N: FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) / TANGEDCO — R - Review the Test

| MANUFACTURER / SUBCONTRACTOR | CONTRACTOR |
|---|---|
| SIGNATURE | |

| PROJECT: 1X660MW ENNORE SEZ SSCTPP AT ASH DYKE OF NCTPS, CHENNAI | | | Package: Pre Treatment Plant | | |
|---|---|---|---|---|---|
| Document Title: TDS of Blowers of PT Plant | | | | | |
| Drawing/Document No. PE-V0-412-158-A012 | | | | | |
| Sr. No. | TANGEDCO comments | Reply | TANGEDCO comments dated 08.10.18 | OTOKLIN / BHEL reply | |
| 1 | Shaft MOC shall be EN 8 in line with DBR, Revise accordingly | Kindly note that shaft MOC offered is EN 19 which is better grade than EN 8 for longevity of blower as shown by the specifications/ material properties, attached in R1. Please accept EN19, being better material as compared to EN8 | Noted. | - | |
| 2 | - | - | BHEL to incorporate the package name in the document title. | Noted and incorporated | |
| 3 | - | - | BHEL to incorporate the make & model. | Noted and incorporated | |
| 4 | - | - | BHEL to submit the blower GADs & curves. | Noted and incorporated | |

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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

PACKAGE NAME: PRE-TREATMENT PLANT

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

TECHNICAL DATA SHEET FOR BLOWERS

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | AQEEL K | AK | 25-06-19 |
| CHKD | MUAZZAM I | MI | 25-06-19 |
| APPD | ASLAM A | AA | 25-06-19 |

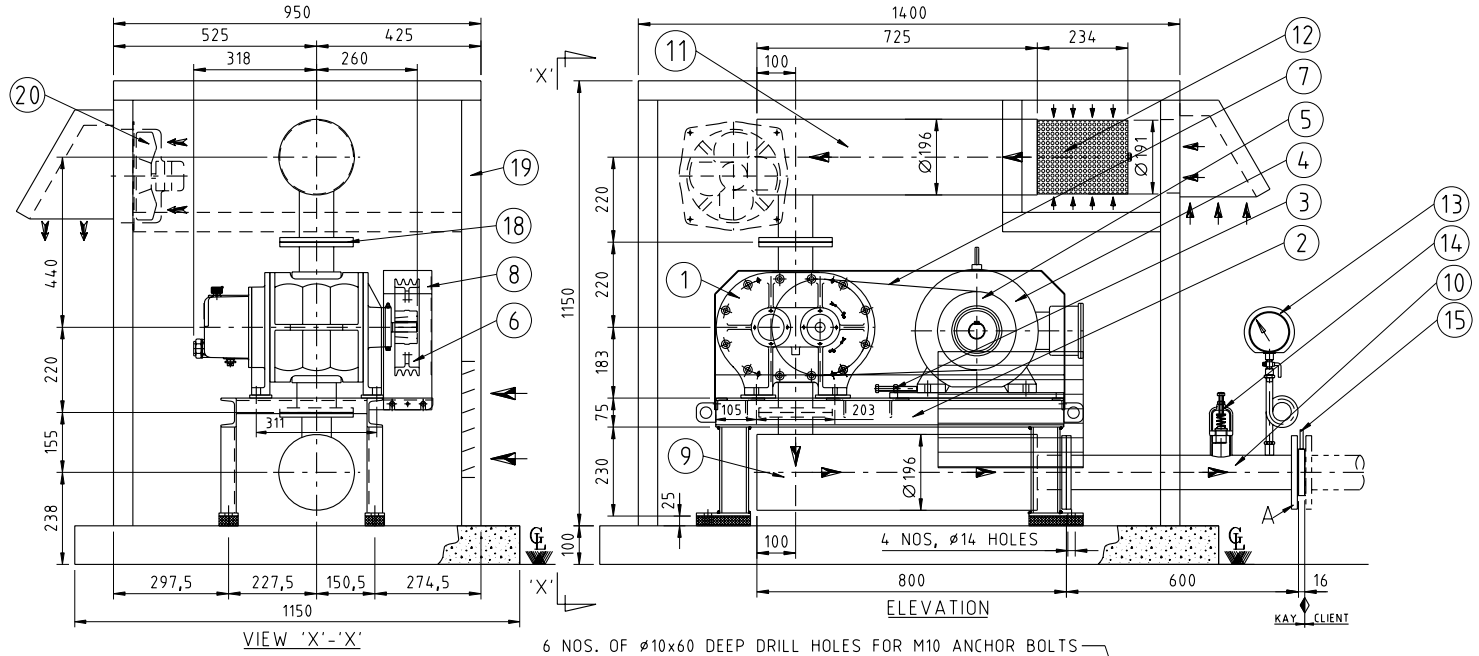
BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

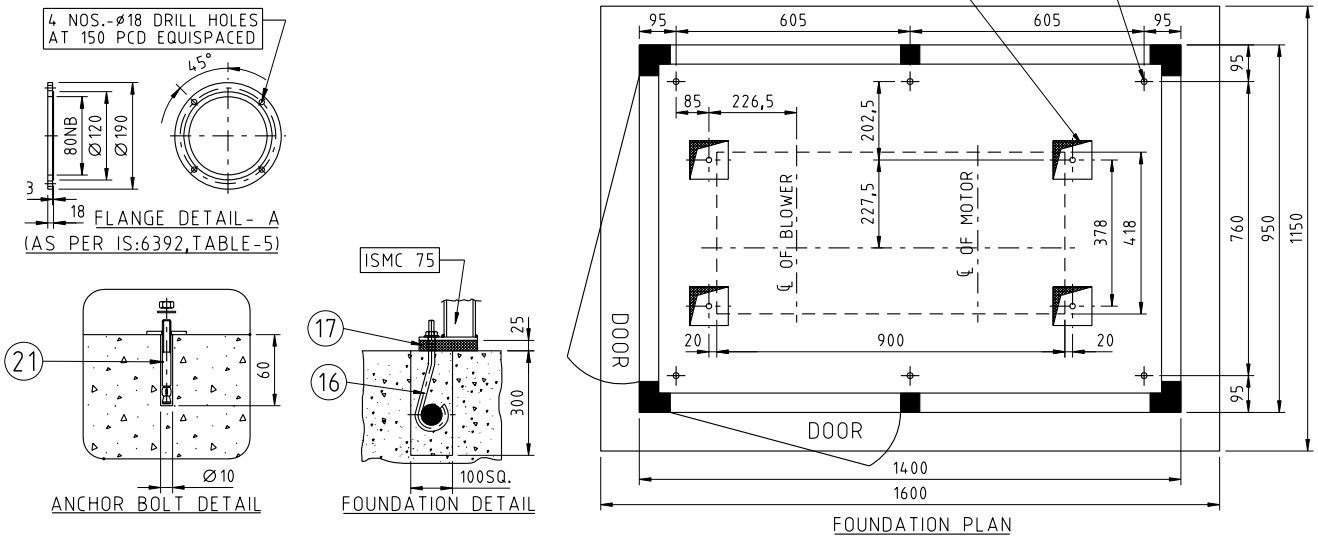
| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. PE-V0-412-158-A012 | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/TDS/B/PTP/18/309 | 2 |
| DATE | | | | | | | | NO. OF SHEETS 3 EXCLUDING COVER PAGE | |

| OTOKLIN GLOBAL BUSINESS LIMITED | DATA SHEET OF AIR BLOWER | | | |
|---|---|---|---|---|
| LOA NO: - PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018 | | PROJECT DOC NO:- PE-V0-412-158-A012 | | REV.: 02 |
| CLIENT | **BHARAT HEAVY ELECTRICALS LMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TD/SB/PTP/18/309 | | |
| PROJECT | **2X660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT** | MADE BY AK | CHKD BY MI | APPD BY AA |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | | | |

| **A** | **TECHNICAL SPECIFICATIONS** | |
|---|---|---|
| 1 | TYPE | Rotary Twin Lobe Blower |
| 2 | QTY | 2 (1W+1S) Sludge sump & Sludge transfer pumps sump |
| 3 | CAPACITY | 300 Nm3/Hr |
| 4 | DISCHARGE PRESSURE | 0.4 KG/CM2 |
| 5 | MOTOR SPEED(RPM) | 1500 |
| 6 | FLUID TO BE HANDLED | AIR |
| 7 | APPLICATION | SLUDGE MIXING |
| 8 | BHP AT DUTY POINT | 7.41 BHP |
| 9 | DRIVE MOTOR | 10 HP |
| 10 | DRIVE | V BELT DRIVEN |
| 11 | PULLEY AND BEARING | GREASE PACKED |
| **B** | **MATERIAL OF CONSTRUCTION** | |
| 1 | CASING | CI Gr. FG 260: IS: 210 |
| 2 | SHAFT | EN19 (BS970:1955) |
| 3 | BASE FRAME | MS FABRICATED |
| 4 | SIDE PLATE AND ROTOR | CI Gr. FG 260: IS: 210 |
| 5 | BEARING | ANTI-FRICTION |
| 6 | SEAL | LIP SEALS |
| 7 | PAINTING | AS PER APPROVED PAINTING SPECIFICATIONS |
| 8 | MAKE | Kay International Private Limited |

| PREPARED BY:AK | CHKD. & APPD. BY: AA | DATE: 11/09/2018 | SHEET NO:- 1 OF 1 |
|---|---|---|---|




| Sl. No. | DESCRIPTION | QTY. | MAKE | SCOPE OF SUPPLY | SIZE |
|---|---|---|---|---|---|
| 1. | T.L. BLOWER | 01 | KAY | KAY | 59AC |
| 2. | COMMON BASE FRAME | 01 | KAY | KAY | --- |
| 3. | MOTOR SLIDE RAIL | 02 | KAY | KAY | --- |
| 4. | MOTOR TEFC STD SQ CAGE ELECT. IND. IE2 MOTOR CONFIRMING TO PROTECTION IP:55, SUITABLE FOR OPERATION ON 415+/-10%V, 50+/-5%Hz, 3 PHASE AC SUPPLY, WITH CLASS 'F' INSULATION & TEMP. RISE LIMITED TO CLASS 'B', MOUNTING-B3, AMBIENT 45°C | 01 | (CGL/ABB/KIRLOSKAR/SIEMENS/BBL | KAY | ND132M |
| 5. | MOTOR PULLEY | 01 | TRANSINDIA/EQUI. | KAY | 6.5"x3B |
| 6. | BLOWER PULLEY | 01 | TRANSINDIA/EQUI. | KAY | 10"x3B |
| 7. | V-BELT | 1 SET | HINDALCO/TURBOFLEX/EQUI. | KAY | B-56 |
| 8. | V-BELT GUARD | 01 | KAY | KAY | --- |
| 9. | DISCHARGE SILENCER | 01 | KAY | KAY | 80 NB |
| 10. | INTERCONNECTING PIPE LINE | 01 | KAY | KAY | 80 NB |
| 11. | SUCTION SILENCER | 01 | KAY | KAY | 80 NB |
| 12. | SUCTION FILTER | 01 | ABSOLUTE/EQUI. | KAY | HO-10 |
| 13. | PRESSURE GAUGE WITH ISOLATION VALVE & SYPHON | 01 | AKVALO | KAY | RANGE 0-1 Kg./cm2 |
| 14. | SAFETY VALVE (SPRING LOADED TYPE) | 01 | KAY | KAY | SIZE-1.5" |
| 15. | NON RETURN VALVE | 01 | KAY | KAY | 80 NB |
| 16. | FOUNDATION BOLT | 04 | --- | KAY | M12x250 lg. |
| 17. | ANTI-VIBRATION PAD | 04 | BRIGHT/EQUI. | KAY | 5"x2.5"x1" |
| 18. | GASKET | 1 SET | --- | KAY | --- |
| 19. | ACOUSTIC HOOD | 01 | --- | KAY | --- |
| 20. | EXHAUST FAN | 01 | MARATHON/EQUI. | KAY | 9" |
| 21. | ANCHOR BOLTS WITH NUTS | 06 | --- | KAY | M10x75LG. |
| -- | ALL FIXING BOLTS & NUTS | 1 SET | --- | KAY | --- |

| STATIC LOAD | | | |
|---|---|---|---|
| BARE SHAFT WT. | ACCESSORIES WT. | MOTOR WT. | TOTAL WT. |
| 110 KG. | 105 KG. | 79 KG. | 294 KG. |

CLIENT:- M/s. OTOKLIN GLOBAL BUSINESS LTD.

ORDER SHEET NO.:- KI-49682

NOTE :-
1. QUANTITY MENTIONED FOR ONE BLOWER ONLY.
2. MOTOR SHOULD HAVE SIDE MOUNTED TERMINAL BOX.
3. MOTOR PULLEY WILL BE SUPPLIED WITH FINISH BORE.
4. 480 ml SP-320 INDIAN OIL & 60 gm CASTROL AP-3 GREASE IS USED AS LUBRICANT.
5. DISTANCE PIECE OF 150mm LENGTH SHOULD BE ADDED AFTER NRV, IF CLIENT DESIRE TO ADD EXPANSION BELLOW IN DISCHARGE LINE.
6. CLIENT MUST SUPPORT THE DISCHARGE PIPELINE AT 300 mm FROM SS EXPANSION BELLOW.
7. CLIENT IF DESIRE TO ADD BEND IN DISCHARGE LINE, IT CAN BE ADDED AFTER 1000mm DISTANCE FROM EXPANSION BELLOW.
8. NOISE LEVEL AT 1.8 M DISTANCE FROM EQUIPMENT WITH ACOUSTIC HOOD, WHEN CONNECTED TO THE SYSTEM AT SITE, WILL BE 72-78 dBA.
9. EXHAUST FAN DETAIL:

| SWEEP DIA. (mm) | PHASE | SPEED (RPM) | VOLTAGE (V) | INPUT (W) | CURRENT (AMPS) | FREE AIR FLOW (m3/hr.) |
|---|---|---|---|---|---|---|
| 230 | SINGLE | 1400 | 230 | 60 | 0.2 | 435 |

DESIGN PARAMETERS OF BLOWER

| | |
|---|---|
| CAPACITY :-------- | 345 M3/HR. (300 NM3/HR.) |
| DIFF. PRESS :----- | 4000 MMWG |
| R.P.M. :---------- | 927 |
| B.H.P. :---------- | 7.71 |
| QUANTITY :------- | 02 NOS. |

MOTOR DATA

| | |
|---|---|
| MAKE :---------- | CGL/ABB/KIRLOSKAR/SIEMENS/BBL |
| FRAME SIZE :----- | ND132M (IE2) |
| R.P.M. :---------- | 1440 |
| H.P./K.W.:----- | 10/7.5 |
| NET WEIGHT :----- | 79 KG. |

| S.NO. | DESCRIPTION | MATERIAL |
|---|---|---|
| 3 | STATIC LOAD = 294 Kg. APPROX. WITH ALL ACCESSORIES INCLUDING MOTOR | |
| 2 | DYNAMIC LOAD = 1.5 x STATIC LOAD | |
| 1 | GD SQ. VALUE = 0.118 Kg m2 | |
| f | BEARING | SKF/FAG/TIMKEN |
| e | FABRICATED ITEMS | M.S./IS:2062 |
| d | GEAR (CASE HARDENED & GROUND) | EN-353, BS:970 |
| c | SHAFT | (EN-19) 709 M40, BS:970⚠ |
| b | LOBE | CIFG-260,IS:210 |
| a | CASING | CIFG-260,IS:210 |

| SYM. | DESCRIPTION OF REVISION | SIGN. | CHD. | APPD. | DATE |
|---|---|---|---|---|---|
| ⚠ | INCORPORATED CLIENT'S COMMENTS | SHAMSHER | | | 2\06\19 |

DRN. SHAMSHER 10.06.19
CHD.
APPD.
SCALE : N.T.S.
MATL. ---
All dimensions are in mm. unless otherwise shown on drawing.

KAY PRECISION PERFECTION PRIDE
Plot No. 64, Phase-5, Sector-53, HSIIDC, Kundli Industrial Area, Dist. Sonepat (Haryana) -131 028
Phones: +91-130-4091061, 4091062, 4091063
e-mail: design@kayblowers.com
Website: www.kayblowers.com

G.A. AND F.P. DRAWING
FOR MODEL 59AC WITH ALL ACCESSORIES
T.L. BLOWER

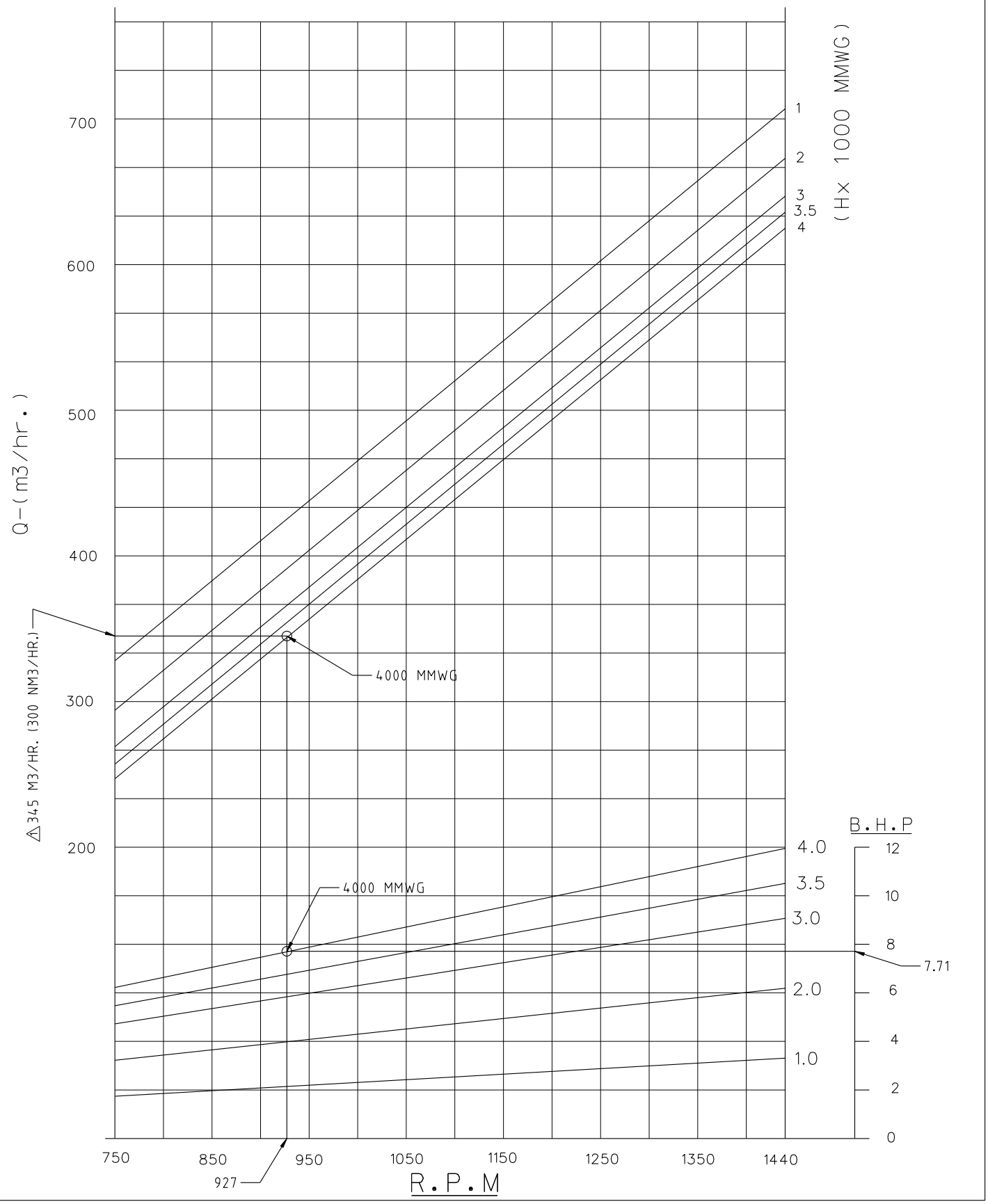
DRG.NO. K-GA-0059AH2646A3 | REV. 2 | SHEET 1 OF 1

# KAY POSITIVE DISPLACEMENT T.L. BLOWER

## PERFORMANCE CURVE FOR 59AC | O.S. NO.:- KI-49682

Q- CAPACITY
B.H.P.- ABSORBED POWER AT SHAFT

H-PRESSURE RISE
R.P.M.-BLOWER SPEED




KAY
PRECISION
PERFECTION
PRIDE

Plot No. 64, Phase–5, Sector–53, HSIIDC,
Kundli Industrial Area, Dist. Sonepat (Haryana) –131 028
Phones: +91–130–4091061, 4091062, 4091063
e–mail: design@kayblowers.com
Website: www.kayblowers.com

| REV. | PREP. | CHKD. | APPD. | DATE |
|---|---|---|---|---|
| 0 | SS | | | 10.06.19 |
| ⚠ | SS | | | 21.06.19 |
| | | | | |
| | | | | |
| | | | | |

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

# BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

QAP FOR BLOWERS WITH MOTOR OF

PRE TREATMENT PLANT

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | ALOYSIUS | AF | 18-07-19 |
| CHKD | MUAZZAM I | MI | 18-07-19 |
| APPD | ASLAM A | AA | 18-07-19 |

| DEPT. | | | | | | | CARD CODE |
|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - |
| DATE | | | | | | | |

BHEL DRAWING NO.
PE-V0-412-158-A013

OTOKLIN-DRG/DOC-NO..
OGBL/OC-983/QAP/B/PTP/18/350

REV 01

NO. OF SHEETS 1 EXCLUDING COVER PAGE

| OTOKLIN GLOBAL BUSINESS LIMITED | OTOKLIN GLOBAL BUSINESS LIMITED<br>R-02 Remi Bizcourt, Off Veera Desai Road, Andheri West,<br>Mumbai 400 053, India | **MANUFACTURING QUALITY PLAN**<br>**ITEM: AIR BLOWER**<br>**SUB-SYSTEM:**<br>**PRETREATMENT PLANT**<br>**QP NO.: PE-V0-412-158-A013**<br>**REV.NO.: 01**<br>**DATE: 18-07-2019**<br>**PAGE: 1 OF 1** | PROJECT: 2X660 MW ENNORE SEZ STPP AT ASH DYKE OF NCTPS<br>PACKAGE: PRETREATMENT PLANT<br>CONTRACT NO.: 412<br>MAIN-SUPPLIER: BHEL<br>SUB- CONTRACTOR:- OTOKLIN |
|---|---|---|---|

| S.NO | COMPONENT & OPERATIONS | CHARACTERISTICS CHECKED | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | M | C | N | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D | 10 | | | 11 |
| [1] | **RAW MATERIAL AND BOUGHT OUT COMPONENTS** | | | | | | | | | | | | |
| 1.1 | CI Casting for Casing, Lobes / Rotor & End covers | Physical Properties | Major | Test & Analysis | One / Heat | Approved Drawing. / Documents | Approved Drawing. / Documents | Insp.Report. MFG. TC | ✓ | P | R | R | |
| 1.2 | Rotor Shafts | Chemical & Physical Properties | Major | Test & Analysis | One / Heat | Approved Drawing. / Documents | As per IS/BS Stnd. | Insp.Report. MFG. TC | ✓ | P | R | R | |
| 1.3 | Timing Gears | Chemical Properties, Hardness | Critical | Test & Analysis | One/Lot | Approved Drawing. / Documents | As per IS/BS Stnd. | Insp.Report. MFG. TC | ✓ | P | R | R | |
| 1.4 | Rotor Assembly | Dynamic Balancing | Critical | Balancing | 100% | App. Drg. | App. Drg. | Insp. Report | ✓ | P | R | R | |
| 1.5 | Casing Hydrotest | Leak Tightness | Critical | Testing | 100% | Mfg. Stnd. | No Leakage | App. Drg. | ✓ | P | R | R | |
| [2] | **FINAL INSPECTION (Performance Test)** | | | | | | | | | | | | |
| 2.1 | Blower with job motor | Performance Test Head VS Capacity Capacity VS Power Capacity VS Efficiency | Major | Test with job motor | 100% | As per IS / BS Code | As per IS / BS Code | Insp. Report | ✓ | P | W | R | Only one Blower/model to be witness |
| 2.2 | Blower with accessories mounted on base frame | Overall Dimensions & Orientation | Major | Visual | 100% | App. GAD | App. GAD | Insp. Report | ✓ | P | W | R | Only one set to be witness |
| 2.3 | Painting | Visual | Major | | | As per Appd Doc | As per Appd Doc | I R | ✓ | P | R | R | Compliance Report |
| 2.4 | Packing | | | | | | | | | P | R | R | Compliance Report |

OTOKLIN GLOBAL BUSINESS LTD. MUMBAI

| MANUFACTURER / SUBCONTRACTOR | CONTRACTOR |
|---|---|
| SIGNATURE | |

**LEGEND:**
* RECORDS, INDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** M: MANUFACTURER/SUB-SUPPLIER P - Performing the Test

C: SUPPLIER/NOMINATED INSPECTION AGENCY W - Witnessing the Test

N: THE OWNER R - Review the Test

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

# BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

TECHNICAL DATASHEET FOR BALL VALVES OF PRE TREATMENT PLANT

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | ALOYSIUS | AF | 06-05-19 |
| CHKD | MUAZZAM I | MI | 06-05-19 |
| APPD | ASLAM A | AA | 06-05-19 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. PE-V0-412-158-A014 | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/TDS/BV/PTP/18/310 | 02 |
| DATE | | | | | | | | NO. OF SHEETS 4 EXCLUDING COVER PAGE | |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF BALL VALVES | | |
|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A014 | REV NO:- 02 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/BV/PTP/18/310 | |
| | | MADE BY AF / CHKD BY MI / APPD BY AA | |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | |

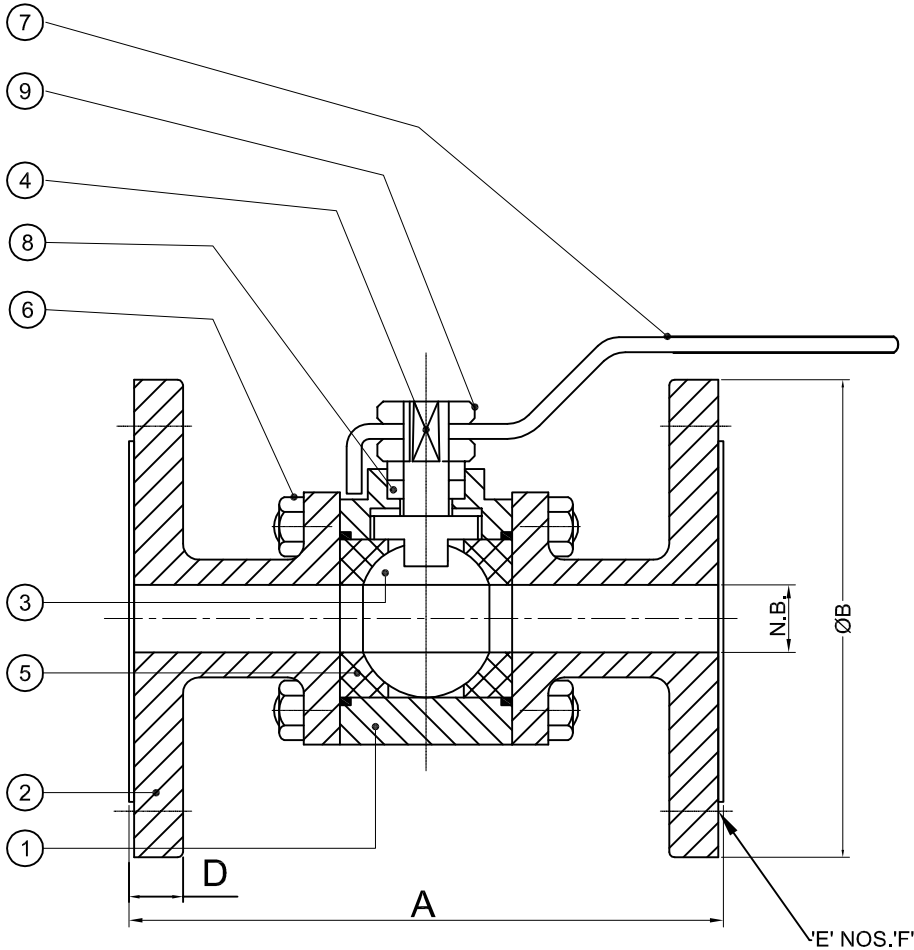
| Sr No. | Description | | |
|---|---|---|---|
| 1 | Valve Type | Ball Valve | |
| 2 | Valve Design | BS 5352 or equivalent of Required rating/class | |
| 3 | Flange Standard | ASME B 16.5 RF Serreted Finish150 AARH | |
| | **Material Specification** | | |
| 1 | Service | Lime Dosing System | |
| 2 | Body | SS 316 | |
| 3 | Spindle/Stem | SS 316 | |
| 4 | Ball | ASTM A351 CF8M | |
| 5 | Insert | SS 316 | |
| 6 | Seat | PTFE | |
| 7 | Gland Packing | PTFE | |
| 8 | Gland flange/Nut | ASTM A351 CF8M | |
| 9 | Hand bar | Cast Iron IS 210 Gr. FG 260 | |
| 10 | Stud, Stud Nut, Eye Bolt Nut / Fasteners | SS 316 | |
| 11 | End Connection | ASME B 16.5 RF Serreted Finish150 AARH | |
| 12 | Size & Quantity | 40NB - 8 Nos. | KKS No. - 90GAA01AA600 / 90GAA01AA602<br>90GAA01AA604 / 90GAA01AA607<br>90GAA01AA576 / 90GAA01AA577<br>90GAA01AA584 / 90GAA01AA585 |
| 13 | Operation Type | Manual | |
| 14 | Leakage Class | IV | |
| 15 | Range of Flow Control | 0-100% | |
| 16 | Valve Rating | PN 10 | |
| 17 | Test duration | Body: 1 min | Seat: 1 min |
| 18 | Design Pressure | 22 kg/sq.cm | |
| 19 | Test Pressure: | PN 10 | |
| 20 | Testing standard | API 598 | |
| 21 | Face to Face Distance | ASME B 16.10 | |
| 22 | Set Testing Pressure | Body: 15 Bar | Seat: 11 Bar |
| 23 | Painting | As per approved painting specification | |
| 24 | MAKE | Venus Pump and Engineering works | |

**S.S BALL VALVE**

| VALVE SIZE | FACE TO FACE | FLANGE DETAILS | | | | | QTY. |
|---|---|---|---|---|---|---|---|
| | | O.D. | P.C.D. | THICK. | HOLE NO. | HOLE DIA. | |
| N.B. | A ±2 | B | C | D | E | F | NOS. |
| 40 | 165 | 127 | 98.4 | 14.3 | 4 | 15.9 | 08 |

NOTES :-

1. ALL DIMENSIONS ARE IN mm. UNLESS OTHERWISE STATED.
2. STANDARD TOLERANCES ARE APPLICABLE
3. FLANGE DRILLED AS PER ASA B 16.5 CL.150# R/F .
4. WE RESERVE OUR RIGHTS FOR MINOR DESIGN CHANGES.




| SL.NO. | DESCRIPTION | MATERIAL | SPECIFICATION |
|---|---|---|---|
| 9 | GLAND NUT | S.S | AISI:316 |
| 8 | GLAND PACKING | PTFE | - |
| 7 | HAND LEVER | M.S. | WITH PVC SLEEVES |
| 6 | BOLTS & NUTS | S.S. | AISI:316 |
| 5 | BALL SEAT | PTFE | - |
| 4 | STEM | S.S | AISI:316 |
| 3 | BALL | S.S | ASTM A 351 GR.CF8M |
| 2 | BODY CONNECTOR | S.S | ASTM A 351 GR.CF8M (SS 316) |
| 1 | BODY | S.S | ASTM A 351 GR.CF8M (SS 316) |

BILL OF MATERIAL

DETAILS

| | |
|---|---|
| VALVE | BALL |
| TYPE | THREE PIECE |
| MFG. STD. | BS : 5351 |
| RATING | CL.150# |
| PARENT MATLS. | S.S |
| TRIM MATLS. | S.S / PTFE |
| SERVICE | LIME DOSING SYSTEM |

THIS DRAWING AND ITS ENCLOSURE(S) UNDER CITED DRG. NO. ARE THE SOLE PROPERTY OF VENUS PUMP & ENGINEERING WORKS. ANY ABUSE OF IT WILL BE LEGALLY DEALT WITH AT THE RISK/COST OF THE ABUSER(S).

ALL DIMENSIONS IN MM. UNLESS OTHERWISE SPECIFIED.
TOLERANCES ON MACHINED DIMENSIONS ± 2 mm UNLESS OTHERWISE SPECIFIED.
SCALING OF DRAWING FOR DIMENSIONS SHOULD BE AVOIDED IN ALL CASES.

| TESTING PARAMETER | HYDROSTATIC TEST PRESSURE IN BAR | | |
|---|---|---|---|
| | BODY | SEAT | |
| | 15 (1 MIN.) | 11 (1 MIN.) | |

TITLE

PROJECTION

TITLE: STAINLESS STEEL, THREE PIECE DESIGN, FLANGED END BALL VALVE

MAIN REF.

VENUS PUMP & ENGINEERING WORKS
BALITIKURI, SHIBTOLLA, HOWRAH - 711 113. WEST BENGAL

| REV | DATE |
|---|---|
| 01 | 00 |
| 02 | 00 |
| 03 | 00 |

| | | | |
|---|---|---|---|
| DRN. | A.GHOSH | DRG. NO. VP-RK-BV-19-5665 | SCALE N.T.S. |
| CHD. | C.HAZRA | | |
| APP. | R. AGARWAL | REV:00 | DATE:01.02.2019 |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF BALL VALVES | | |
|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A014 | REV NO:-02 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/BV/PTP/18/310 | |
| | | MADE BY AF / CHKD BY MI / APPD BY AA | |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | |

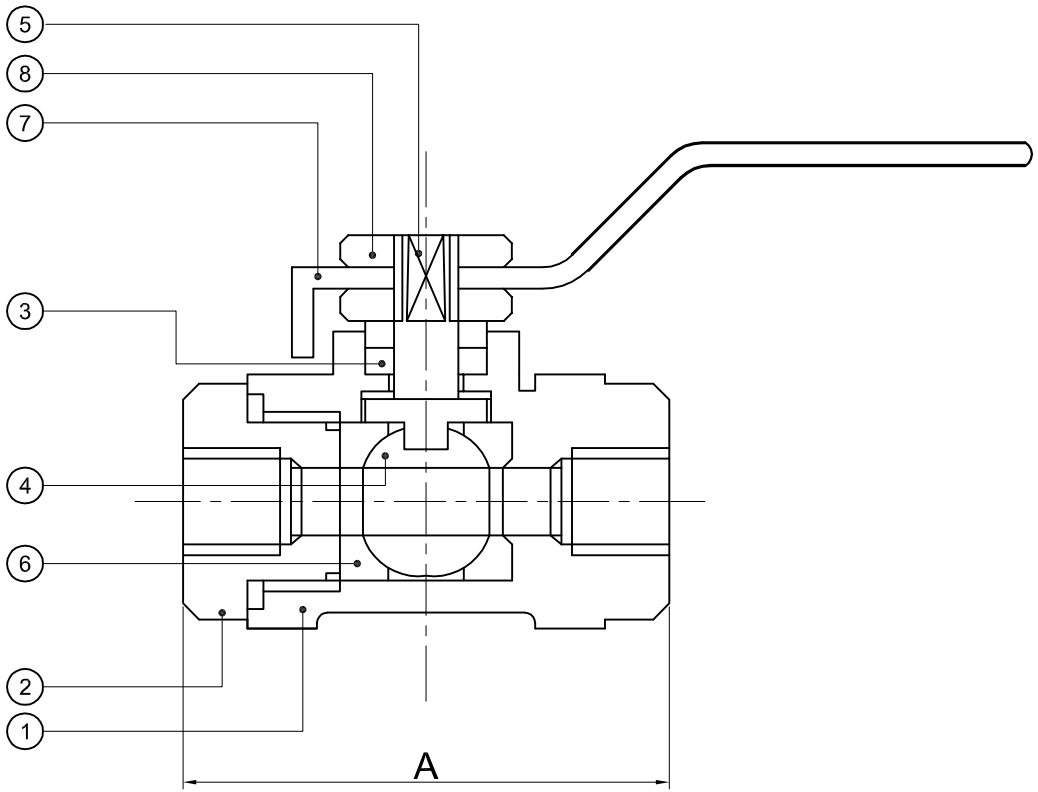
| Sr No. | Description | | |
|---|---|---|---|
| 1 | Valve Type | Ball Valve | |
| 2 | Valve Design | BS 5351 or equivalent of Required rating/class | |
| | **Material Specification** | | |
| 1 | Service | Air | |
| 2 | Body | SS 316 | |
| 3 | Spindle/Stem | SS 316 | |
| 4 | Ball | ASTM A351 CF8M | |
| 5 | Insert | SS 316 | |
| 6 | Seat | PTFE | |
| 7 | Gland Packing | PTFE | |
| 8 | Gland flange/Nut | ASTM A351 CF8M | |
| 9 | Hand bar | Cast Iron IS 210 Gr. FG 260 | |
| 10 | Stud, Stud Nut, Eye Bolt Nut / Fasteners | SS 316 | |
| 11 | End Connection | Screwed End | |
| 12 | Size & Quantity | 80NB - 5 Nos. | KKS No. - 90GAA01AA540 / 90GAA01AA543 90GAA01AA647 / 90GAA01AA648 90GAA01AA649 |
| 13 | Operation Type | Manual | |
| 14 | Leakage Class | IV | |
| 15 | Range of Flow Control | 0-100% | |
| 16 | Valve Rating | PN 10 | |
| 17 | Test duration | Body: 1 min | Seat: 1 min |
| 18 | Design Pressure | 22 kg/sq.cm | |
| 19 | Test Pressure: | PN 10 | |
| 20 | Testing standard | API 598 | |
| 21 | Face to Face Distance | ASME B 16.10 | |
| 22 | Set Testing Pressure | Body: 15 Bar | Seat: 11 Bar |
| 23 | Painting | As per approved painting specification | |
| 24 | MAKE | Venus Pump and Engineering works | |

# BALL VALVE

| VALVE SIZE | FACE TO FACE | QTY. |
|---|---|---|
| N.B. | A±2 | NOS. |
| 80 | 158 | 05 |

NOTES :-

1. ALL DIMENSIONS ARE IN mm. UNLESS OTHERWISE STATED.
2. VALVE STANDARD AS PER BS: 5351
3. END CONNECTION AS PER BSP FEMALE THREAD.
4. WE RESERVE OUR RIGHTS FOR MINOR DESIGN CHANGES.




| SL.NO. | DESCRIPTION | MATERIAL | SPECIFICATION |
|---|---|---|---|
| 8 | GLAND NUT | S.S | AISI : 316 |
| 7 | HAND LEVER | M.S. | WITH PVC SLEEVES |
| 6 | BALL SEAT | PTFE | - |
| 5 | STEM | S.S | AISI : 316 |
| 4 | BALL | S.S | ASTM A351 CF8M |
| 3 | GLAND PACKING | PTFE | - |
| 2 | BODY CONNECTOR | S.S | ASTM A351 CF8M ( SS 316) |
| 1 | BODY | S.S | ASTM A351 CF8M ( SS 316) |

BILL OF MATERIAL

DETAILS

| | |
|---|---|
| VALVE | BALL |
| TYPE | FULL PORT |
| MFG. STD. | BS : 5351 |
| RATING | CLASS - 150# |
| PARENT MATLS. | S.S |
| TRIM MATLS. | PTFE |
| SERVICE | AIR |

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ALL DIMENSIONS IN MM. UNLESS OTHERWISE SPECIFIED.
TOLERANCES ON MACHINED DIMENSIONS ± 2 mm UNLESS OTHERWISE SPECIFIED.
SCALING OF DRAWING FOR DIMENSIONS SHOULD BE AVOIDED IN ALL CASES.

| TESTING PARAMETER | HYDROSTATIC TEST PRESSURE IN BAR. | | |
|---|---|---|---|
| | BODY | SEAT | |
| | 15 (1MIN.) | 11 (1MIN.) | |

TITLE

PROJECTION

TITLE

S.S, SINGLE PIECE DESIGN, FEMALE SCREWED END BALL VALVE.

MAIN REF.

| REV | DATE |
|---|---|
| 01 | 00 |
| 02 | 00 |
| 03 | 00 |

VENUS PUMP & ENGINEERING WORKS

BALITIKURI, SHIBTOLLA, HOWRAH - 711 113. WEST BENGAL

| | | | |
|---|---|---|---|
| DRN. | A.GHOSH | DRG. NO. VP-RK-BV-19-5666 | SCALE N.T.S. |
| CHD. | C.HAZRA | | |
| APP. | R.AGARWAL | REV:00 DATE:01.02.2019 | |

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

# BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

TECHNICAL DATASHEET FOR BUTTERFLY VALVES OF PRE TREATMENT PLANT

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | ALOYSIUS | AF | 06-05-19 |
| CHKD | MUAZZAM I | MI | 06-05-19 |
| APPD | ASLAM A | AA | 06-05-19 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

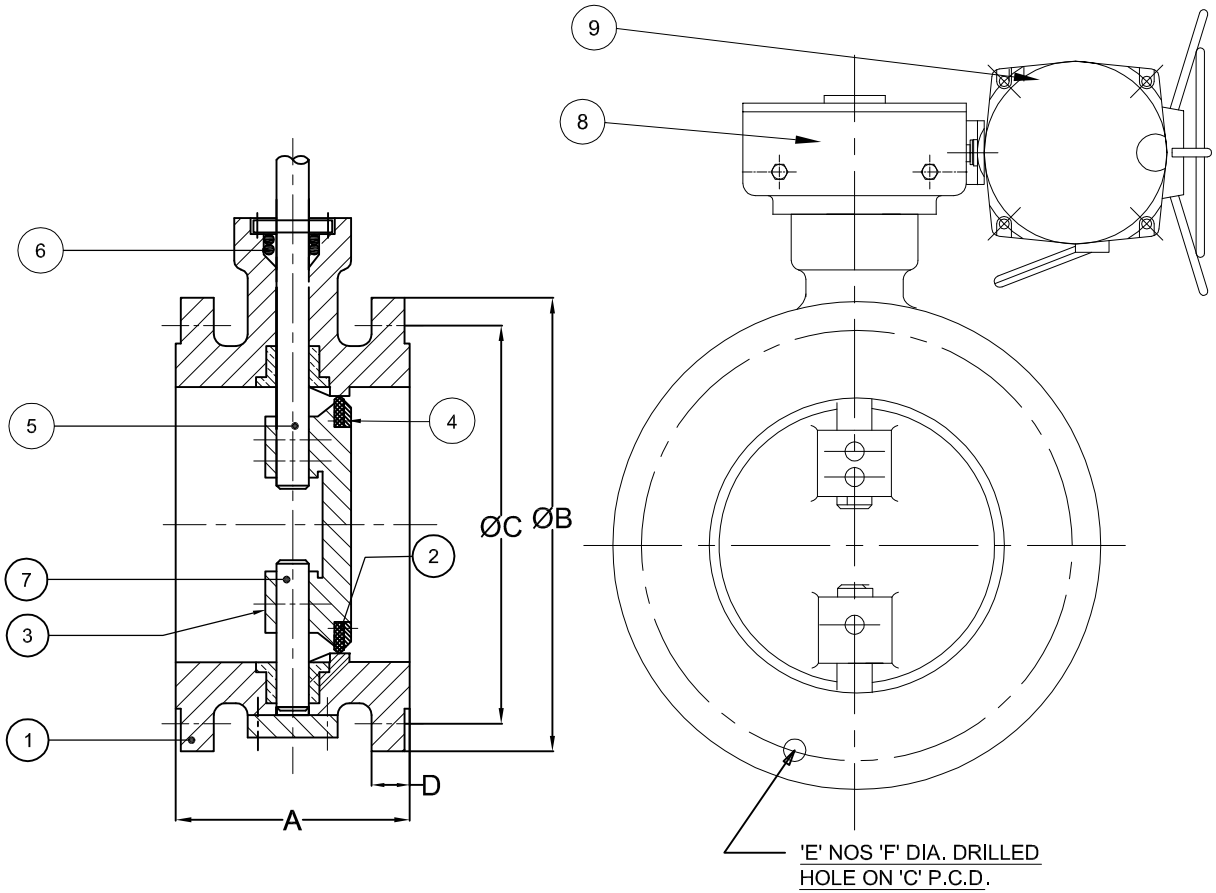
| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. PE-V0-412-158-A015 | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/TDS/BFV/PTP/18/311 | 02 |
| DATE | | | | | | | | NO. OF SHEETS 9 EXCLUDING COVER PAGE | |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF BUTTERFLY VALVES | | | |
|---|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A015 | | REV NO:- 02 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/BFV/PTP/18/311 | | |
| | | MADE BY AF | CHKD BY MI | APPD BY AA |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | | |

| Sr No. | Description | | | |
|---|---|---|---|---|
| 1 | Valve Type | | Butterfly Valve | |
| 2 | Valve Design | | BS5155 | |
| 3 | Flange Standard | | ASME B 16.5 RF for 400NB<br>END FLANGED TO AWWA C207 for 800NB PN-10 | |
| | **Material Specification** | | | |
| 1 | Service | | Sludge for 400NB and Sea water for 800NB | |
| 2 | Body | | ASTM A 995 GR 5A-CE3MN (Duplex Stainless Steel) | |
| 3 | Disc | | ASTM A 995 GR 5A-CE3MN (Duplex Stainless Steel) | |
| 4 | Shaft/Spinldle | | ASTM A276 S31803 (Duplex Stainless Steel) / F51 | |
| 5 | Seat rings | | Nitrile rubber / EPDM | |
| 6 | Stud, Stud Nut, Eye Bolt Nut / Fasteners | | SS 316L | |
| 7 | Hand Wheel | | MS to IS:2062 / Cast Iron | |
| 8 | End Connection | | ASME B 16.5 RF for 400NB<br>END FLANGED TO AWWA C207 for 800NB PN-10 | |
| 9 | Size & Quantity | KKS No. - 90GBS41AA001<br>90GBS42AA001<br>90GBS43AA001 | 400NB - 3 Nos. | Location-Sludge Transfer pump outlet pipeline |
| | | KKS No. - 90GBD01AA001<br>90GBD01AA002 | 800NB - 2 Nos. | Location-Sea Water Inlet valve station |
| 10 | Operation Type | | Electrical Actuated | |
| 11 | Leakage Class | | VI | |
| 12 | Range of Flow Control | | 0-100% | |
| 13 | Valve Rating | | PN 10 | |
| 14 | Test duration | | Body: 5 min | Seat: 2 min |
| 15 | Design Pressure | | 11 Bar | |
| 16 | Test Pressure: | | PN 10 | |
| 17 | Testing standard | | API 598 | |
| 18 | Face to Face Distance | | AWWA-C-504 / BS 5155 / API 609 | |
| 19 | Set Testing Pressure | | Body: 15 Bar | Seat: 11 Bar |
| 20 | Accessories | | Limit switches to indicate full open/closed position of valve | |
| 21 | Painting | | As per approved painting specification | |
| 22 | MAKE | | Venus Pump and Engineering works | |

# DOUBLE FLANGED BUTTERFLY VALVE

| VALVE SIZE | FACE TO FACE | FLANGE DETAILS | | | | | DRILLIING STD. | SERVICE | QTY. |
|---|---|---|---|---|---|---|---|---|---|
| | | O.D. | P.C.D. | THICK. | HOLE NO. | HOLE DIA. | | | |
| N.B. | A±5 | B | C | D | E | F | -- | -- | NOS. |
| 400 | 216 | 596.9 | 539.8 | 30 | 16 | 28.6 | ASME B-16.5 R/F | SLUDGE | 03 |
| 800 | 318 | 1060 | 977.9 | 38 | 28 | 41.2 | AWWA C207 | SEA WATER | 02 |




NOTES :
1. ALL DIMENSIONS ARE IN M.M.
2. STANDARD TOLERANCES ARE APPLICABLE.
3. WE RESERVE OUR RIGHT FOR MINOR DESIGN CHANGES.

| SL.NO. | DESCRIPTION | QTY. | MATERIAL | SPECIFICATION |
|---|---|---|---|---|
| 9 | ACTUATOR | 1 | ROTORK | |
| 8 | WORM GEAR BOX | 1 | INDIGINIOUS | |
| 7 | STUB SHAFT | 1 | D.S.S. | ASTM A276 |
| 6 | PACKING O-RING | As reqd. | RUBBER | NITRILE/EPDM |
| 5 | DRIVE SHAFT | 1 | D.S.S. | ASTM A276 |
| 4 | RETAINER BOLT | As reqd. | D.S.S. | AISI:316L |
| 3 | DISC | 1 | D.S.S. | ASTM A995 GR.5A CE3MN |
| 2 | DISC SEAT RING | 1 | RUBBER | NITRILE / EPDM |
| 1 | BODY | 1 | D.S.S. | ASTM A995 GR.5A CE3MN |

## BILL OF MATERIAL

DETAILS

| | |
|---|---|
| VALVE | BUTTERFLY |
| TYPE | FLANGE |
| MFG. STD. | BS:5155 |
| RATING | PN -10 |
| PARENT MATLS. | D.S.S. |
| TRIM MATLS. | RUBBER / D.S.S. |
| SERVICE | SEE ABOVE TABLE |

THIS DRAWING AND ITS ENCLOSURE(S) UNDER CITED DRG. NO. ARE THE SOLE PROPERTY OF VENUS PUMP & ENGINEERING WORKS. ANY ABUSE OF IT WILL BE LEGALLY DEALT WITH AT THE RISK/COST OF THE ABUSER(S).

ALL DIMENSIONS IN MM. UNLESS OTHERWISE SPECIFIED. TOLERANCES ON MACHINED DIMENSIONS ± 2 MM SCALING OF DRAWING FOR DIMENSIONS SHOULD BE AVOIDED IN ALL CASES.

| TESTING PARAMETER | HYDROSTATIC TEST PRESSURE IN BAR | | |
|---|---|---|---|
| | BODY | SEAT | - |
| | 15 (5MIN.) | 11 (2MIN.) | - |

TITLE

PROJECTION

D.S.S. DOUBLE FLANGED BUTTERFLY VALVE ACTUATOR OPERATED.

MAIN REF.

VENUS PUMP & ENGINEERING WORKS

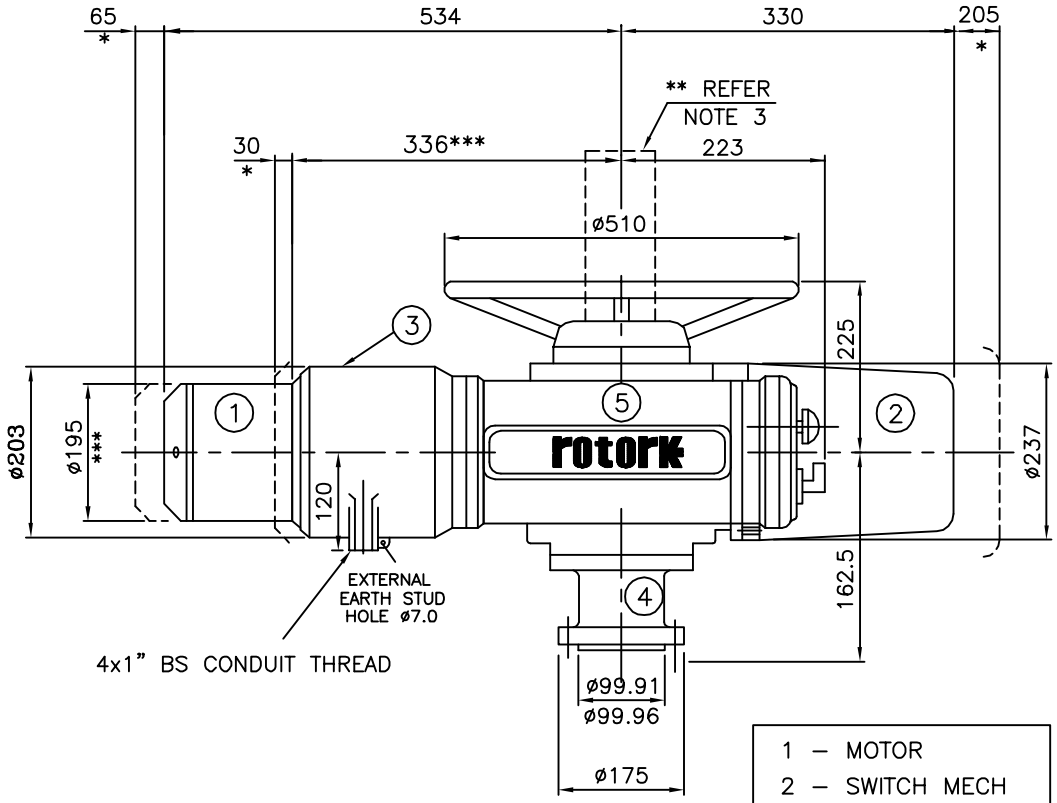
BALITIKURI, SHIBTOLLA, HOWRAH - 711 113. WEST BENGAL

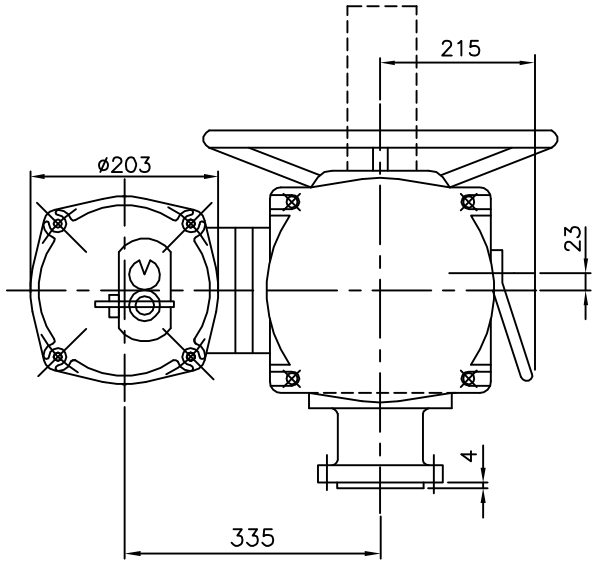
| REV | DATE |
|---|---|
| 01 | 00 |
| 02 | 00 |
| 03 | 00 |

| | | | |
|---|---|---|---|
| DRN. | A.GHOSH | DRG. NO. VP-RK-DFBV-19-5664 | SCALE N.T.S. |
| CHD. | C.HAZRA | | |
| APP. | R. AGARWAL | REV:00 | DATE:01.02.2019 |

| | | | | | | |
|---|---|---|---|---|---|---|
| MATERIAL – | UNSPECIFIED DIMENSIONAL TOLERANCES<br>MACHINED ± 0.25mm 010"<br>CAST ± 0.8mm 1/32"<br>ANGULAR ± 1/2" | THREAD TOLERANCES<br>METRIC TO BS 3643<br>CLASS 6H & 6G | SURFACE FINISH<br>▽250 MICRO INCH<br>▽▽125 MICRO INCH<br>▽▽▽ 63 MICRO INCH<br>▽▽▽▽ 32 MICRO INCH | GAUGING POINTS (G.P.)<br>REFERENCE SHOULD BE MADE TO BEACON ROTORK QUALITY CONTROL DEPT. PRIOR TO PURCHASE OR MANUFACTURE OF GAUGES. | PART NUMBER<br>☒ INDICATES POSITION WHERE PART NUMBERS ARE TO BE MARKED. | LETTERING AND LAYOUT<br>DO NOT PREPARE NEW OR REVISE EXISTING ARTWORK POSTITIVES OR NEGATIVES |
| SPECIFICATION – | | | | | | |
| TREATMENT – | ISO GEOMETRICAL TOLERANCING SYSTEM TO BS 308 PART 3 1972 | UNIFIED TO BS 1580<br>CLASS 2A & 2B | REMOVE ALL BURRS AND SHARP EDGES | | | |

# (For 800 NB)
# Butterfly Valve




1 – MOTOR
2 – SWITCH MECH
3 – TERMINAL HSG.
4 – ACTUATOR BASE
5 – SYNCROPAK

| DESCRIPTION | MATERIAL |
|---|---|
| MOTOR HSG. | AL. ALLOY |
| S/MECH COVER | AL. ALLOY |
| TERMINAL HSG. | AL. ALLOY |
| BASE | CAST IRON |
| SYN.PAK HSG. | AL. ALLOY |
| HAND WHEEL HUB | S.G. IRON |
| PUSH BUTTON COVER | AL. ALLOY |
| GEAR CASE | AL. ALLOY |
| HAND AUTO LEVER | AL. ALLOY |

NOTE :-

1. APPROX. WEIGHT OF ACTUATOR – 81 Kgs.
2. * INDICATES COVER REMOVAL ALLOWANCE
3. ** COVER TUBE WHEN FITTED – 3" NPT THREAD (LENGTH – AS REQUIRED BY CUSTOMER)
4. *** DIMENSION SHOWN FOR MAX.RPM

Drawing Number BR/MISC–9014

Manufacturing dimensions specified in millimeters precise inch conversions for reference | Do not Scale

Third angle projection | Scale NTS

Pre production issue indicated with letter production issue indicate with numeral

| Issue | Modifications |
|---|---|
| | |

Title DIMN.CHART FOR K300 & KM300 F14E SYNCROPAK ACTUATOR

Drawn Ksk 8.2.2008

Checked

Approved 8.2.2008

Used on K300&KM300 F14E SYN.PAK ACTR. G1/2 & F14 'E' BASE

Assembly drawing no. –

List of part no. – | Sht.No. 1 OF 1

Drawing number BR/MISC–9014


rotork Rotork Controls (India) Pvt, Limited
28 B, Ambattur Industrial Estate (North)
Chennai–600 098

| MATERIAL | UNSPECIFIED DIMENSIONAL TOLERANCES | THREAD TOLERANCES | SURFACE FINISH | GAUGING POINTS (G.P.) | PART NUMBER | LETTERING AND LAYOUT |
|---|---|---|---|---|---|---|
| SPECIFICATION | MACHINED ± 0.25mm 010" | METRIC TO BS 3643 CLASS 6H & 6G | ▽250 MICRO INCH | REFERENCE SHOULD BE MADE TO BEACON ROTORK QUALITY CONTROL DEPT. PRIOR TO PURCHASE OR MANUFACTURE OF GAUGES. | ☒ INDICATES POSITION WHERE PART NUMBERS ARE TO BE MARKED. | DO NOT PREPARE NEW OR REVISE EXISTING ARTWORK POSTITIVES OR NEGATIVES |
| TREATMENT | CAST ± 0.8mm 1/32" | UNIFIED TO BS 1580 CLASS 2A & 2B | ▽▽125 MICRO INCH | | | |
| | ANGULAR ± 1/2° | | ▽▽▽ 63 MICRO INCH | | | |
| | ISO GEOMETRICAL TOLERANCING SYSTEM TO BS 308 PART 3 1972 | | ▽▽▽▽ 32 MICRO INCH | | | |
| | | | REMOVE ALL BURRS AND SHARP EDGES | | | |

Drawing Number BR/MISC-10444

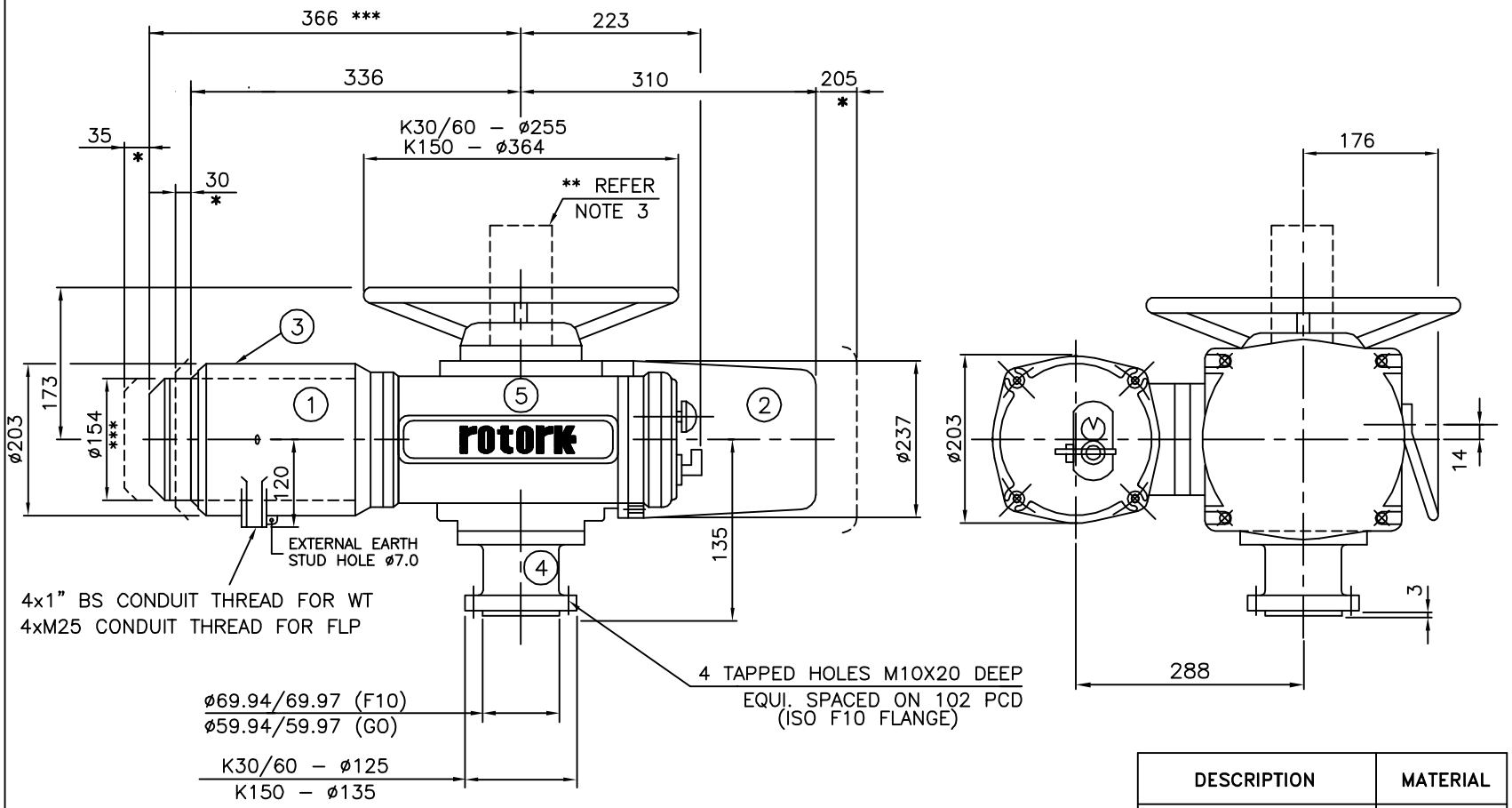
Manufacturing dimensions specified in millimeters precise inch conversions for reference | Do not Scale

Third angle projection | Scale NTS

Pre production issue indicated with letter production issue indicate with numeral

| Issue | Modifications: |
|---|---|
| | |

# (For 400 NB)
# Butterfly Valve




1–MOTOR
2–SWITCH MECH
3–TERMINAL HSG.
4–ACTUATOR BASE
5–SYNCROPAK

NOTE :–

1. APPROX. WEIGHT OF ACTUATOR – 63 Kgs.
2. * INDICATES COVER REMOVAL ALLOWANCE
3. ** COVER TUBE WHEN FITTED – 2" NPT THREAD (LENGTH – AS REQUIRED BY CUSTOMER)
4. *** DIMENSION SHOWN FOR MAX. RPM.

| DESCRIPTION | MATERIAL |
|---|---|
| MOTOR HSG. | AL. ALLOY |
| S/MECH COVER | AL. ALLOY |
| TERMINAL HSG. | AL. ALLOY |
| BASE | CAST IRON |
| SYN.PAK HSG. | AL. ALLOY |
| HAND WHEEL | S.G. IRON |
| PUSH BUTTON COVER | AL. ALLOY |
| GEAR CASE | AL. ALLOY |
| HAND AUTO LEVER | AL. ALLOY |

Title DIMN.CHART FOR K30/60/150 & KM30/60/150 F10E SYNCROPAK ACTR. (WT&FLP)

| | | |
|---|---|---|
| Drawn | MAHI | 18.07.2016 |
| Approved | DAB | 18.07.2016 |

Used on K & KM30/60/150 GO/F10E BASE

Assembly drawing no. –

List of part no. – | Sht.No. 1 OF 1

Drawing number BR/MISC-10444


rotork Rotork Controls (India) Pvt, Limited
28 B, Ambattur Industrial Estate (North)
Chennai–600 098

Venus

FORM NO. PEM-6666-0

| | | | |
|---|---|---|---|
| BHEL | **SPECIFICATION FOR MOTORISED VALVE ACTUATOR** | SPECIFICATION NO.: PE-DG-412-145-I902 | |
| | | VOLUME | II B |
| | | SECTION | D |
| | | REV. NO. 02 | DATE: 28.03.17 |
| | | 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 | 2x 660 MW ENNORE SUPERCRITICAL TPP | |
| | OFFER REFERENCE | | |
| | * TAG NO. SERVICE | | |
| | * DUTY | ■ ON / OFF ■ INCHING | Inching |
| | * 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% | Comply |
| | VALVE SEAT TEST PRESS | BIDDER TO SPECIFY | — |
| | REQUIRED VALVE TORQUE | BIDDER TO SPECIFY | — |
| | ACTUATOR RATED TORQUE | BIDDER TO SPECIFY | 305 Nm (K300F14E) / 152 Nm (K150F10E) |
| CONSTRUCTION AND SIZING | CONSTRUCTION | TOTALLY ENCLOSED, WEATHER PROOF, IP:68 | Comply |
| | MECHANICAL POSITION INDICATOR | TO BE PROVIDED FOR 0-100% TRAVEL | Comply |
| | BEARINGS | DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION. | Comply |
| | 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. | Comply |
| | SIZING | OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. **FOR INCHING SERVICE - 150 STARTS/HR MINIMUM** & FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM. | Inching Duty (150 starts per hour) based on a S2 type duty cycle - 15 mins. |
| HANDWHEEL | * REQUIRED | ■ YES ☐ NO | Provided |
| | * ORIENTATION | ☐ TOP MOUNTED ☐ SIDE MOUNTED | Top Mounted |
| | *TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION. | | |
| ELECTRIC ACTUATOR | ACTUATOR MAKE/MODEL | BIDDER TO SPECIFY | ROTORK / K300F14E / K150F10E, |
| | MOTOR MAKE / MODEL / TYPE / RATING (KW) | BIDDER TO SPECIFY | ROTORK / K300F14E - 1.2 kW, 48 rpm K150F10E - 0.85 kW / Syncropak. |
| | @ MOTOR TYPE | SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT-INCLUSIVE OF I.S. TOLERANCE | Comply. |
| | ACTUATOR APPLICABLE WIRING DIAGRAM | ☐ ENCLOSED (BIDDER TO CONFIRM)<br>A: ☐ DRG. NO. 3-V-MISC-24227 R00<br>B: ☐ DRG. NO. 3-V-MISC-24550 R00<br>C: ☐ DRG. NO. 3-V-MISC-24283 R00<br>D: ☐ DRG. NO. 4-V-MISC-90271 R11<br>E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram | BH97Z50JV |
| | COLOUR SHADE | ☐ BLUE (RAL 5012) ☐ ..... | RAL 5012 |
| | PAINT TYPE (## Refer Notes) | ☐ ENAMEL ■ EPOXY ☐ ..... | Epoxy |
| | SHAFT RPM | BIDDER TO SPECIFY | 48 rpm |
| | OLR SET VALVE | BIDDER TO SPECIFY | K300F14E - 4.5 / K150F10E - 3.6. |
| | @ STARTING / FULL LOAD CURRENT | BIDDER TO SPECIFY | K300F14E - 25A / K300F14E - 6A. K150F10E - 20A / K150F10E - 5.4A. |
| | NO. OF REV FOR FULL TRAVEL | BIDDER TO SPECIFY | |
| | @ PWR SUPP TO MTR / STARTER | 415V, 3PH, AC | Comply |
| | @ CONTROL VOLTAGE REQUIREMENT | TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V | 24 V DC |

ROTORK CONTROLS (INDIA) PVT. LTD.

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FORM NO. PEM-6666-0

| | SPECIFICATION FOR MOTORISED VALVE ACTUATOR | SPECIFICATION NO.: PE-DG-412-145-1902 | |
|---|---|---|---|
| | | VOLUME II B | |
| | | SECTION D | |
| | | REV. NO. 02 | DATE: 28.03.17 |
| | | SHEET 2 OF 3 | |

## Data Sheet A & B

| | | DATA SHEET-A (TO BE FILLED BY PURCHASER) | DATA SHEET-B (TO BE FILLED-UP BY BIDDER) |
|---|---|---|---|
| | @ ENCLOSURE CLASS OF MOTOR | ■ IP 68 ☐ FLAME PROOF | Comply |
| | @ INSULATION CLASS | CLASS-F TEMP. RISE LIMITED TO CLASS-B | Comply |
| | @ WINDING TEMP PROTECTION | ■ THERMOSTAT (3 Nos.,1 IN EACH PHASE) ☐ ---------- | Comply (1 in each winding) |
| | SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION | REQUIRED | Comply |
| INTEGRAL STARTER | INTEGRAL STARTER | ■ REQUIRED ☐ NOT REQUIRED | Provided |
| | TYPE OF SWITCHING DEVICE | ■ CONTACTORS ☐ THYRISTORS | Comply |
| | TYPE | ■ CONVENTIONAL ☐ SMART (NON-INTRUSIVE) | Comply |
| | 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 | Comply |
| | STATUS CONTACTS FOR MONITORING | ■ REQUIRED ☐ NOT REQUIRED | |
| | INTEGRAL STARTER DISTURBED SIGNAL | REQUIRED (MOTOR THERMOSTAT TRIP , O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, PHASE LOSS, S/S IN LOCAL or OFF MODE, STOP PB OPTD, TORQUE OPEN/CLOSE CUTOFF) | 1 |
| INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter) | TYPE OF ISOLATING DEVICE | ☐ INTERPOSING RELAY ☐ OPTO COUPLER ☐ EITHER | Interposing Relay |
| | QUANTITY | ■ 2 NOs. ☐ 3 Nos*. | 3 nos. (Inching operation) |
| | DRIVING VOLTAGE | ■ 20.5 – 24V DC ☐ _____V DC | Comply |
| | DRIVING CURRENT | ■ 125mA MAX ☐ _____mA MAX | |
| | LOAD RESISTANCE | ■ > 192 ohms - <25 k ohms ☐ > _____ohms - < _____ohms | |
| TORQUE SWITCH (Not Applicable for Smart Actuator) ($$ Refer Notes) | MFR & MODEL NO. | BIDDER TO SPECIFY | ROTORK |
| | OPEN / CLOSE | ■1 No. ☐2Nos. / ■1 No. ☐2Nos | Comply \| Comply |
| | CONTACT TYPE | 2 NO + 2 NC | Comply |
| | RATING | 5A 240V AC AND 0.5A 220V DC | Comply |
| | CALIBRATED KNOBS(OPEN&CLOSE TS) | REQUIRED FOR SETTING DESIRED TORQUE | Comply |
| | ACCURACY | +3% OF SET VALUE | Comply |
| LIMIT SWITCH (Not Applicable for Smart Actuator) ($$ Refer Notes) | MFR & MODEL NO. | BIDDER TO SPECIFY | ROTORK |
| | OPEN : INT : CLOSE | ☐1 No ■2 Nos. \| 2 Nos. (ADJ.) \| ☐1 No. ■2Nos. | Comply \| Comply \| Comply |
| | CONTACT TYPE | 2 NO + 2 NC | Comply |
| | RATING (AC / DC) | 5A 240V AC AND 0.5A 220V DC | Comply |
| | | | |

*For inching type drives IPR 3 Nos. to be considered for inching operation. 2

ROTORK CONTROLS (INDIA) PVT. LTD.

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FORM NO. PEM-6666-0

| | SPECIFICATION FOR MOTORISED VALVE ACTUATOR | SPECIFICATION NO.: PE-DG-412-145-1902 | |
|---|---|---|---|
| | | VOLUME II B | |
| | | SECTION D | |
| | | REV. NO. 02 | DATE: 28.03.17 |
| | | SHEET 3 OF 3 | |

## Data Sheet A & B

| | | DATA SHEET-A (TO BE FILLED BY PURCHASER) | DATA SHEET-B (TO BE FILLED-UP BY BIDDER) |
|---|---|---|---|
| POSITION TRANSMITTER | POSITION TRANSMITTER (For inching duty & other specific applications) | ■ REQUIRED ☐ NOT REQUIRED | Provided |
| | MFR & MODEL NO. | BIDDER TO SPECIFY | Rotork |
| | TYPE | ☐ ELECTRONIC (2 WIRE) R/I CONVERTER<br>■ ELECTRONIC (2 WIRE) CONTACTLESS | Comply |
| | SUPPLY | ■ 24V DC ☐ ..... | Comply |
| | OUTPUT | ■ 4-20mA | Comply |
| | ACCURACY | ± 1% FS | Comply |
| SPACE HEATER | @SPACE HEATER | REQUIRED | Provided |
| | @ POWER SUPPLY (NON INTEGRAL) | 230V AC,1 PH.,50 Hz | Not Applicable. |
| | @ POWER SUPPLY (INTEGRAL) | BIDDER TO SPECIFY | 160VAC, 1ph, 50Hz Internally Fed. |
| | @ RATING | | 8-10 watt |
| TERMINAL BOX | ACTUATOR/MOTOR TERMINAL BOX | REQUIRED | Provided (Common Terminal Box) |
| | ENCL CLASS ACTUATOR/MOTOR T.B. | @■ IP 68 @☐..... | Comply |
| | @ EARTHING TERMINAL | REQUIRED | Provided |
| | PLUG & SOCKET(9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT) | ☐ REQUIRED ■ NOT REQUIRED☐<br>☐ 2 NOS. ☐ ..... | Comply |
| CABLE GLANDS | @ POWER CABLE GLAND | SIZE: suitable for 3Cx2.5sq mm Cu | Cable OD required |
| | @ SPACE HEATER CABLE GLAND | SIZE:- | Cable OD required |
| | OTHER CONTROL CABLE GLANDS | QUANTITY & SIZE: Cable gland suitable for 8Px0.5 sq mm & 2P x 0.5 sq mm cable. | Cable OD required |
| WEIGHT | TOTAL WEIGHT (ACTUATOR + ACCESSORIES) | BIDDER TO SPECIFY | K300F14E-81 Kg.<br>K150F10E - 63 kg. |

NOTES:

1. SCOPE: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
2. CODES & STANDARDS: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATION STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
   IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
3. ACTUATOR SHALL HAVE HARDWIRED CONTACTS FOR FOLLOWING SIGNALS (a) ACTUATOR IN LOCAL MODE (b) ACTUATOR IN REMOTE MODE. 1
4. BIDDER TO ENSURE AVAILABILITY OF SPARE 1NO + 1NC LIMIT SWITCH & TORQUE SWITCH.
5. SS TAG NAME PLATE SHALL BE PROVIDED.
6. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
7. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, Ni PLATED BRASS MATERIAL SHALL BE PROVIDED.
8. 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.
9. 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%.
10. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.
11. LOCAL DIGITAL POSITION INDICATOR SHALL BE PROVIDED FOR INCHING DUTY DRIVES. 1
12. COMMANDS SHALL BE LATCHED AT INTEGRAL STARTER END.
13. SWITCHES SHALL BE TERMINATED IN JB MOUNTED ON ACTUATOR.
14. ACTUATORS FOR HAZARDOUS AREA SHALL BE CERTIFIED FLAME PROOF FOR ZONES 1 & 2. 2

$$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.

## EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.

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

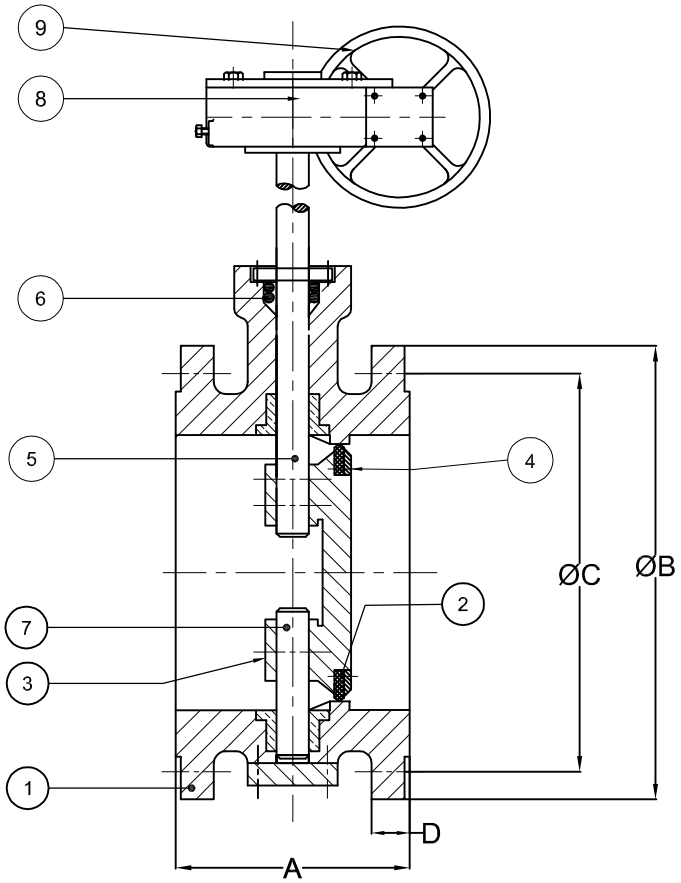
ROTORK CONTROLS (INDIA) PVT. LTD.

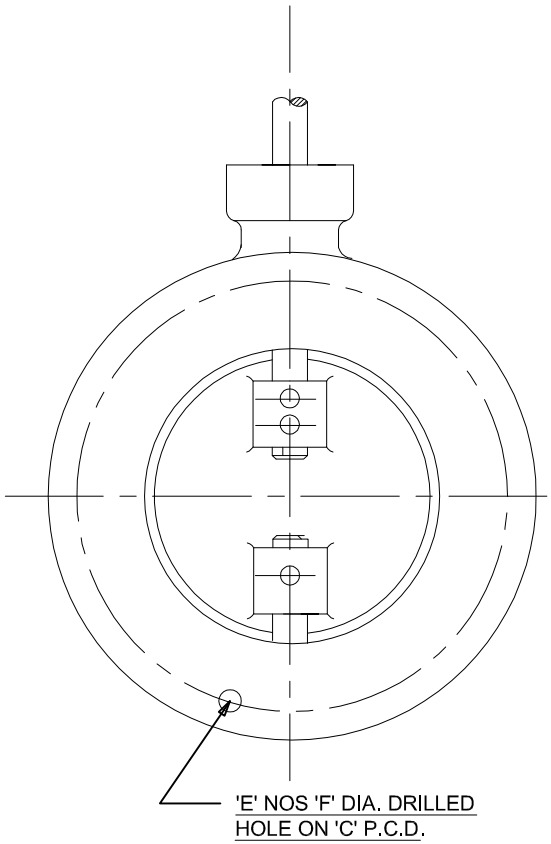
| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF BUTTERFLY VALVES | | | |
|---|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A015 | | REV NO:- 02 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/BFV/PTP/18/311 | | |
| | | MADE BY AF | CHKD BY MI | APPD BY AA |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | | |

| Sr No. | Description | | | |
|---|---|---|---|---|
| 1 | Valve Type | | Butterfly Valve | |
| 2 | Valve Design | | BS5155 | |
| 3 | Flange Standard | | ASME B 16.5 RF for 400NB<br>END FLANGED TO AWWA C207 for 800NB PN-10 | |
| | **Material Specification** | | | |
| 1 | Service | | Sludge for 400NB and Sea water for 800NB | |
| 2 | Body | | ASTM A 995 GR 5A-CE3MN | |
| 3 | Disc | | ASTM A 995 GR 5A-CE3MN | |
| 4 | Shaft/Spinldle | | ASTM A 995 GR 5A-CE3MN | |
| 5 | Seat rings | | Nitrile rubber / EPDM | |
| 6 | Stud, Stud Nut, Eye Bolt Nut / Fasteners | | SS 316L | |
| 7 | Hand Wheel | | MS to IS:2062 / Cast Iron | |
| 8 | End Connection | | ASME B 16.5 RF for 400NB<br>END FLANGED TO AWWA C207 for 800NB PN-10 | |
| 9 | Size & Quantity | KKS No. - 90GAA01AA651<br>90GAA01AA652 | 400NB - 2 Nos. | Location: Sludge Transfer Pump outlet recirculation/guard pond pipeline |
| | | KKS No. - 90GBD01AA502<br>90GBD01AA503<br>90GBD01AA504<br>90GBD01AA505<br>90GBD01AA509 | 800NB - 5 Nos. | Location-Sea Water Inlet valve station |
| 10 | Operation Type | | GEAR BOX OPERATED | |
| 11 | Leakage Class | | VI | |
| 12 | Range of Flow Control | | 0-100% | |
| 13 | Valve Rating | | PN 10 | |
| 14 | Test duration | | Body: 5 min | Seat: 2 min |
| 15 | Design Pressure | | 11 Bar | |
| 16 | Test Pressure: | | PN 10 | |
| 17 | Testing standard | | API 598 | |
| 18 | Face to Face Distance | | AWWA-C-504 / BS 5155 / API 609 | |
| 19 | Set Testing Pressure | | Body: 15 Bar | Seat: 11 Bar |
| 20 | Accessories | | Limit switches to indicate full open/closed position of valve | |
| 21 | Painting | | As per approved painting specification | |
| 22 | MAKE | | Venus Pump and Engineering works | |

# DOUBLE FLANGED BUTTERFLY VALVE

| VALVE SIZE | FACE TO FACE | FLANGE DETAILS | | | | | DRILLIING STD. | SERVICE | QTY. |
|---|---|---|---|---|---|---|---|---|---|
| | | O.D. | P.C.D. | THICK. | HOLE NO. | HOLE DIA. | | | |
| N.B. | A±5 | B | C | D | E | F | -- | -- | NOS. |
| 400 | 216 | 596.9 | 539.8 | 30 | 16 | 28.6 | ASME B-16.5 R/F | SLUDGE | 02 |
| 800 | 318 | 1060 | 977.9 | 38 | 28 | 41.2 | AWWA C207 | SEA WATER | 05 |




NOTES :
1. ALL DIMENSIONS ARE IN M.M.
2. STANDARD TOLERANCES ARE APPLICABLE.
3. WE RESERVE OUR RIGHT FOR MINOR DESIGN CHANGES.

| SL.NO. | DESCRIPTION | QTY. | MATERIAL | SPECIFICATION |
|---|---|---|---|---|
| 9 | HAND WHEEL | 1 | C.I. | IS:210 FG-260 |
| 8 | WORM GEAR BOX | 1 | INDIGINIOUS | |
| 7 | STUB SHAFT | 1 | D.S.S. | ASTM A276 |
| 6 | PACKING O-RING | As reqd. | RUBBER | NITRILE/EPDM |
| 5 | DRIVE SHAFT | 1 | D.S.S. | ASTM A276 |
| 4 | RETAINER BOLT | As reqd. | S.S. | AISI:316L |
| 3 | DISC | 1 | D.S.S. | ASTM A995 GR.5A CE3MN |
| 2 | DISC SEAT RING | 1 | RUBBER | NITRILE / EPDM |
| 1 | BODY | 1 | D.S.S. | ASTM A995 GR.5A CE3MN |

## BILL OF MATERIAL

DETAILS

| | |
|---|---|
| VALVE | BUTTERFLY |
| TYPE | FLANGE |
| MFG. STD. | BS:5155 |
| RATING | PN -10 |
| PARENT MATLS. | D.S.S. |
| TRIM MATLS. | RUBBER / D.S.S. |
| SERVICE | SEE ABOVE TABLE |

THIS DRAWING AND ITS ENCLOSURE(S) UNDER CITED DRG. NO. ARE THE SOLE PROPERTY OF VENUS PUMP & ENGINEERING WORKS. ANY ABUSE OF IT WILL BE LEGALLY DEALT WITH AT THE RISK/COST OF THE ABUSER(S).

ALL DIMENSIONS IN MM. UNLESS OTHERWISE SPECIFIED. TOLERANCES ON MACHINED DIMENSIONS ± 2 MM SCALING OF DRAWING FOR DIMENSIONS SHOULD BE AVOIDED IN ALL CASES.

| TESTING PARAMETER | HYDROSTATIC TEST PRESSURE IN BAR. | | |
|---|---|---|---|
| | BODY | SEAT | - |
| | 15 (5 MIN.) | 11 (2 MIN.) | - |

TITLE

PROJECTION

D.S.S. DOUBLE FLANGED BUTTERFLY VALVE WORM GEAR BOX OPERATED.

MAIN REF.

VENUS PUMP & ENGINEERING WORKS

BALITIKURI, SHIBTOLLA, HOWRAH - 711 113. WEST BENGAL

| REV | DATE |
|---|---|
| 01 | 00 |
| 02 | 00 |
| 03 | 00 |

| | | | |
|---|---|---|---|
| DRN. | A.GHOSH | DRG. NO. VP-RK-DFBV-19-5663 | SCALE N.T.S. |
| CHD. | C.HAZRA | | |
| APP. | R. AGARWAL | REV:00 | DATE:01.02.2019 |

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

# BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

TECHNICAL DATASHEET FOR DIAPHRAGM VALVES OF PRE TREATMENT PLANT

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | ALOYSIUS | AF | 31-05-19 |
| CHKD | MUAZZAM I | MI | 31-05-19 |
| APPD | ASLAM A | AA | 31-05-19 |

| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | PE-V0-412-158-A016 | 03 |
| DATE | | | | | | | | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/TDS/DV/PTP/18/312 | |
| | | | | | | | | NO. OF SHEETS 6 EXCLUDING COVER PAGE | |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF DIAPHRAGM VALVES | | |
|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A016 | REV NO:- 03 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/DV/PTP/18/312 | |
| | | MADE BY AF / CHKD BY MI / APPD BY AA | |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | |

| Sr No. | Description | | |
|---|---|---|---|
| 1 | Valve Type | Diaphragm Valve | |
| 2 | Valve Design | BS:5156 or equivalent of required rating/class | |
| 3 | Flange Standard | ANSI B 16.5, 150# | |
| | **Material Specification** | | |
| 1 | Service (R2) | FeCl3 and NaOCl dosing (Instrument Isolation Purpose) | |
| 2 | Body (R2) | Duplex Stainless steel. | |
| 3 | Diaphragm | Neoprene / PTFE | |
| 4 | Stem (R2) | Duplex Stainless steel. | |
| 5 | Compressor & Bush (R2) | Duplex Stainless steel. | |
| 6 | Hand wheel | Cast Iron IS 210 Gr. FG 260 | |
| 7 | End Connection | FLANGED ENDS, DRILLED TO B 16.5, 150#-SOFF | |
| 8 | Bolts and Nuts / Fasteners (R3) | SS 316 | |
| 9 | Size & Quantity (R2) | 25NB - 8 Nos. | KKS No. - 90GAA01AA545 / 90GAA01AA546<br>90GAA01AA548 / 90GAA01AA549<br>90GAA01AA551 / 90GAA01AA552<br>90GAA01AA566 / 90GAA01AA567 |
| 10 | Operation Type | Manual | |
| 11 | Leakage Class | VI | |
| 12 | Range of Flow Control | 0-100% | |
| 13 | Valve Rating | PN 10 | |
| 14 | Test duration | Body: 1 min | Seat: 1 min |
| 15 | Design Pressure | 11 Bar | |
| 16 | Test Pressure: | PN 10 | |
| 17 | Testing standard | API 598 | |
| 18 | Face to Face Distance | BS 5156 | |
| 19 | Set Testing Pressure | Body: 15 Bar | Seat: 10 Bar |
| 20 | Painting | As per approved painting specification | |
| 21 | MAKE | Venus Pump & Engineering Works | |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF DIAPHRAGM VALVES | | |
|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A016 | REV NO:- 03 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/DV/PTP/18/312 | |
| | | MADE BY AF / CHKD BY MI / APPD BY AA | |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | |

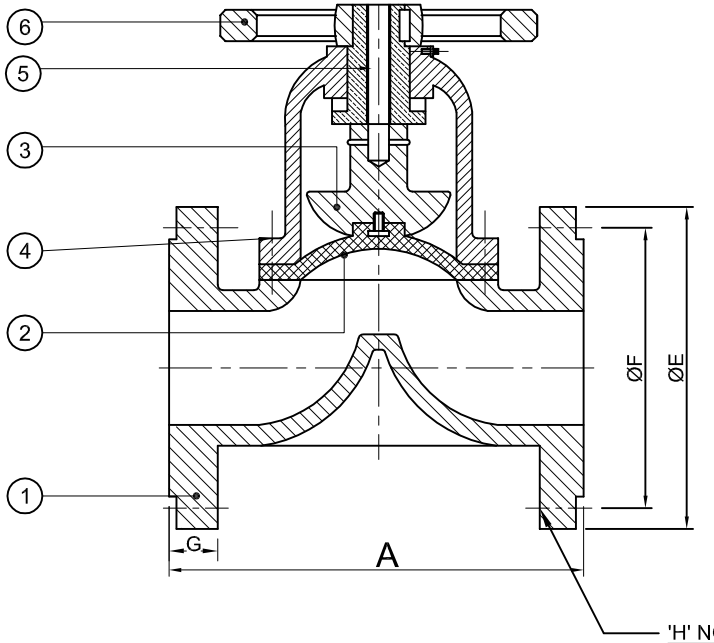
| Sr No. | Description | | |
|---|---|---|---|
| 1 | Valve Type | Diaphragm Valve | |
| 2 | Valve Design | BS:5156 or equivalent of required rating/class | |
| 3 | Flange Standard | ANSI B 16.5, 150# | |
| | **Material Specification** | | |
| 1 | Service (R2) | FeCl3 and NaOCl dosing | |
| 2 | Body (R2) | Duplex Stainless steel. | |
| 3 | Diaphragm | Neoprene / PTFE | |
| 4 | Stem (R2) | Duplex Stainless steel. | |
| 5 | Compressor & Bush (R2) | Duplex Stainless steel. | |
| 6 | Hand wheel | Cast Iron IS 210 Gr. FG 260 | |
| 7 | End Connection | FLANGED ENDS, DRILLED TO B 16.5, 150#-SOFF | |
| 8 | Bolts and Nuts / Fasteners (R3) | SS 316L | |
| 9 | Size & Quantity (R2) | 25NB - 6 Nos. | KKS No. - 90GAA01AA568 / 90GAA01AA588 90GAA01AA620 / 90GAA01AA623 90GAA01AA625 / 90GAA01AA628 |
| | | 40NB - 11 Nos. | KKS No. - 90GAA01AA573 / 90GAA01AA574 90GAA01AA575 / 90GAA01AA580 90GAA01AA581 / 90GAA01AA582 90GAA01AA583 / 90GAA01AA590 90GAA01AA592 / 90GAA01AA595 90GAA01AA598 |
| 10 | Operation Type | Manual | |
| 11 | Leakage Class | VI | |
| 12 | Range of Flow Control | 0-100% | |
| 13 | Valve Rating | PN 10 | |
| 14 | Test duration | Body: 1 min | Seat: 1 min |
| 15 | Design Pressure | 11 Bar | |
| 16 | Test Pressure: | PN 10 | |
| 17 | Testing standard | API 598 | |
| 18 | Face to Face Distance | BS 5156 | |
| 19 | Set Testing Pressure | Body: 15 Bar | Seat: 10 Bar |
| 20 | Painting | As per approved painting specification | |
| 21 | MAKE | Venus Pump & Engineering Works | |

**S.S. DIAPHRAGM VALVE**

| VALVE SIZE | FACE TO FACE | FLANGE DETAILS | | | | | QTY. |
|---|---|---|---|---|---|---|---|
| | | O.D. | P.C.D. | THICK. | HOLE NO. | HOLE DIA. | |
| N.B. | A±2 | E | F | G | H | I | NOS. |
| 25 | 127 | 108 | 79.4 | 12 | 4 | 15.9 | 6 + 8 |
| 40 | 159 | 127 | 98.4 | 14.3 | 4 | 15.9 | 11 |

NOTES :-

1. ALL DIMENSION ARE IN 'MM'
2. FLANGE DRILLING AS PER :- ANSI B-16.5 CL-150# R/F.
3. WE RESERVE OUR RIGHTS FOR MINOR DESIGN CHANGES
4. SERVICE: FeCl3 and NaOCl DOSING




| SL.NO. | DESCRIPTION | MATERIAL | SPECIFICATION |
|---|---|---|---|
| 6 | HAND WHEEL | CAST IRON | IS : 210, FG-260 |
| 5 | STEM | S.S. | DUPLEX |
| 4 | BOLTS & NUTS | S.S. | AISI: 316L |
| 3 | COMPRESSOR | S.S. | ASTM A890-5A(CE 3MN) |
| 2 | DIAPHRAGM | RUBBER | NEOPRINE/PTFE |
| 1 | BODY | S.S. | ASTM A890-5A(CE 3MN) |

BILL OF MATERIAL

| DETAILS | | |
|---|---|---|
| VALVE | DIAPHRAGM | |
| TYPE | WEIR PATTERN | |
| MFG. STD. | BS : 5156 | |
| RATING | PN-10 | |
| PARENT MATLS. | S.S. | |
| TRIM MATLS. | RUBBER | |
| SERVICE | CHEMICAL DOSING | |

THIS DRAWING AND ITS ENCLOSURE(S) UNDER CITED DRG. NO. ARE THE SOLE PROPERTY OF VENUS PUMP & ENGINEERING WORKS. ANY ABUSE OF IT WILL BE LEGALLY DEALT WITH AT THE RISK/COST OF THE ABUSER(S).

ALL DIMENSIONS IN MM. UNLESS OTHERWISE SPECIFIED.
TOLERANCES ON MACHINED DIMENSIONS ±2 mm UNLESS OTHERWISE SPECIFIED.
SCALING OF DRAWING FOR DIMENSIONS SHOULD BE AVOIDED IN ALL CASES.

| TESTING PARAMETER | HYDROSTATIC TEST PRESSURE IN BAR. | | |
|---|---|---|---|
| | BODY | SEAT | - |
| | 15 (1MIN.) | 11 (1MIN.) | |

TITLE

PROJECTION

D.S.S. DOUBLE FLANGED,DIAPHRAGM VALVE .

MAIN REF.

VENUS PUMP & ENGINEERING WORKS
BALITIKURI, SHIBTOLLA, HOWRAH - 711 113. WEST BENGAL

| REV | DATE |
|---|---|
| 01 | 00 |
| 02 | 00 |
| 03 | 00 |

| | | | | |
|---|---|---|---|---|
| DRN. | A.GHOSH | DRG. NO. VP-RK-DFV-19-5750 | | SCALE |
| CHD. | C.HAZRA | | | N.T.S. |
| APP. | R. AGARWAL | REV:00 | DATE:24.05.2019 | |



C:\VENUS PUMP\BERA RAKESH\DIAFRAME VALVE\STANDARD\VP-RK-DFV-19-5750.dwg

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF DIAPHRAGM VALVES | | |
|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A016 | REV NO:- 03 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/DV/PTP/18/312 | |
| | | MADE BY AF / CHKD BY MI / APPD BY AA | |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | |

| Sr No. | Description | | |
|---|---|---|---|
| 1 | Valve Type | Diaphragm Valve | |
| 2 | Valve Design | BS:5156 or equivalent of required rating/class | |
| 3 | Flange Standard | ANSI B 16.5, 150# | |
| | **Material Specification** | | |
| 1 | Service (R2) | Lime and PE dosing (Instrument Isolation Purpose) | |
| 2 | Body | SS 316 | |
| 3 | Diaphragm | Neoprene / PTFE | |
| 4 | Stem | SS 316 | |
| 5 | Compressor & Bush | SS 316 | |
| 6 | Hand wheel | Cast Iron IS 210 Gr. FG 260 | |
| 7 | End Connection | FLANGED ENDS, DRILLED TO B 16.5, 150#-SOFF | |
| 8 | Bolts and Nuts / Fasteners (R3) | SS 316 | |
| 9 | Size & Quantity (R2) | 25NB - 10 Nos. | KKS No. - 90GAA01AA554 / 90GAA01AA555<br>90GAA01AA557 / 90GAA01AA558<br>90GAA01AA560 / 90GAA01AA561<br>90GAA01AA563 / 90GAA01AA564<br>90GAA01AA569 / 90GAA01AA570 |
| 10 | Operation Type | Manual | |
| 11 | Leakage Class | VI | |
| 12 | Range of Flow Control | 0-100% | |
| 13 | Valve Rating | PN 10 | |
| 14 | Test duration | Body: 1 min | Seat: 1 min |
| 15 | Design Pressure | 11 Bar | |
| 16 | Test Pressure: | PN 10 | |
| 17 | Testing standard | API 598 | |
| 18 | Face to Face Distance | BS 5156 | |
| 19 | Set Testing Pressure | Body: 15 Bar | Seat: 10 Bar |
| 20 | Painting | As per approved painting specification | |
| 21 | MAKE | Venus Pump & Engineering Works | |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF DIAPHRAGM VALVES | | |
|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A016 | REV NO:- 03 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/DV/PTP/18/312 | |
| | | MADE BY AF / CHKD BY MI / APPD BY AA | |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | |

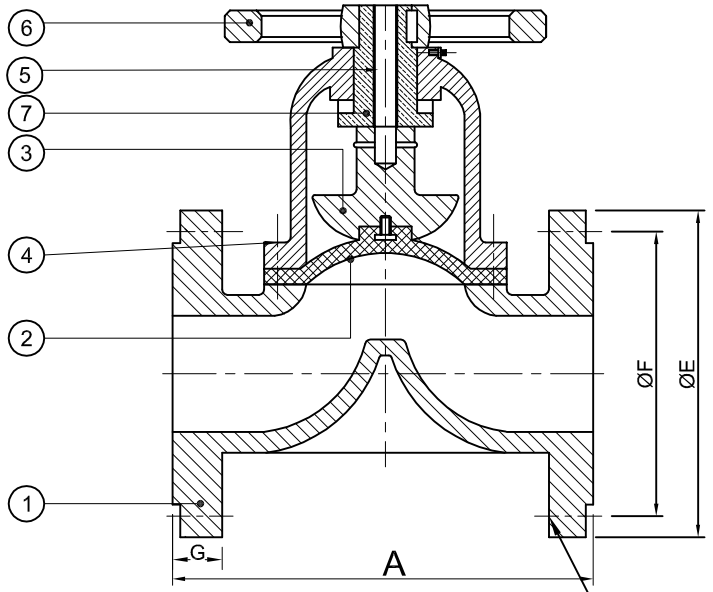
| Sr No. | Description | | |
|---|---|---|---|
| 1 | Valve Type | Diaphragm Valve | |
| 2 | Valve Design | BS:5156 or equivalent of required rating/class | |
| 3 | Flange Standard | ANSI B 16.5, 150# | |
| | **Material Specification** | | |
| 1 | Service (R2) | Lime and PE dosing | |
| 2 | Body | SS 316 | |
| 3 | Diaphragm | Neoprene / PTFE | |
| 4 | Stem | SS 316 | |
| 5 | Compressor & Bush | SS 316 | |
| 6 | Hand wheel | Cast Iron IS 210 Gr. FG 260 | |
| 7 | End Connection | FLANGED ENDS, DRILLED TO B 16.5, 150#-SOFF | |
| 8 | Bolts and Nuts / Fasteners (R3) | SS 316 | |
| 9 | Size & Quantity (R2) | 25NB - 6 Nos. | KKS No. - 90GAA01AA587 / 90GAA01AA586 90GAA01AA610 / 90GAA01AA612 90GAA01AA615 / 90GAA01AA618 |
| | | 40NB - 3 Nos. | KKS No. - 90GAA01AA579 / 90GAA01AA578 90GAA01AA572 |
| 10 | Operation Type | Manual | |
| 11 | Leakage Class | VI | |
| 12 | Range of Flow Control | 0-100% | |
| 13 | Valve Rating | PN 10 | |
| 14 | Test duration | Body: 1 min | Seat: 1 min |
| 15 | Design Pressure | 11 Bar | |
| 16 | Test Pressure: | PN 10 | |
| 17 | Testing standard | API 598 | |
| 18 | Face to Face Distance | BS 5156 | |
| 19 | Set Testing Pressure | Body: 15 Bar | Seat: 10 Bar |
| 20 | Painting | As per approved painting specification | |
| 21 | MAKE | Venus Pump & Engineering Works | |

**S.S. DIAPHRAGM VALVE**

| VALVE SIZE | FACE TO FACE | FLANGE DETAILS | | | | | QTY. |
|---|---|---|---|---|---|---|---|
| | | O.D. | P.C.D. | THICK. | HOLE NO. | HOLE DIA. | |
| N.B. | A±2 | E | F | G | H | I | NOS. |
| 25 | 127 | 108 | 79.4 | 12 | 4 | 15.9 | 6 + 10 |
| 40 | 159 | 127 | 98.4 | 14.3 | 4 | 15.9 | 3 |

NOTES :-

1. ALL DIMENSION ARE IN 'MM'
2. FLANGE DRILLING AS PER :- ANSI B-16.5 CL-150# R/F.
3. WE RESERVE OUR RIGHTS FOR MINOR DESIGN CHANGES
4. SERVICE: LIME PE DOSING




'H' NOS,I DIA ,DRILLED HOLE ON 'F' P.C.D

| SL.NO. | DESCRIPTION | MATERIAL | SPECIFICATION |
|---|---|---|---|
| 7 | BUSH | S.S. | AISI:316 |
| 6 | HAND WHEEL | CAST IRON | IS : 210, FG-260 |
| 5 | STEM | S.S. | AISI:316 |
| 3 4 | BOLTS & NUTS | S.S. | AISI:316 |
| 3 | COMPRESSOR | S.S. | AISI:316 |
| 2 | DIAPHRAGM | RUBBER | NEOPRINE/PTFE |
| 1 | BODY | S.S. | ASTM A351 CF8M (SS316) |

BILL OF MATERIAL

| DETAILS | | |
|---|---|---|
| VALVE | DIAPHRAGM | |
| TYPE | WEIR PATTERN | |
| MFG. STD. | BS : 5156 | |
| RATING | PN-10 | |
| PARENT MATLS. | S.S. | |
| TRIM MATLS. | RUBBER | |
| SERVICE | CHEMICAL DOSING | |

THIS DRAWING AND ITS ENCLOSURE(S) UNDER CITED DRG. NO. ARE THE SOLE PROPERTY OF VENUS PUMP & ENGINEERING WORKS. ANY ABUSE OF IT WILL BE LEGALLY DEALT WITH AT THE RISK/COST OF THE ABUSER(S).

ALL DIMENSIONS IN MM. UNLESS OTHERWISE SPECIFIED. TOLERANCES ON MACHINED DIMENSIONS ±2 mm UNLESS OTHERWISE SPECIFIED. SCALING OF DRAWING FOR DIMENSIONS SHOULD BE AVOIDED IN ALL CASES.

| TESTING PARAMETER | HYDROSTATIC TEST PRESSURE IN BAR. | | |
|---|---|---|---|
| | BODY | SEAT | - |
| | 15 (1MIN.) | 11 (1MIN.) | |

TITLE

PROJECTION

S.S. DOUBLE FLANGED,DIAPHRAGM VALVE .

MAIN REF.

VENUS PUMP & ENGINEERING WORKS

BALITIKURI, SHIBTOLLA, HOWRAH - 711 113. WEST BENGAL

| REV | DATE |
|---|---|
| 01 | 24.05.19 |
| 02 | 00 |
| 03 | 00 |

| | | | |
|---|---|---|---|
| DRN. | A.GHOSH | DRG. NO. VP-RK-DFV-19-5670 | SCALE N.T.S. |
| CHD. | C.HAZRA | | |
| APP. | R. AGARWAL | REV:00 | DATE:02.02.2019 |



C:\VENUS PUMP\BERA RAKESH\DIAFRAME VALVE\STANDARD\VP-RK-DFV-19-5670R1.dwg

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

# BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

TECHNICAL DATASHEET FOR GATE VALVES & GLOBE VALVES OF PRE TREATMENT PLANT

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | ALOYSIUS | AF | 27-05-19 |
| CHKD | MUAZZAM I | MI | 27-05-19 |
| APPD | ASLAM A | AA | 27-05-19 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

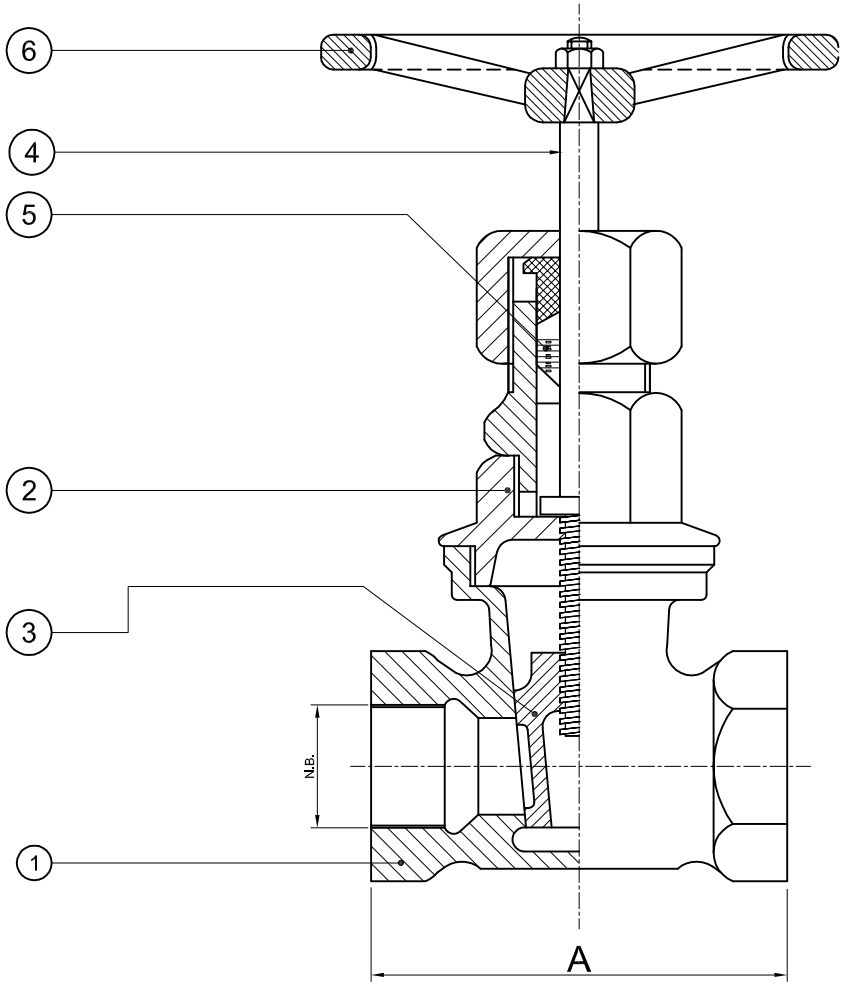
| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. PE-V0-412-158-A017 | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/TDS/GV/PTP/18/313 | 02 |
| DATE | | | | | | | | NO. OF SHEETS 10 EXCLUDING COVER PAGE | |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF GATE VALVES | | |
|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A017 | REV NO:-02 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/GV/PTP/18/313 | |
| | | MADE BY AF / CHKD BY MI / APPD BY AA | |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | |

| Sr No. | Description | | |
|---|---|---|---|
| 1 | Valve Type | Gate Valve | |
| 2 | Valve Design | BS 5352 or equivalent of Required rating/class | |
| | **Material Specification** | | |
| 1 | Service | Sea water and clarified water | |
| 2 | Body | ASTM A890-5A (CE3MN) | |
| 3 | Spindle/Stem | Duplex Stainless Steel. | |
| 4 | Body face ring | Intergral | |
| 5 | Wedge face ring | Intergral | |
| 6 | Bonnet & Disc | ASTM A890-5A (CE3MN) | |
| 7 | Seat & seat rings | Integral | |
| 8 | Gland Packing | PTFE | |
| 9 | Gland Nut | Duplex Stainless Steel. | |
| 10 | Hand wheel | Cast Iron IS 210 Gr. FG 260 | |
| 11 | End Connection | Female Screwed ends NPT | |
| 12 | Size & Quantity | 15NB - 9 Nos | KKS No. - 90GAA01AA501 / 90GAA01AA512<br>90GAA01AA513 / 90GAA01AA514<br>90GAA01AA515 / 90GAA01AA516<br>90GAA01AA518 / 90GAA01AA521<br>90GAA01AA642 |
| 13 | Operation Type | Manual | |
| 14 | Leakage Class | VI | |
| 15 | Range of Flow Control | 0-100% | |
| 16 | Valve Rating | PN 10 | |
| 17 | Test duration | Body: 1 min | Seat: 1 min |
| 18 | Design Pressure | 22 kg/sq.cm | |
| 19 | Test Pressure: | PN 10 | |
| 20 | Testing standard | API 598 | |
| 21 | Face to Face Distance | ASME B 16.10 | |
| 22 | Set Testing Pressure | Body: 15 Bar | Seat: 11 Bar |
| 23 | Painting | As per approved painting specification | |
| 24 | MAKE | Venus Pump and Engineering works | |

# GATE VALVE

| VALVE SIZE | FACE TO FACE | QTY. |
|---|---|---|
| N.B. | A ±2 | NOS. |
| 15 | 57 | 09 |




NOTE

1. ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE SPECIFIED.
2. STANDARD TOLERANCES ARE APPLICABLE.
3. VALVE SHALL BE NPT FEMALE SCREWED END.
4. WE RESERVE OUR RIGHTS FOR MINOR DESIGN CHANGES.

| SL.NO. | DESCRIPTION | QTY. | MATERIAL | SPECIFICATION |
|---|---|---|---|---|
| 6 | HAND WHEEL | 1 | C.I. | IS:210 GR. FG 260 |
| 5 | PACKING | As reqd. | PTFE | -- |
| 4 | STEM / SPINDLE | 1 | D.S.S | ASTM A276 |
| 3 | WEDGE WITH INTEGRAL SEAT | 1 | D.S.S | ASTM A890-5A (CE 3MN) |
| 2 | BONNET | 1 | D.S.S | ASTM A890-5A (CE 3MN) |
| 1 | BODY WITH INTEGRAL SEAT | 1 | D.S.S | ASTM A890-5A (CE 3MN) |

BILL OF MATERIAL

DETAILS

| | |
|---|---|
| VALVE | GATE |
| TYPE | NON-RISING |
| MFG. STD. | BS:5352 |
| RATING | PN-10 |
| PARENT MATLS. | D.S.S |
| TRIM MATLS. | D.S.S |
| SERVICE | SEA WATER AND CLARIFIED WATER |

THIS DRAWING AND ITS ENCLOSURE(S) UNDER CITED DRG NO. ARE THE SOLE PROPERTY OF VENUS PUMP & ENGINEERING WORKS. ANY ABUSE OF IT WILL BE LEGALLY DEALT WITH AT THE RISK/COST OF THE ABUSER(S).

ALL DIMENSIONS IN MM, UNLESS OTHERWISE SPECIFIED.
TOLERANCES ON MACHINED DIMENSIONS ±2 mm UNLESS OTHERWISE SPECIFIED.
SCALING OF DRAWING FOR DIMENSIONS SHOULD BE AVOIDED IN ALL CASES.

HYDROSTATIC TEST PRESSURE

| HYDROSTATIC TEST PRESSURE BAR. | | |
|---|---|---|
| BODY | SEAT | – |
| 15 (1 MIN.) | 11 (1 MIN.) | --- |

TITLE

PROJECTION

D.S.S. SCREWED END NON-RISING SPINDLE GATE VALVE.

MAIN REF.

VENUS PUMP & ENGINEERING WORKS
BALITIKURI, SHIBTOLLA, HOWRAH - 711 113. WEST BENGAL

| REV | DATE |
|---|---|
| 01 | 00 |
| 02 | 00 |
| 03 | 00 |

| | | | |
|---|---|---|---|
| DRN. | A.GHOSH | DRG. NO. VP-RK-FSGV-19-5671 | SCALE N.T.S. |
| CHD. | C.HAZRA | | |
| APP. | R.AGARWAL | REV:00 | DATE:02.02.2019 |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF GATE VALVES | | |
|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A017 | REV NO:- 02 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/GV/PTP/18/313 | |
| | | MADE BY AF / CHKD BY MI / APPD BY AA | |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | |

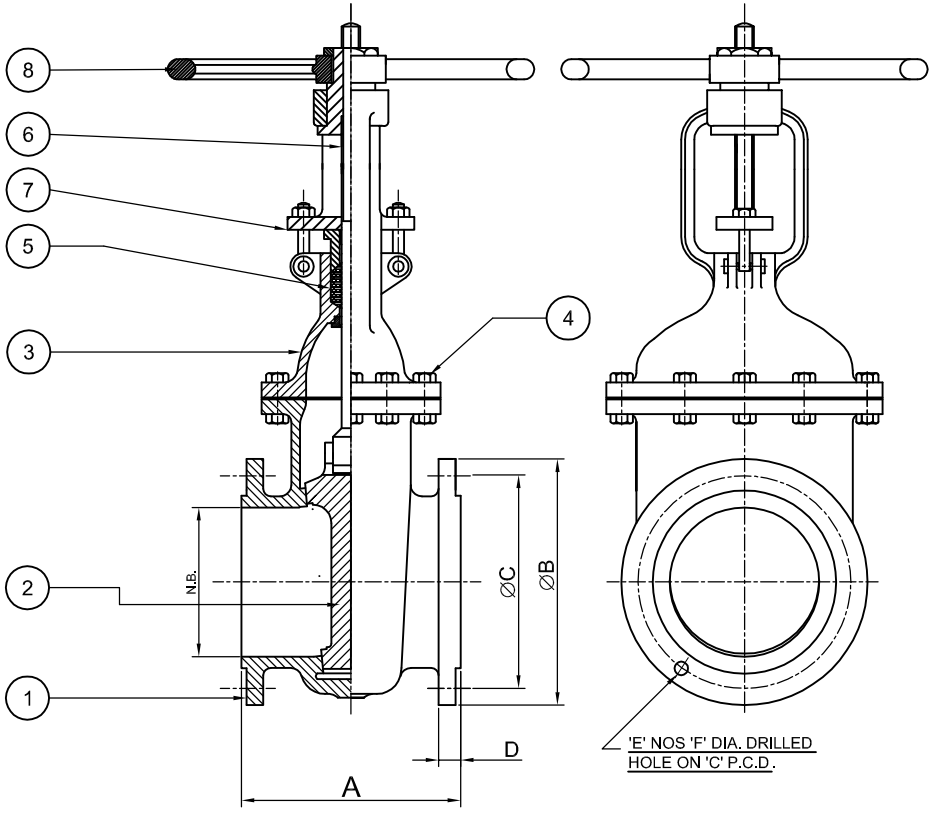
| Sr No. | Description | | |
|---|---|---|---|
| 1 | Valve Type | Gate Valve | |
| 2 | Valve Design | API 600 or equivalent of Required rating/class | |
| 3 | Flange Standard | ASME B 16.5 RF Serreted Finish150 AARH | |
| | **Material Specification** | | |
| 1 | Service | Sea water sludge | |
| 2 | Body | ASTM A890-5A (CE3MN) | |
| 3 | Spindle/Stem | Duplex Stainless Steel. | |
| 4 | Body face ring | Duplex Stainless Steel. | |
| 5 | Wedge face ring | Duplex Stainless Steel. | |
| 6 | Bonnet & Disc | ASTM A890-5A (CE3MN) | |
| 7 | Seat & seat rings | Duplex Stainless Steel. | |
| 8 | Gland Packing | GRAPHITE RING/PTFE | |
| 9 | Gland flange | Duplex Stainless Steel. | |
| 10 | Hand wheel | Cast Iron IS 210 Gr. FG 260 | |
| 11 | Stud, Stud Nut, Eye Bolt Nut / Fasteners | SS 316L | |
| 12 | End Connection | ASME B 16.5 RF Serreted Finish150 AARH | |
| 13 | Size & Quantity | 80NB - 2 Nos. | KKS No. - 90GAA01AA510 / 90GAA01AA511 |
| 14 | Operation Type | Manual | |
| 15 | Leakage Class | IV | |
| 16 | Range of Flow Control | 0-100% | |
| 17 | Valve Rating | PN 10 | |
| 18 | Test duration | Body: 1 min | Seat: 1 min |
| 19 | Design Pressure | 22 kg/sq.cm | |
| 20 | Test Pressure: | PN 10 | |
| 21 | Testing standard | API 598 | |
| 22 | Face to Face Distance | ASME B 16.10 | |
| 23 | Set Testing Pressure | Body: 15 Bar | Seat: 11 Bar |
| 24 | Painting | As per approved painting specification | |
| 25 | MAKE | Venus Pump and Engineering works | |

**D.S.S GATE VALVE**

| VALVE SIZE | FACE TO FACE | FLANGE DETAILS | | | | | QTY. |
|---|---|---|---|---|---|---|---|
| | | O.D. | P.C.D. | THICK. | HOLE NO. | HOLE DIA. | |
| N.B. | A±2 | B | C | D | E | F | NOS. |
| 80 | 203 | 190.5 | 152.4 | 19.1 | 04 | 19 | 02 |

NOTE

1. ALL DIMENSIONS ARE IN MM. UNLESS OTHERWISE SPECIFIED.
2. STANDARD TOLERANCES ARE APPLICABLE.
3. FLANGED END DRILLED TO ANSI B 16.5 CL-150#R/F.
4. WE RESEVE OUR RIGHTS FOR MINOR DESIGN CHANGES.




| SL.NO | DESCRIPTION | QTY. | MATERIAL | SPECIFICATION |
|---|---|---|---|---|
| 8 | HAND WHEEL | 1 | C.I. | IS:210 GR.FG-260 |
| 7 | GLAND FLANGE | 1 | D.S.S. | ASTM A890-5A(CE 3MN) |
| 6 | SPINDLE | 1 | D.S.S. | ASTM A276 |
| 5 | GLAND PACKING | 1 | GRAPHITE RING/PTFE | -- |
| 4 | STUDS & NUTS | As reqd. | S.S. | AISI:316L |
| 3 | BONNET | 1 | D.S.S. | ASTM A890-5A(CE 3MN) |
| 2 | WEDGE WITH INTEGRAL SEAT | 1 | D.S.S. | ASTM A890-5A(CE 3MN) |
| 1 | BODY WITH INTEGRAL SEAT | 1 | D.S.S. | ASTM A890-5A(CE 3MN) |

BILL OF MATERIAL

DETAILS

| | |
|---|---|
| VALVE | GATE |
| TYPE | OS & Y |
| MFG. STD. | API : 600 |
| RATING | PN-10 |
| PARENT MATLS. | D.S.S. |
| TRIM MATLS. | D.S.S. |
| SERVICE | SEA WATER /SLUDGE |

THIS DRAWING AND ITS ENCLOSURE(S) UNDER CITED DRG. NO. ARE THE SOLE PROPERTY OF VENUS PUMP & ENGINEERING WORKS. ANY ABUSE OF IT WILL BE LEGALLY DEALT WITH AT THE RISK/COST OF THE ABUSER(S).

ALL DIMENSIONS IN MM. UNLESS OTHERWISE SPECIFIED.
TOLERANCES ON MACHINED DIMENSIONS ± 2 mm UNLESS OTHERWISE SPECIFIED.
SCALING OF DRAWING FOR DIMENSIONS SHOULD BE AVOIDED IN ALL CASES.

| TESTING PARAMETER | HYDROSTATIC TEST PRESSURE IN BAR. | | |
|---|---|---|---|
| | BODY | SEAT | – |
| | 15 (1 MIN.) | 11 (1 MIN.) | -- |

TITLE

PROJECTION

TITLE

D.S.S. DOUBLE FLANGED, RISING SPINDLE TAPER WEDGE GATE VALVE

MAIN REF.

VENUS PUMP & ENGINEERING WORKS

BALITIKURI, SHIBTOLLA, HOWRAH - 711 113. WEST BENGAL

| REV | DATE |
|---|---|
| 01 | 00 |
| 02 | 00 |
| 03 | 00 |

| | | | |
|---|---|---|---|
| DRN. | A.GHOSH | DRG. NO. VP-RK-DSSGV-19-5672 | SCALE |
| CHD. | C.HAZRA | | N.T.S. |
| APP. | R. AGARWAL | REV:00 | DATE: 02.02.2019 |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF GLOBE VALVES | | |
|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A017 | REV NO:- 02 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/GV/PTP/18/313 | |
| | | MADE BY AF / CHKD BY MI / APPD BY AA | |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | |

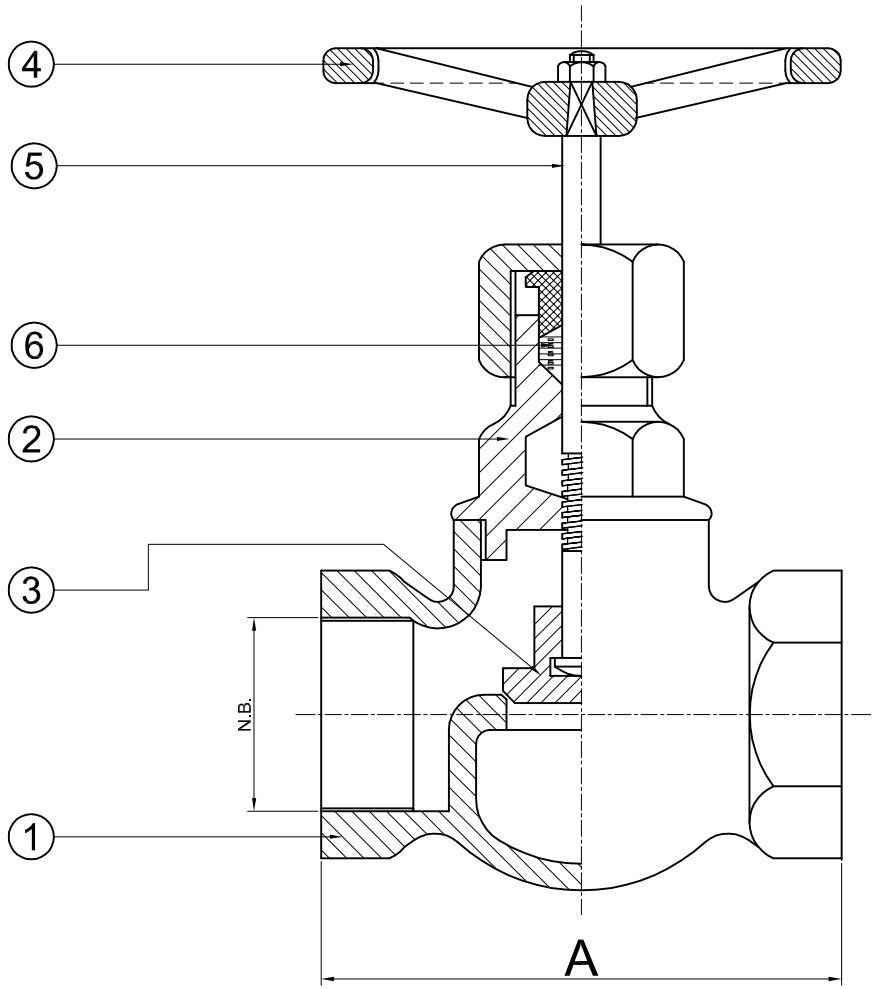
| Sr No. | Description | | |
|---|---|---|---|
| 1 | Valve Type | Globe Valve | |
| 2 | Valve Design | BS 5352 or equivalent of Required rating/class | |
| | **Material Specification** | | |
| 1 | Service (R2) | Sea water / Sludge / FeCl3 and NaOCl dosing (Instrument Isolation Purpose) | |
| 2 | Body | ASTM A890-5A (CE3MN) | |
| 3 | Spindle/Stem | Duplex SS | |
| 4 | Seat Ring | ASTM A890-5A (CE3MN) | |
| 5 | Stem Packing | Graphite / PTFE | |
| 6 | Disc | ASTM A890-5A (CE3MN) | |
| 7 | Bonnet | ASTM A890-5A (CE3MN) | |
| 8 | Bonnet Gasket | GRAPHITE RING / PTFE RING | |
| 9 | Gland Packing | GRAPHITE RING / PTFE RING | |
| 10 | Gland flange | ASTM A890-5A (CE3MN) | |
| 11 | Yoke Bush | SS 316 /D2 | |
| 12 | Hand wheel | Carbon Steel ASTM A216 Gr WCB | |
| 13 | Stud, Stud Nut, Eye Bolt Nut / Fasteners | SS 316L | |
| 14 | End Connection | Female Screwed ends NPT | |
| 15 | Size & Quantity (R2) | 15NB - 18 Nos | KKS No. - 90GAA01AA530 / 90GAA01AA531<br>90GAA01AA533 / 90GAA01AA534<br>90GAA01AA536 / 90GAA01AA537<br>90GAA01AA637 / 90GAA01AA640<br>90GAA01AA641 / 90GAA01AA650<br>90GAA01AA593 / 90GAA01AA596<br>90GAA01AA629 / 90GAA01AA630<br>90GAA01AA621 / 90GAA01AA626<br>90GAA01AA635 / 90GAA01AA636 |
| 16 | Operation Type | Manual | |
| 17 | Leakage Class | VI | |
| 18 | Range of Flow Control | 0-100% | |
| 19 | Valve Rating | PN 10 | |
| 20 | Test duration | Body: 15 sec | Seat: 15 sec |
| 21 | Design Pressure | 22 kg/sq.cm | |
| 22 | Test Pressure: | PN 10 | |
| 23 | Testing standard | API 598 | |
| 24 | Face to Face Distance | ASME B 16.10 | |
| 25 | Set Testing Pressure (PSIG) | Body: 15 Bar | Seat: 11 Bar |
| 26 | Painting | As per approved painting specification | |
| 27 | MAKE | Venus Pump & Engineering Works | |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF GLOBE VALVES | | |
|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A017 | REV NO:- 02 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/GV/PTP/18/313 | |
| | | MADE BY AF / CHKD BY MI / APPD BY AA | |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | |

| Sr No. | Description | | |
|---|---|---|---|
| 1 | Valve Type | Globe Valve | |
| 2 | Valve Design (R2) | BS 5352 or equivalent of Required rating/class | |
| | **Material Specification** | | |
| 1 | Service (R2) | FeCl3 and NaOCl dosing | |
| 2 | Body | ASTM A890-5A (CE3MN) | |
| 3 | Spindle/Stem | Duplex SS | |
| 4 | Seat Ring | ASTM A890-5A (CE3MN) | |
| 5 | Stem Packing | Graphite / PTFE | |
| 6 | Plug Disc | ASTM A890-5A (CE3MN) | |
| 7 | Bonnet | ASTM A890-5A (CE3MN) | |
| 8 | Bonnet Gasket | GRAPHITE RING / PTFE RING | |
| 9 | Gland Packing | GRAPHITE RING / PTFE RING | |
| 10 | Gland flange | ASTM A890-5A (CE3MN) | |
| 11 | Yoke Bush | SS 316 /D2 | |
| 12 | Hand wheel | Carbon Steel ASTM A216 Gr WCB | |
| 13 | Stud, Stud Nut, Eye Bolt Nut / Fasteners | SS 316L | |
| 14 | End Connection | Female Screwed ends NPT | |
| 15 | Size & Quantity (R2) | 25NB - 4 Nos | KKS No. - 90GAA01AA589 / 90GAA01AA591 90GAA01AA619 / 90GAA01AA624 |
| 16 | Operation Type | Manual | |
| 17 | Leakage Class | VI | |
| 18 | Range of Flow Control | 0-100% | |
| 19 | Valve Rating | PN 10 | |
| 20 | Test duration | Body: 15 sec | Seat: 15 sec |
| 21 | Design Pressure | 22 kg/sq.cm | |
| 22 | Test Pressure: | PN 10 | |
| 23 | Testing standard | API 598 | |
| 24 | Face to Face Distance | ASME B 16.10 | |
| 25 | Set Testing Pressure | Body: 15 Bar | Seat: 11 Bar |
| 26 | Painting | As per approved painting specification | |
| 27 | MAKE | Venus Pump & Engineering Works | |

# GLOBE VALVE

| VALVE SIZE | FACE TO FACE | QTY. |
|---|---|---|
| N.B. | A±5 | NOS. |
| 15 | 57 | 18 |
| 25 | 82 | 04 |




NOTE :-

1. ALL DIMENSIONS ARE IN M.M. UNLESS OTHERWISE STATED.
2. STANDARD TOLERANCES APPLICABLE.
3. END CONNECTION : FEMALE SCREWED NPT.
4. WE RESERVE OUR RIGHTS FOR MINOR DESIGN CHANGES.

| SL.NO | DESCRIPTION | QTY. | MATERIAL | SPECIFICATION |
|---|---|---|---|---|
| 6 | GLAND PACKING | AS REQD | GRAPHITE / PTFE | |
| 5 | STEM | 1 | D.S.S. | - |
| 4 | HAND WHEEL | | C.S. | ASTM A216 GR. WCB |
| 3 | DISC WITH INTEGRAL SEAT | 1 | D.S.S. | ASTM A890-5A(CE 3MN) |
| 2 | BONNET | 1 | D.S.S. | ASTM A890-5A(CE 3MN) |
| 1 | BODY WITH INTEGRAL SEAT | 1 | D.S.S. | ASTM A890-5A(CE 3MN) |

BILL OF MATERIAL

DETAILS

| | |
|---|---|
| VALVE | GLOBE |
| TYPE | O.S. & Y |
| MFG. STD. | BS:5352 |
| RATING | -- |
| PARENT MATLS. | D.S.S. |
| TRIM MATLS. | D.S.S. |
| SERVICE | SEA WATER/SLUDGE |

THIS DRAWING AND ITS ENCLOSURE(S) UNDER CITED DRG NO. ARE THE SOLE PROPERTY OF VENUS PUMP & ENGINEERING WORKS. ANY ABUSE OF IT WILL BE LEGALLY DEALT WITH AT THE RISK/COST OF THE ABUSER(S).

ALL DIMENSIONS IN MM. UNLESS OTHERWISE SPECIFIED.
TOLERANCES ON MACHINED DIMENSIONS ± 2 mm UNLESS OTHERWISE SPECIFIED.
SCALING OF DRAWING FOR DIMENSIONS SHOULD BE AVOIDED IN ALL CASES.

| HYDROSTATIC TEST PRESSURE | HYDROSTATIC TEST PRESSURE IN BAR | | | |
|---|---|---|---|---|
| | BODY | SEAT | | |
| | 15 (15 SEC) | 11 (15 SEC) | | |

TITLE

PROJECTION

TITLE
D.S.S. SCREWED END NON-RISING SPINDLE GLOBE VALVE

MAIN REF.

VENUS PUMP & ENGINEERING WORKS
BALITIKURI, SHIBTOLLA, HOWRAH - 711 113. WEST BENGAL

| REV | DATE |
|---|---|
| 01 | 24.05.19 |
| 02 | 00 |
| 03 | 00 |

| | | | |
|---|---|---|---|
| DRN. | A.GHOSH | DRG. NO. VP-RK-FSGLV-19-5674 | SCALE N.T.S. |
| CHD. | C.HAZRA | | |
| APP. | R. AGARWAL | REV:01 | DATE:02.02.2019 |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF GLOBE VALVES | | |
|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A017 | REV NO:- 02 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/GV/PTP/18/313 | |
| | | MADE BY AF / CHKD BY MI / APPD BY AA | |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | |

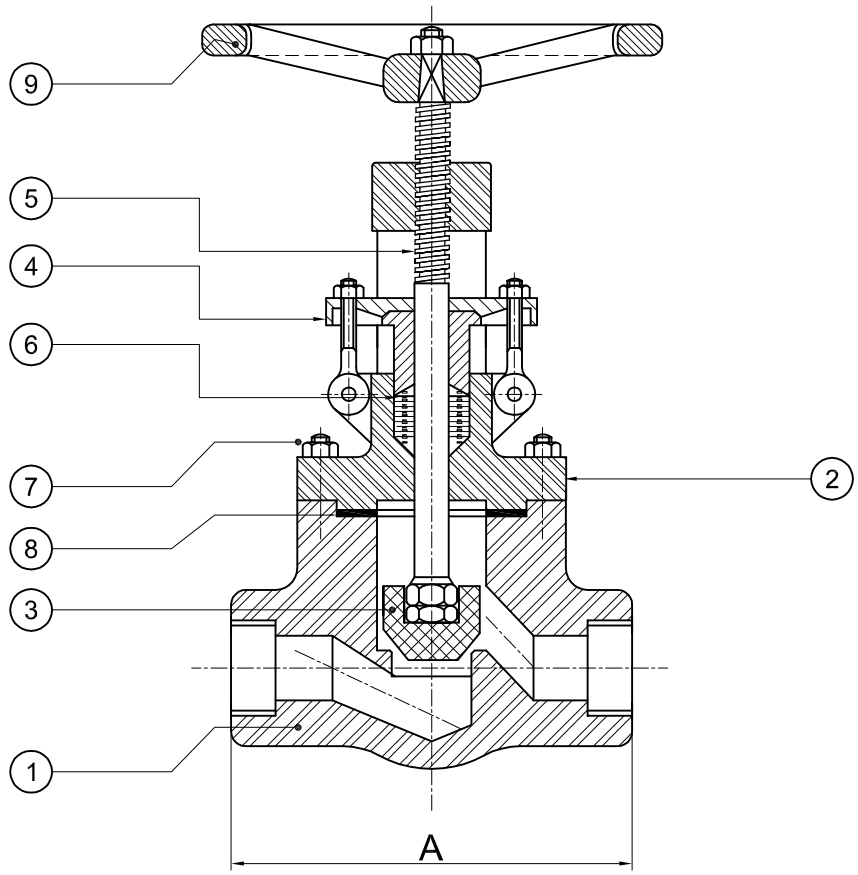
| Sr No. | Description | | |
|---|---|---|---|
| 1 | Valve Type | Globe Valve | |
| 2 | Valve Design | API 602 or equivalent of Required rating/class | |
| | **Material Specification** | | |
| 1 | Service (R2) | Lime and PE dosing / Air (Instrument Isolation Purpose) | |
| 2 | Body | FSS ASTM A 182 Gr F316 | |
| 3 | Spindle/Stem | SS AISI:316 | |
| 4 | Seat Ring | SS AISI:316 | |
| 5 | Stem Packing | Graphite / PTFE | |
| 6 | Plug Disc | SS AISI:316 | |
| 7 | Bonnet | FSS ASTM A 182 Gr F316 | |
| 8 | Bonnet Gasket | GRAPHITE RING / PTFE RING | |
| 9 | Gland Packing | GRAPHITE RING / PTFE RING | |
| 10 | Gland flange | ASTM A105/ SS 316 | |
| 11 | Yoke Bush | FSS ASTM A 182 Gr F316/D2 | |
| 12 | Hand wheel | Carbon Steel ASTM A216 Gr WCB | |
| 13 | Stud, Stud Nut, Eye Bolt Nut / Fasteners | SS 316 | |
| 14 | End Connection | Female Screwed ends NPT | |
| 15 | Size & Quantity (R2) | 15NB - 10 Nos | KKS No. - 90GAA01AA605 / 90GAA01AA608<br>90GAA01AA631 / 90GAA01AA632<br>90GAA01AA613 / 90GAA01AA616<br>90GAA01AA633 / 90GAA01AA634<br>90GAA01AA539 / 90GAA01AA542 |
| 16 | Operation Type | Manual | |
| 17 | Leakage Class | VI | |
| 18 | Range of Flow Control | 0-100% | |
| 19 | Valve Rating | PN 10 | |
| 20 | Test duration | Body: 15 sec | Seat: 15 sec |
| 21 | Design Pressure | 22 kg/sq.cm | |
| 22 | Test Pressure: | PN 10 | |
| 23 | Testing standard | API 598 | |
| 24 | Face to Face Distance | ASME B 16.10 | |
| 25 | Set Testing Pressure (PSIG) | Body: 15 Bar | Seat: 11 Bar |
| 26 | Painting | As per approved painting specification | |
| 27 | MAKE | Venus Pump & Engineering Works | |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF GLOBE VALVES | | |
|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A017 | REV NO:- 02 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/GV/PTP/18/313 | |
| | | MADE BY AF / CHKD BY MI / APPD BY AA | |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | |

| Sr No. | Description | | |
|---|---|---|---|
| 1 | Valve Type | Globe Valve | |
| 2 | Valve Design | API 602 or equivalent of Required rating/class | |
| | **Material Specification** | | |
| 1 | Service (R2) | Service water from overhead tank to chemical dosing / Overhead clarified water | |
| 2 | Body | FSS ASTM A 182 Gr F316 | |
| 3 | Spindle/Stem | SS 316 | |
| 4 | Seat Ring | SS 316 | |
| 5 | Stem Packing | Graphite / PTFE | |
| 6 | Plug Disc | SS 316 | |
| 7 | Bonnet | FSS ASTM A 182 Gr F316 | |
| 8 | Bonnet Gasket | GRAPHITE RING / PTFE RING | |
| 9 | Gland Packing | GRAPHITE RING / PTFE RING | |
| 10 | Gland flange | ASTM A105/ SS 316 | |
| 11 | Yoke Bush | FSS ASTM A 182 Gr F316/ D2 | |
| 12 | Hand wheel | Carbon Steel ASTM A216 Gr WCB | |
| 13 | Stud, Stud Nut, Eye Bolt Nut / Fasteners | ASTM A193 B7 & ASTM A194-2H | |
| 14 | End Connection | Female Screwed ends NPT | |
| 15 | Size & Quantity (R2) | 25NB - 13 Nos | KKS No. -90GAA01AA544 /90GAA01AA547 90GAA01AA550 / 90GAA01AA599 90GAA01AA601 / 90GAA01AA553 90GAA01AA556 / 90GAA01AA565 90GAA01AA572 / 90GAA01AA609 90GAA01AA611 / 90GAA01AA559 90GAA01AA562 |
| 16 | Operation Type | Manual | |
| 17 | Leakage Class | VI | |
| 18 | Range of Flow Control | 0-100% | |
| 19 | Valve Rating | PN 10 | |
| 20 | Test duration | Body: 15 sec | Seat: 15 sec |
| 21 | Design Pressure | 22 kg/sq.cm | |
| 22 | Test Pressure: | PN 10 | |
| 23 | Testing standard | API 598 | |
| 24 | Face to Face Distance | ASME B 16.10 | |
| 25 | Set Testing Pressure | Body: 15 Bar | Seat: 11 Bar |
| 26 | Painting | As per approved painting specification | |
| 27 | MAKE | Venus Pump & Engineering Works | |

**GLOBE VALVE**

| VALVE SIZE | FACE TO FACE | QTY. | SERVICE |
|---|---|---|---|
| N.B. | A±5 | NOS. | -- |
| 15 | 82 | 02 | AIR |
| 15 | 82 | 08 | CHEMICAL DOSING |
| 25 | 102 | 13 | WATER TO CHEMICAL DOSING / OVERHEAD CLARIFIED WATER |




NOTE :-

1. ALL DIMENSIONS ARE IN M.M. UNLESS OTHERWISE STATED.
2. STANDARD TOLERANCES APPLICABLE.
3. END CONNECTION : FEMALE SCREWED NPT.
4. WE RESERVE OUR RIGHTS FOR MINOR DESIGN CHANGES.

| SL.NO. | DESCRIPTION | QTY. | MATERIAL | SPECIFICATION |
|---|---|---|---|---|
| 9 | HAND WHEEL | 1 | C.S. | ASTM A216 GR. WCB |
| 8 | GASKET | TO SUIT | GRAPHITE / PTFE | |
| 7 | BOLTS & NUTS | AS REQD | S.S. | AISI : 316 |
| 6 | GLAND PACKING | AS REQD | GRAPHITE / PTFE | |
| 5 | STEM | 1 | S.S. | AISI : 316 |
| 4 | GLAND FLANGE | 1 | S.S. | AISI:316 |
| 3 | PLUG DISC WITH INTEGRAL SEAT | 1 | S.S. | AISI : 316 |
| 2 | BONNET | 1 | F.S.S. | ASTM A 182 GR F316 |
| 1 | BODY WITH INTEGRAL SEAT | 1 | F.S.S. | ASTM A 182 GR F316 |

BILL OF MATERIAL

DETAILS

| | |
|---|---|
| VALVE | GLOBE |
| TYPE | O.S. & Y |
| MFG. STD. | API : 602 |
| RATING | CLASS - 800# |
| PARENT MATLS. | F.S.S. |
| TRIM MATLS. | S.S. |
| SERVICE | SEE ABOVE TABLE |

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ALL DIMENSIONS IN MM, UNLESS OTHERWISE SPECIFIED.
TOLERANCES ON MACHINED DIMENSIONS ± 2 mm UNLESS OTHERWISE SPECIFIED.
SCALING OF DRAWING FOR DIMENSIONS SHOULD BE AVOIDED IN ALL CASES.

HYDROSTATIC TEST PRESSURE

| HYDROSTATIC TEST PRESSURE IN BAR. | | | |
|---|---|---|---|
| BODY | SEAT | | |
| 15 (15 SEC) | 11 (15 SEC) | | |

TITLE

PROJECTION

TITLE: F.S.S. SCREWED END RISING SPINDLE GLOBE VALVE

MAIN REF.

VENUS PUMP & ENGINEERING WORKS
BALITIKURI, SHIBTOLLA, HOWRAH - 711 113. WEST BENGAL

| REV | DATE |
|---|---|
| 01 | 00 |
| 02 | 00 |
| 03 | 00 |

| | | | | |
|---|---|---|---|---|
| DRN. | A.GHOSH | DRG. NO. VP-RK-FSGLV-19-5673 | | SCALE |
| CHD. | C.HAZRA | | | N.T.S. |
| APP. | R. AGARWAL | REV:01 | DATE:02.02.2019 | |

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

# BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

TECHNICAL DATASHEET FOR NON RETURN VALVES & ISOLATION GATE OF PRE TREATMENT PLANT

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | ALOYSIUS | AF | 24-05-19 |
| CHKD | MUAZZAM I | MI | 24-05-19 |
| APPD | ASLAM A | AA | 24-05-19 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

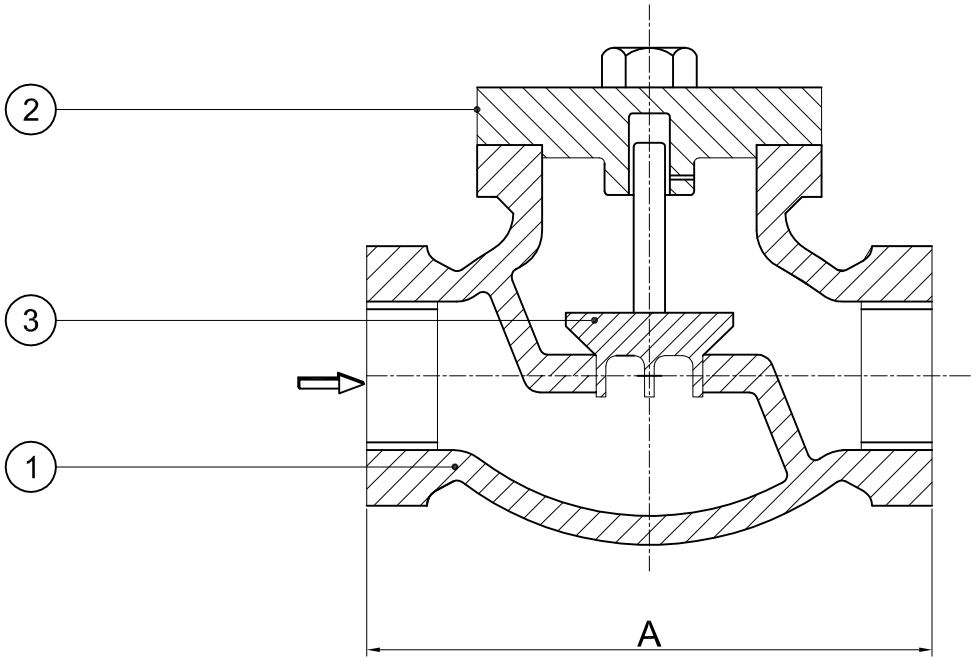
| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. PE-V0-412-158-A018 | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/TDS/NRV/PTP/18/314 | 02 |
| DATE | | | | | | | | NO. OF SHEETS 9 EXCLUDING COVER PAGE | |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF NON RETURN VALVE | | | |
|---|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A018 | | REV NO:- 02 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/NRV/PTP/18/314 | | |
| | | MADE BY<br>AF | CHKD BY<br>MI | APPD BY<br>AA |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | | |

| Sr No. | Description | | | |
|---|---|---|---|---|
| 1 | Valve Type | | Non Return valve | |
| 2 | Valve Design (R2) | | BS:5352 | |
| | **Material Specification** | | | |
| 1 | SERVICE (APPLICATION) | | Chemical Dosing System | |
| 2 | Type | | Piston type | |
| 3 | Body (R2) | | Cast duplex stainless steel | |
| 4 | Piston (R2) | | Cast duplex stainless steel | |
| 5 | Bolts & Nuts / Fasteners (R2) | | SS 316 L | |
| 6 | End Connection | | Screwed End | |
| 7 | Size & Quantity (R2) | KKS No. - 90GAA01AA622<br>90GAA01AA627 | 25NB - 2 Nos | Location- NaOCl Dosing Pump |
| | | KKS No. - 90GAA01AA594<br>90GAA01AA597 | 40NB - 2 Nos | Location- FeCl3 Dosing Pump |
| 8 | Leakage Class | | VI | |
| 9 | Range of Flow Control | | 0-100% | |
| 10 | Valve Rating | | PN 10 | |
| 11 | Test duration | | Body: 1 min | Seat: 1 min |
| 12 | Design Pressure | | 11 Bar | |
| 13 | Test Pressure: | | PN 10 | |
| 14 | Testing standard | | BS 6755 | |
| 15 | Face to Face Distance | | ASME B 16.10 | |
| 16 | Set Testing Pressure | | Body: 15 bar | Seat: 11 bar |
| 17 | Painting | | As per approved painting specification | |
| 18 | MAKE | | Venus Pump & Engineering Works | |

**D.S.S CHECK VALVE**

| VALVE SIZE | FACE TO FACE | QTY. |
|---|---|---|
| N.B. | A±5 | NOS. |
| 25 | 82 | 02 |
| 40 | 102 | 02 |




NOTE :-

1. ALL DIMENSIONS ARE IN M.M.
2. STANDARD TOLERANCES APPLICABLE.
3. END CONNECTION : BSP SCREWED END.
4 WE RESERVE OUR RIGHTS FOR MINOR DESIGN CHANGES.

| SL.NO | DESCRIPTION | QTY. | MATERIAL | SPECIFICATION |
|---|---|---|---|---|
| 3 | DISC | 1 | S.S | ASTM A890 GR.5A-CE3MN |
| 2 | COVER | 1 | S.S | ASTM A890 GR.5A-CE3MN |
| 1 | BODY | 1 | S.S | ASTM A890 GR.5A-CE3MN |

BILL OF MATERIAL

DETAILS

| | |
|---|---|
| VALVE | CHECK |
| TYPE | LIFT |
| MFG. STD. | BS : 5352 |
| RATING | PN - 10 |
| PARENT MATLS. | S.S |
| TRIM MATLS. | S.S. |
| SERVICE | AIR |

THIS DRAWING AND ITS ENCLOSURE(S) UNDER CITED DRG NO. ARE THE SOLE PROPERTY OF VENUS PUMP & ENGINEERING WORKS. ANY ABUSE OF IT WILL BE LEGALLY DEALT WITH AT THE RISK/COST OF THE ABUSER(S).

ALL DIMENSIONS IN MM. UNLESS OTHERWISE SPECIFIED. TOLERANCES ON MACHINED DIMENSIONS ± 2 mm UNLESS OTHERWISE SPECIFIED.
SCALING OF DRAWING FOR DIMENSIONS SHOULD BE AVOIDED IN ALL CASES.

| TESTING PARAMETER | HYDROSTATIC TEST PRESSURE IN BAR. | | |
|---|---|---|---|
| | BODY | SEAT | |
| | 15 (1 MIN.) | 11 (1 MIN.) | |

TITLE

PROJECTION

TITLE

DSS LIFT TYPE CHECK VALVE, SCREWED END.

MAIN REF.

| REV | DATE |
|---|---|
| 01 | 00 |
| 02 | 00 |
| 03 | 00 |

VENUS PUMP & ENGINEERING WORKS

BALITIKURI, SHIBTOLLA, HOWRAH - 711 113. WEST BENGAL

| | | | |
|---|---|---|---|
| DRN. | A.GHOSH | DRG. NO. VP-RK-CV-19-5751 | SCALE N.T.S. |
| CHD. | C. HAZRA | | |
| APP. | R. AGARWAL | REV : 00 | DATE :24.05.2019 |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF NON RETURN VALVE | | | |
|---|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A018 | | REV NO:- 02 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/NRV/PTP/18/314 | | |
| | | MADE BY AF | CHKD BY MI | APPD BY AA |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | | |

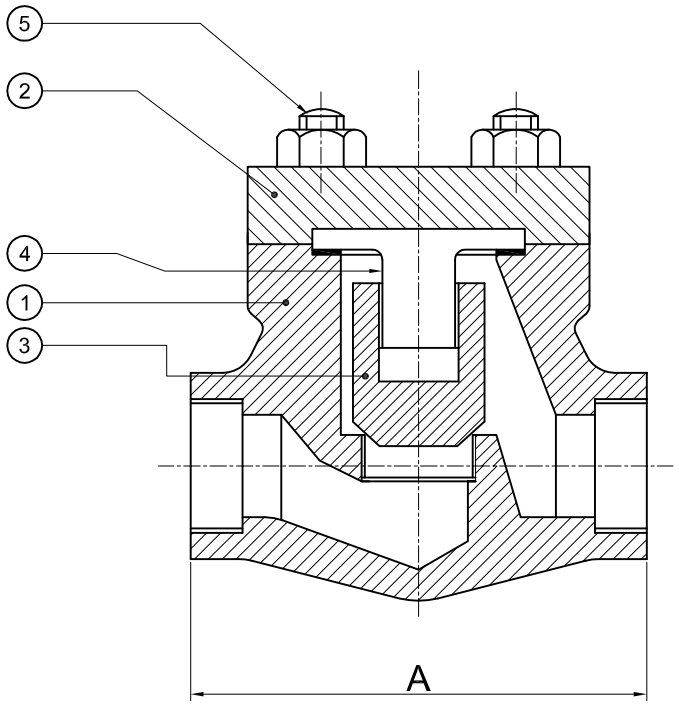
| Sr No. | Description | | | |
|---|---|---|---|---|
| 1 | Valve Type | | Non Return valve | |
| 2 | Valve Design | | API 602 or equivalent of Required rating/class | |
| | **Material Specification** | | | |
| 1 | SERVICE (APPLICATION) | | Chemical Dosing System (Lime / Polyelectrolyte) | |
| 2 | Type | | Piston type | |
| 3 | Body | | SS 316 | |
| 4 | Piston | | SS 316 | |
| 5 | Bolts & Nuts / Fasteners | | SS 316 | |
| 6 | End Connection | | Screwed End | |
| 7 | Size & Quantity (R2) | KKS No. - 90GAA01AA614 90GAA01AA617 | 25NB - 2 Nos | Location- PE Dosing Pump |
| | | KKS No. - 90GAA01AA603 90GAA01AA606 | 40NB - 2 Nos | Location- Lime Dosing Pump |
| 8 | Leakage Class | | VI | |
| 9 | Range of Flow Control | | 0-100% | |
| 10 | Valve Rating | | PN 10 | |
| 11 | Test duration | | Body: 1 min | Seat: 1 min |
| 12 | Design Pressure | | 11 Bar | |
| 13 | Test Pressure: | | PN 10 | |
| 14 | Testing standard | | BS 6755 | |
| 15 | Face to Face Distance | | ASME B 16.10 | |
| 16 | Set Testing Pressure | | Body: 15 bar | Seat: 11 bar |
| 17 | Painting | | As per approved painting specification | |
| 18 | MAKE | | Venus Pump & Engineering Works | |

# LIFT TYPE CHECK VALVE

| VALVE SIZE | FACE TO FACE | REQD QNTY |
|---|---|---|
| N.B. | A±5 | NOS. |
| 25 | 108 | 02 |
| 40 | 125 | 02 |

NOTE :-

1. ALL DIMENSIONS ARE IN M.M. UNLESS OTHERWISE STATED.
2. STANDARD TOLERANCES APPLICABLE.
3. END CONNECTION -: SCREWED END.
4. Seervice:Lıme/polyelectrolyte dosıng




| SL.NO. | DESCRIPTION | QTY. | MATERIAL | SPECIFICATION |
|---|---|---|---|---|
| 5 | STUDS & NUTS | As Reqd. | S.S. | AISI:316 |
| 4 | PISTON GUIDE | 1 | S.S. | AISI:316 |
| 3 | DISC | 1 | S.S. | AISI:316 |
| 2 | COVER | 1 | S.S. | ASTM A182 GR F316 |
| 1 | BODY | 1 | S.S. | ASTM A182 GR F316 |

BILL OF MATERIAL

DETAILS

| | |
|---|---|
| VALVE | CHECK |
| TYPE | LIFT |
| MFG. STD. | API:602 |
| RATING | PN-10 |
| PARENT MATLS. | S.S. |
| TRIM MATLS. | S.S. |
| SERVICE | CHEMICAL DOSING |

THIS DRAWING AND ITS ENCLOSURE(S) UNDER CITED DRG NO. ARE THE SOLE PROPERTY OF VENUS PUMP & ENGINEERING WORKS. ANY ABUSE OF IT WILL BE LEGALLY DEALT WITH AT THE RISK/COST OF THE ABUSER(S).

ALL DIMENSIONS IN MM, UNLESS OTHERWISE SPECIFIED.
TOLERANCES ON MACHINED DIMENSIONS ± 2 mm UNLESS OTHERWISE SPECIFIED.
SCALING OF DRAWING FOR DIMENSIONS SHOULD BE AVOIDED IN ALL CASES.

HYDROSTATIC TEST PRESSURE

HYDRO STATIC TEST PRESSURE IN BAR

| BODY | SEAT | – |
|---|---|---|
| 15 (1 MIN.) | 11 (1 MIN.) | |

TITLE

PROJECTION

TITLE

S.S. LIFT TYPE PISTON CHECK VALVE
SCREWED END

MAIN REF.

VENUS PUMP & ENGINEERING WORKS
BALITIKURI, SHIBTOLLA, HOWRAH - 711 113. WEST BENGAL

| REV | DATE |
|---|---|
| 1 | 00 |
| 2 | 00 |
| 3 | 00 |

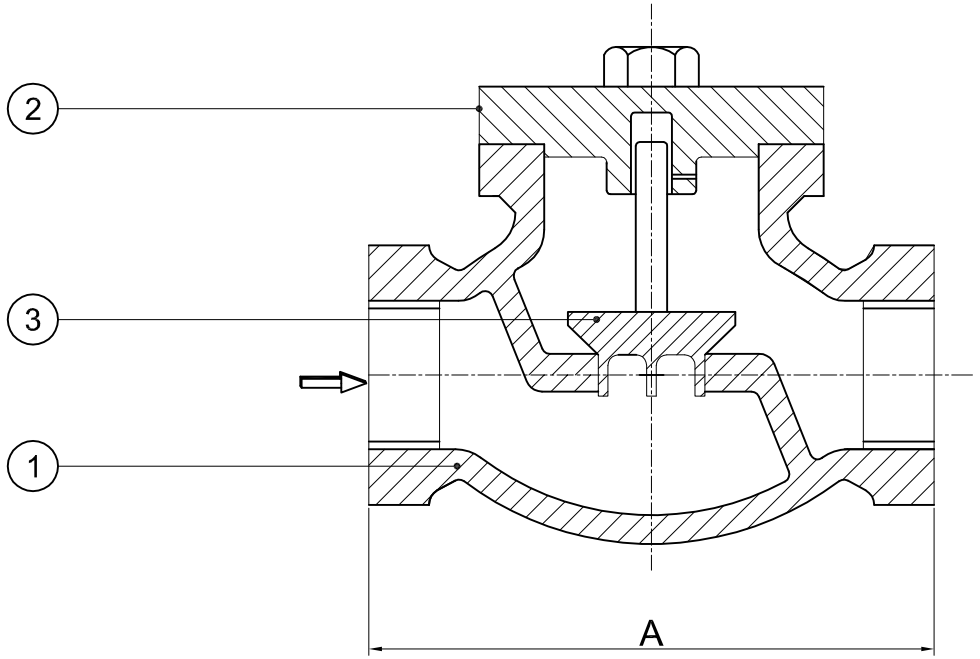
| | | | |
|---|---|---|---|
| DRN. | A.GHOSH | DRG. NO. | SCALE |
| CHD. | C.HAZRA | VP-RK-FSCV(LT)-19-5667 | N.T.S. |
| APP. | R. AGARWAL | REV:00 DATE:01.02.2019 | |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF NON RETURN VALVE | | | |
|---|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A018 | | REV NO:- 02 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/NRV/PTP/18/314 | | |
| | | MADE BY AF | CHKD BY MI | APPD BY AA |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | | |

| Sr No. | Description | | | |
|---|---|---|---|---|
| 1 | Valve Type | | Non Return valve | |
| 2 | Valve Design | | BS 5352 or equivalent of Required rating/class | |
| | **Material Specification** | | | |
| 1 | SERVICE (APPLICATION) | | Air | |
| 2 | Type | | Lift type | |
| 3 | Body | | SS 316 | |
| 4 | Disc | | SS 316 | |
| 5 | Hinged pin | | SS 316 | |
| 6 | Bolts & Nuts / Fasteners | | SS 316 | |
| 7 | End Connection | | Screwed End | |
| 8 | Size & Quantity | KKS No. - 90GAA01AA538<br>90GAA01AA541 | 80NB - 2 Nos. | Location-Air Blower |
| 9 | Leakage Class | | VI | |
| 10 | Range of Flow Control | | 0-100% | |
| 11 | Valve Rating | | PN 10 | |
| 12 | Test duration | | Body: 1 min | Seat: 1 min |
| 13 | Design Pressure | | 11 Bar | |
| 14 | Test Pressure: | | PN 10 | |
| 15 | Testing standard | | BS 6755 | |
| 16 | Face to Face Distance | | ASME B 16.10 | |
| 17 | Set Testing Pressure | | Body: 15 bar | Seat: 11 bar |
| 18 | Painting | | As per approved painting specification | |
| 19 | MAKE | | Venus Pump and Engineering works | |

# S.S CHECK VALVE

| VALVE SIZE | FACE TO FACE | QTY. |
|---|---|---|
| N.B. | A±5 | NOS. |
| 80 | 127 | 02 |




NOTE :-

1. ALL DIMENSIONS ARE IN M.M.
2. STANDARD TOLERANCES APPLICABLE.
3. END CONNECTION : BSP SCREWED END.
4 WE RESERVE OUR RIGHTS FOR MINOR DESIGN CHANGES.

| SL.NO | DESCRIPTION | QTY. | MATERIAL | SPECIFICATION |
|---|---|---|---|---|
| 3 | DISC | 1 | S.S | ASTM A351 CF8M |
| 2 | COVER | 1 | S.S | ASTM A351 CF8M |
| 1 | BODY | 1 | S.S | ASTM A351 CF8M |

BILL OF MATERIAL

DETAILS

| | |
|---|---|
| VALVE | CHECK |
| TYPE | LIFT |
| MFG. STD. | BS : 5352 |
| RATING | PN - 10 |
| PARENT MATLS. | S.S |
| TRIM MATLS. | S.S. |
| SERVICE | AIR |

THIS DRAWING AND ITS ENCLOSURE(S) UNDER CITED DRG NO. ARE THE SOLE PROPERTY OF VENUS PUMP & ENGINEERING WORKS. ANY ABUSE OF IT WILL BE LEGALLY DEALT WITH AT THE RISK/COST OF THE ABUSER(S).

ALL DIMENSIONS IN MM, UNLESS OTHERWISE SPECIFIED.
TOLERANCES ON MACHINED DIMENSIONS ± 2 mm UNLESS OTHERWISE SPECIFIED.
SCALING OF DRAWING FOR DIMENSIONS SHOULD BE AVOIDED IN ALL CASES.

| TESTING PARAMETER | HYDROSTATIC TEST PRESSURE IN BAR. | | |
|---|---|---|---|
| | BODY | SEAT | |
| | 15 (1 MIN.) | 11 (1 MIN.) | |

TITLE

PROJECTION

TITLE

STAINLESS STEEL LIFT TYPE CHECK VALVE, SCREWED END.

MAIN REF.

| REV | DATE |
|---|---|
| 01 | 00 |
| 02 | 00 |
| 03 | 00 |

VENUS PUMP & ENGINEERING WORKS

BALITIKURI, SHIBTOLLA, HOWRAH - 711 113. WEST BENGAL

| | | | |
|---|---|---|---|
| DRN. | A.GHOSH | DRG. NO. VP-RK-CV-19-5675 | SCALE N.T.S. |
| CHD. | C. HAZRA | | |
| APP. | R. AGARWAL | REV : 00 | DATE : 02.02.2019 |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF NON RETURN VALVE | | | |
|---|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A018 | | REV NO:- 02 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/NRV/PTP/18/314 | | |
| | | MADE BY AF | CHKD BY MI | APPD BY AA |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | | |

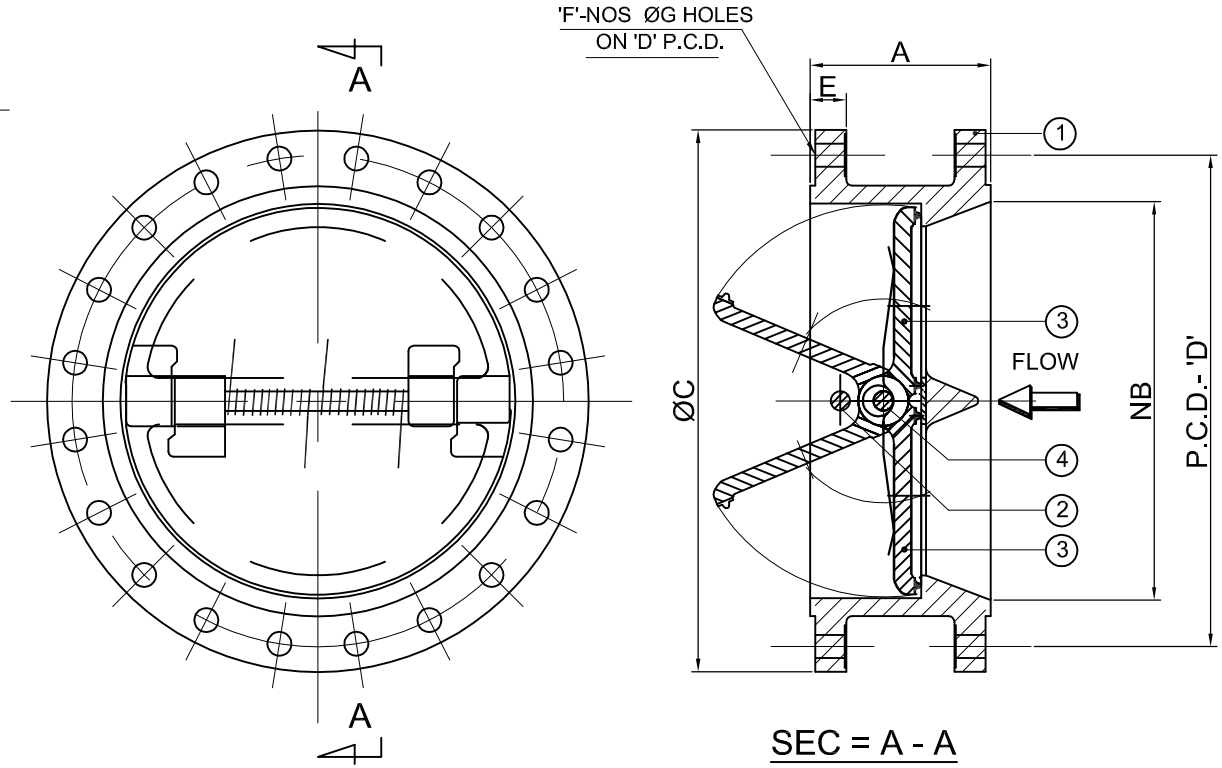
| Sr No. | Description | | | |
|---|---|---|---|---|
| 1 | Valve Type | Non Return valve | | |
| 2 | Valve Design | BS 1868 or equivalent of Required rating/class | | |
| 3 | Flange Standard | ENDS FLANGED TO ASME B 16.5 RF | | |
| | **Material Specification** | | | |
| 1 | SERVICE (APPLICATION) | Sea Water Sludge | | |
| 2 | Type | Double Flanged Dual Plate Check Valve | | |
| 3 | Body | Super duplex stainless steel, ASTM A890-5A (CE3MN) | | |
| 4 | Disc/door | Super duplex stainless steel, ASTM A890-5A (CE3MN) | | |
| 5 | Hinged pin | Duplex Stainless Steel | | |
| 6 | Bolts & Nuts / Fasteners | SS 316L | | |
| 7 | End Connection | ENDS FLANGED TO ASME B 16.5 RF | | |
| 8 | Size & Quantity | KKS No. - 90GAA01AA529<br>90GAA01AA532<br>90GAA01AA535 | 400NB - 3 Nos. | Location-Sludge Transfer Pump |
| 9 | Leakage Class | IV | | |
| 10 | Range of Flow Control | 0-100% | | |
| 11 | Valve Rating | PN 10 | | |
| 12 | Test duration | Body: 5 min | Seat: 2 min | |
| 13 | Design Pressure | 11 Bar | | |
| 14 | Test Pressure: | PN 10 | | |
| 15 | Testing standard | API 598 | | |
| 16 | Face to Face Distance | ASME B 16.10 | | |
| 17 | Set Testing Pressure | Body: 15 bar | Seat: 11 bar | |
| 18 | Painting | As per approved painting specification | | |
| 19 | MAKE | Venus Pump and Engineering works | | |

**DUAL DISC CHECK VALVE**

| VALVE SIZE | FACE TO FACE | FLANGE DETAILS | | | | | QTY. |
|---|---|---|---|---|---|---|---|
| | | O.D. | P.C.D. | THICK. | HOLE NO. | HOLE DIA. | |
| N.B. | A±3 | C | D | E | F | G | NOS. |
| 400 | 191 | 596.9 | 539.8 | 36.5 | 16 | 28.6 | 03 |

## NOTES

1. ALL DIMENSION ARE IN 'MM',UNLESS OTHER WISE SPECIFIED
2. STANDARD TOLLERENCE ARE APPLICABLE.
3) FLANGE END DRILLING AS PER ANSI B 16.5 R/F.
4.. WE RESERVE OUR RIGHTS FOR MINOR DESIGN CHANGES.




SEC = A - A

| SL.NO | DESCRIPTION | MATERIAL | SPECIFICATION |
|---|---|---|---|
| 4 | HINGE PIN | D.S.S. | ASTM A276 |
| 3 | DISC WITH RUBBER MOULDED SEAT | D.S.S. | ASTM A890 GR. 5A-CE3MN |
| 2 | STOPPER ROD | D.S.S. | ASTM A276 |
| 1 | BODY | D.S.S. | ASTM A890 GR. 5A-CE3MN |

BILL OF MATERIAL

DETAILS

| | |
|---|---|
| VALVE | DUAL DISC CHECK |
| TYPE | FLANGED |
| MFG. STD. | API : 594 |
| RATING | CLASS-150# |
| PARENT MATLS. | D.S.S. |
| TRIM MATLS. | D.S.S. |
| SERVICE | SEA WATER SLUDGE |

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ALL DIMENSIONS IN MM. UNLESS OTHERWISE SPECIFIED.
TOLERANCES ON MACHINED DIMENSIONS ± 2 mm UNLESS OTHERWISE SPECIFIED.
SCALING OF DRAWING FOR DIMENSIONS SHOULD BE AVOIDED IN ALL CASES.

| TESTING PARAMETER | HYDROSTATIC TEST PRESSURE IN BAR | | |
|---|---|---|---|
| | BODY | SEAT | |
| | 15 (5 MIN.) | 11 (2 MIN.) | |

TITLE

PROJECTION

D.S.S. DOUBLE FLANGED DUAL DISC SPRING LOADED CHECK VALVE

MAIN REF.

VENUS PUMP & ENGINEERING WORKS
BALITIKURI, SHIBTOLLA, HOWRAH - 711 113. WEST BENGAL

| REV | DATE |
|---|---|
| 01 | 00 |
| 02 | 00 |
| 03 | 00 |

| | | | |
|---|---|---|---|
| DRN. | A.GHOSH | DRG. NO. | SCALE |
| CHD. | C.HAZRA | VP-RK-DDCV-19-5668 | N.T.S. |
| APP. | R. AGARWAL | REV:00 DATE:01.02.2019 | |

| OTOKLIN GLOBAL BUSINESS LIMITED | TECHNICAL DATA SHEET OF ISOLATION GATE | | | |
|---|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A018 | | REV NO:- 02 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/TDS/NRV/PTP/18/314 | | |
| | | MADE BY AF | CHKD BY MI | APPD BY AA |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | | | |

| | | | | |
|---|---|---|---|---|
| **A** | **Technical description** | | | |
| 1 | Quantity (Nos.) | | 8 nos. | |
| 2 | Design standard | | IS: 3042 or Equivalent. | |
| 3 | Spindle Type | | Rising | |
| 4 | Operation | | Headstock with Geared Handle | |
| 5 | Gear Box Arrangement | | Open/Closed type | |
| 6 | Type of Closure | | Flush Bottom | |
| **B** | **Mechanical Construction** | | | |
| 1 | Standard | | Manufacturer Standard | |
| 2 | Design | | Designed for seating and unseating water head pressure | |
| 3 | Mounting | | Face Wall mounted | |
| 4 | Differential pressure | | 1 kg/sq.cm minimum | |
| 5 | Suction pressure | | 1 kg/sq.cm max | |
| 6 | Ambient temperature | | 45° c max | |
| 7 | Range of operation | | 10 - 100% | |
| **C** | **List of Isolation Gate** | | | |
| | **Size** | **Tag No.** | **Quantity** | **Location** |
| 1 | 800 X 800 | 90GAA01AA523 / 90GAAA01AA524 | 2 | Outlet channel from clarifier |
| 2 | 800 X 800 | 90GAA01AA526 / 90GAAA01AA527 | 2 | Inlet channel to clarified water storage tank |
| 3 | 300 X 300 | 90GAA01AA643 / 90GAAA01AA644<br>90GAA01AA645 / 90GAAA01AA646 | 4 | Sludge Sump Area |
| **D** | **Material of Construction** | | | |
| 1 | Head Stock, Wedge | | C.I IS 210 FG 200 | |
| 2 | Shutter , Gate Frame | | MS+FRP lining | |
| 3 | Stem | | MS+FRP lining | |
| 4 | Seat Facing / Sealing Face | | Brass / SS Duplex | |
| 5 | Bottom Rubber seal | | EPDM / Natureal | |
| 6 | Stem Guide Bracket | | C.I IS 210 FG 200 / MS+FRP lining | |
| 7 | Fasteners and Studs | | SS Duplex | |
| 8 | Anchor Bolts | | SS Duplex | |
| 9 | Painting | | As per painting specification | |
| 10 | MAKE | | As per approved make | |

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

# BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

QAP FOR VALVES AND ISOLATION GATE OF PRE TREATMENT PLANT

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | ALOYSIUS | AF | 12-07-19 |
| CHKD | MUAZZAM I | MI | 12-07-19 |
| APPD | ASLAM A | AA | 12-07-19 |

| DEPT. | | | | | | | CARD CODE |
|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - |
| DATE | | | | | | | |

BHEL DRAWING NO.
PE-V0-412-158-A020

OTOKLIN-DRG/DOC-NO..
OGBL/OC-983/QAP/V/PTP/18/351

REV 01

NO. OF SHEETS 2 EXCLUDING COVER PAGE

| OTOKLIN GLOBAL BUSINESS LIMITED | OTOKLIN GLOBAL BUSINESS LIMITED<br>R-02 Remi Bizcourt, Off Veera Desai Road, Andheri West,<br>Mumbai 400 053, India | **MANUFACTURING QUALITY PLAN**<br>**ITEM: VALVE (15 TO 400 NB GATE,GLOBE,BALL,NRV & ~~BUTTERFLY VALVES~~)**<br>**SUB-SYSTEM: PRETREATMENT PLANT** | **QP NO.: PE-V0-412-158-A020**<br>**REV.NO.: 01**<br>**DATE: 12-07-2019**<br>**PAGE: 1 OF 2** | PROJECT: 2X660 MW ENNORE SEZ STPP AT ASH DYKE OF NCTPS<br>PACKAGE: PRETREATMENT PLANT<br>CONTRACT NO.: 412<br>MAIN-SUPPLIER: BHEL<br>SUB- CONTRACTOR:- OTOKLIN |
|---|---|---|---|---|

| S.NO | COMPONENT & OPERATIONS | CHARACTERISTICS CHECKED | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | D | AGENCY M | AGENCY C | AGENCY N | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D | 10 | | | 11 |
| [1] | **MATERIAL CONTROL** | | | | | | | | | | | | |
| 1.1 | MAJOR CI COMPONENTS | PHYSICAL | MAJOR | UTS & BHN | 1 / HEAT | APPROVED DRG. & DATA SHEET | APPROVED DRG. & DATA SHEET | INSP. REP. MFG. TC | ✓ | P | R | R | |
| 1.1 | SPINDLE | CHEMICAL | MAJOR | CHEM. COMPO. | 1 Sample/Lot | APPROVED DRG. & DATA SHEET | APPROVED DRG. & DATA SHEET | INSP. REP. MFG. TC | ✓ | P | R | R | |
| 1.2 | BODY & SEAT RING & SURFACE DEFECTS | CHEMICAL & VISUAL | MAJOR | CHEM. COMPO. | 1 Sample/Lot | APPROVED DRG. & DATA SHEET | APPROVED DRG. & DATA SHEET | INSP. REP. MFG. TC | ✓ | P | R | R | |
| [2] | **IN-PROCESS CONTROL** | | | | | | | | | | | | |
| 2.1 | MACHINING OF ALL COMPONENTS & SURFACE FINISH | DIMENSIONS & VISUAL | MAJOR | MEASURMENT | 100% | APPROVED DRAWING. | APPROVED DRAWING. | INSPN. REPORT. | ✓ | P | R | R | |
| 2.2 | SURFACE DEFECTS | VISUAL | MAJOR | VISUAL CHECK | 100% | APPROVED DRAWING. | APPROVED DRAWING. | INSPN. REPORT. | ✓ | P | R | R | |
| [3] | **ASSEMBLY** | | | | | | | | | | | | |
| 3.1 | COMPLETE ARRANGEMENT ASSY. | OVERALL DIMENSIONS, OPERATE | WITNESS | MEASURMENT | 100% | APPROVED DRG.& DATA SHEET | APPROVED DRG.& DATA SHEET | INSPN. REPORT. | ✓ | P,W | R | R | Only overall dimension may check as per GAD |
| 3.2 | HYDROTEST (Body & Seat) | HYDROTEST | WITNESS | PRESSURE & LEAKAGE TIGHTNESS | SAMPLING | APPROVED DRG.& DATA SHEET | APPROVED DRG.& DATA SHEET | INSPN. REPORT. | ✓ | P,W | R | R | |

**LEGEND:**
* RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** M: MANUFACTURER/SUB-SUPPLIER — P - Performing the Test

C: SUPPLIER/NOMINATED INSPECTION AGENCY — W - Witnessing the Test

N: THE OWNER — R- Review the Test

| MANUFACTURER / SUBCONTRACTOR | CONTRACTOR |
|---|---|
| SIGNATURE | |

| OTOKLIN GLOBAL BUSINESS LIMITED | OTOKLIN GLOBAL BUSINESS LIMITED<br>R-02 Remi Bizcourt, Off Veera Desai Road, Andheri West,<br>Mumbai 400 053, India | **MANUFACTURING QUALITY PLAN**<br>**ITEM: ISOLATION GATE**<br>**SUB-SYSTEM:**<br>**PRETREATMENT PLANT** | **QP NO.: PE-V0-412-158-A020**<br>**REV.NO.: 01**<br>**DATE: 12-07-2019**<br>**PAGE: 2 OF 2** | PROJECT: 2X660 MW ENNORE SEZ STPP AT ASH DYKE OF NCTPS<br>PACKAGE: PRETREATMENT PLANT<br>CONTRACT NO.: 412<br>MAIN-SUPPLIER: BHEL<br>SUB- CONTRACTOR:- OTOKLIN |
|---|---|---|---|---|

| S.NO | COMPONENT & OPERATIONS | CHARACTERISTICS CHECKED | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | | AGENCY | | | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | M | C | N | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | D | 10 | | | 11 |
| [1] | **RAW MATERIAL** | | | | | | | | | | | | |
| 1.1 | Gate frame, Gate Plate, stiffeners | Mechanical / Chemical | MAJOR | Chemical & Mechanical | 1 Sample/ Lot | Approved Drawing /Data sheet | Approved Drawing /Data sheet | TC | ✓ | P | R | R | |
| 1.2 | Spindle | Mechanical / Chemical | MAJOR | Chemical | 1 Sample/ Lot | Approved Drawing /Data sheet | Approved Drawing /Data sheet | TC | ✓ | P | R | R | |
| 1.3 | Operating Nut | Mechanical / Chemical | MAJOR | Chemical & Mechanical | 1 Sample/ Lot | As per Approved Drg./Data sheet | GM. LTB-2. | T.C. | ✓ | P | R | R | |
| 1.4 | Seating faces | Mechanical / Chemical | MAJOR | Mechanical / Chemical | 1 Sample/ Lot | Approved Drawing | Approved Drawing /Data sheet | T.C. | ✓ | P | R | R | |
| [2] | **INPROCESS INSPECTION** | | | | | | | | | | | | |
| 2.1 | Machining of MS Spindle, Nut, & Fitting of Stem , Seating faces. | Acceptance | MAJOR | VISUAL | Minor | Approved Drawing | Approved Drawing /Data sheet | Works Internal Inspection report | ✓ | P | R | R | |
| [3] | **FINAL INSPECTION** | | | | | | | | | | | | |
| 3.1 | Dimensional verification | Overall dimensions | MAJOR | VISUAL | 100% | Approved Drawing | Approved Drawing /Data sheet | Inspection report | ✓ | P,W | R | R | |
| 3.2 | Movement | Full open and Close movement of shutter mounting assy. In horizontal position. | MAJOR | VISUAL | 1Sample/lot | Approved Drawing | Approved Drawing /Data sheet | Inspection report | ✓ | P,W | R | R | |

**MANUFACTURER / SUBCONTRACTOR** | **CONTRACTOR**

SIGNATURE

**LEGEND:**
* RECORDS, IDENTIFIED WITH "TICK" (ü) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.

** M: MANUFACTURER/SUB-SUPPLIER — P - Performing the Test

C: SUPPLIER/NOMINATED INSPECTION AGENCY — W - Witnessing the Test

N: THE OWNER — R - Review the Test

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

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PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

## VALVE SCHEDULE OF PRE TREATMENT PLANT

BHEL LOA NO:PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | ALOYSIUS | AF | 02-10-18 |
| CHKD | MUAZZAM I | MI | 02-10-18 |
| APPD | ASLAM A | AA | 02-10-18 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| DEPT. | | | | | | | CARD CODE |
| SIGN | | | N.A. | | | | - |
| DATE | | | | | | | |

BHEL DRAWING NO.
PE-V0-412-158-A021

OTOKLIN-DRG/DOC-NO..
OGBL/OC-983/VS/PTP/18/316

REV 01

NO. OF SHEETS 4 EXCLUDING COVER PAGE

## VALVE SCHEDULE

CLIENT: BHARAT HEAVY ELECTRICALS LIMITED

PROJECT: 2 X 660 MW ENNORE SEZ STPP

PACKAGE: PRE TREATMENT PLANT

BHEL DOC NO-PE-V0-412-158-A021 | REV NO | 1

OTOKLIN DOC NO- OGBL/OC-983/VS/PTP/18/316 | REF P&ID DRAWING NO | PE-V0-412-158-A001

| SL NO | SERVICE DESCRIPTION/LOCATION | Valve Tag No. | SIZE IN MM/NB | QTY IN NOS | TYPE | OPERATION | BODY MATERIAL | VALVE CLASS/RATING | END CONNECTIOM | MAKE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Air Blower | 90GAA01AA540 | 80 | 1 | BALL | MANUAL | SS | BS 5351 PN10 | SCREWED | | |
| 2 | Air Blower | 90GAA01AA543 | 80 | 1 | BALL | MANUAL | SS | BS 5351 PN10 | SCREWED | | |
| 3 | Lime Dosing Tank | 90GAA01AA576 | 40 | 1 | BALL | MANUAL | SS | BS 5352 PN10 | FLANGED | | |
| 4 | Lime Dosing Tank | 90GAA01AA577 | 40 | 1 | BALL | MANUAL | SS | BS 5352 PN10 | FLANGED | | |
| 5 | Lime Dosing Tank | 90GAA01AA584 | 40 | 1 | BALL | MANUAL | SS | BS 5352 PN10 | FLANGED | | |
| 6 | Lime Dosing Tank | 90GAA01AA585 | 40 | 1 | BALL | MANUAL | SS | BS 5352 PN10 | FLANGED | | |
| 7 | Lime Dosing Pump | 90GAA01AA600 | 40 | 1 | BALL | MANUAL | SS | BS 5352 PN10 | FLANGED | | |
| 8 | Lime Dosing Pump | 90GAA01AA602 | 40 | 1 | BALL | MANUAL | SS | BS 5352 PN10 | FLANGED | | |
| 9 | Lime Dosing Pump | 90GAA01AA604 | 40 | 1 | BALL | MANUAL | SS | BS 5352 PN10 | FLANGED | | |
| 10 | Lime Dosing Pump | 90GAA01AA607 | 40 | 1 | BALL | MANUAL | SS | BS 5352 PN10 | FLANGED | | |
| 11 | Air Blower | 90GAA01AA647 | 80 | 1 | BALL | MANUAL | SS | BS 5351 PN10 | SCREWED | | To Sludge Tank |
| 12 | Air Blower | 90GAA01AA648 | 80 | 1 | BALL | MANUAL | SS | BS 5351 PN10 | SCREWED | | To Sludge Tank |
| 13 | Air Blower | 90GAA01AA649 | 80 | 1 | BALL | MANUAL | SS | BS 5351 PN10 | SCREWED | | To Sludge Tank |
| 14 | Sea water inlet | 90GBD01AA502 | 800 | 1 | BUTTERFLY | MANUAL | DUPLEX SS | BS:5155 PN 10 | FLANGED | | |
| 15 | Sea water inlet | 90GBD01AA503 | 800 | 1 | BUTTERFLY | MANUAL | DUPLEX SS | BS:5155 PN 10 | FLANGED | | |
| 16 | Sea water inlet | 90GBD01AA504 | 800 | 1 | BUTTERFLY | MANUAL | DUPLEX SS | BS:5155 PN 10 | FLANGED | | |
| 17 | Sea water inlet | 90GBD01AA505 | 800 | 1 | BUTTERFLY | MANUAL | DUPLEX SS | BS:5155 PN 10 | FLANGED | | |
| 18 | Sea water inlet | 90GBD01AA509 | 800 | 1 | BUTTERFLY | MANUAL | DUPLEX SS | BS:5155 PN 10 | FLANGED | | |
| 19 | Sludge Transfer Pump | 90GAA01AA651 | 400 | 1 | BUTTERFLY | MANUAL | DUPLEX SS | BS:5155 PN 10 | FLANGED | | To Guard Pond |
| 20 | Sludge Transfer Pump | 90GAA01AA652 | 400 | 1 | BUTTERFLY | MANUAL | DUPLEX SS | BS:5155 PN 10 | FLANGED | | Recirculation |
| 21 | Sea water inlet | 90GBD01AA001 | 800 | 1 | BUTTERFLY | MOTORIZED | DUPLEX SS | BS:5155 PN 10 | FLANGED | | |
| 22 | Sea water inlet | 90GBD01AA002 | 800 | 1 | BUTTERFLY | MOTORIZED | DUPLEX SS | BS:5155 PN 10 | FLANGED | | |
| 23 | Sludge Transfer Pump | 90GBS41AA001 | 400 | 1 | BUTTERFLY | MOTORIZED | DUPLEX SS | BS:5155 PN 10 | FLANGED | | |
| 24 | Sludge Transfer Pump | 90GBS42AA001 | 400 | 1 | BUTTERFLY | MOTORIZED | DUPLEX SS | BS:5155 PN 10 | FLANGED | | |
| 25 | Sludge Transfer Pump | 90GBS43AA001 | 400 | 1 | BUTTERFLY | MOTORIZED | DUPLEX SS | BS:5155 PN 10 | FLANGED | | |
| 26 | FeCl3 Dosing Tank | 90GAA01AA545 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 27 | FeCl3 Dosing Tank | 90GAA01AA546 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 28 | FeCl3 Dosing Tank | 90GAA01AA548 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 29 | FeCl3 Dosing Tank | 90GAA01AA549 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 30 | FeCl3 Dosing Tank | 90GAA01AA551 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 31 | FeCl3 Dosing Tank | 90GAA01AA552 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 32 | Lime Dosing Tank | 90GAA01AA554 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 33 | Lime Dosing Tank | 90GAA01AA555 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 34 | Lime Dosing Tank | 90GAA01AA557 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 35 | Lime Dosing Tank | 90GAA01AA558 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 36 | PE Dosing Tank | 90GAA01AA560 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 37 | PE Dosing Tank | 90GAA01AA561 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 38 | PE Dosing Tank | 90GAA01AA563 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 39 | PE Dosing Tank | 90GAA01AA564 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 40 | NaOCl Dosing Tank | 90GAA01AA566 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 41 | NaOCl Dosing Tank | 90GAA01AA567 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |

| SL NO | SERVICE DESCRIPTION/LOCATION | Valve Tag No. | SIZE IN MM/NB | QTY IN NOS | TYPE | OPERATION | BODY MATERIAL | VALVE CLASS/RATING | END CONNECTIOM | MAKE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 42 | NaOCl Dosing Tank | 90GAA01AA568 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 43 | Overhead Clarified Water Storage Tank above chemical house | 90GAA01AA569 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 44 | Overhead Clarified Water Storage Tank above chemical house | 90GAA01AA570 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | INSTRUMENT |
| 45 | Overhead Clarified Water Storage Tank above chemical house | 90GAA01AA572 | 40 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 46 | FeCl3 Dosing Tank | 90GAA01AA573 | 40 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 47 | FeCl3 Dosing Tank | 90GAA01AA574 | 40 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 48 | FeCl3 Dosing Tank | 90GAA01AA575 | 40 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 49 | PE Dosing Tank | 90GAA01AA578 | 40 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 50 | PE Dosing Tank | 90GAA01AA579 | 40 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 51 | NaOCl Dosing Tank | 90GAA01AA580 | 40 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 52 | FeCl3 Dosing Tank | 90GAA01AA581 | 40 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 53 | FeCl3 Dosing Tank | 90GAA01AA582 | 40 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 54 | FeCl3 Dosing Tank | 90GAA01AA583 | 40 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 55 | PE Dosing Tank | 90GAA01AA586 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 56 | PE Dosing Tank | 90GAA01AA587 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 57 | NaOCl Dosing Tank | 90GAA01AA588 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 58 | FeCl3 Dosing Pump | 90GAA01AA590 | 40 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 59 | FeCl3 Dosing Pump | 90GAA01AA592 | 40 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 60 | FeCl3 Dosing Pump | 90GAA01AA595 | 40 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 61 | FeCl3 Dosing Pump | 90GAA01AA598 | 40 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 62 | PE Dosing Pump | 90GAA01AA610 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 63 | PE Dosing Pump | 90GAA01AA612 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 64 | PE Dosing Pump | 90GAA01AA615 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 65 | PE Dosing Pump | 90GAA01AA618 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 66 | NaOCl Dosing Pump | 90GAA01AA620 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 67 | NaOCl Dosing Pump | 90GAA01AA623 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 68 | NaOCl Dosing Pump | 90GAA01AA625 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 69 | NaOCl Dosing Pump | 90GAA01AA628 | 25 | 1 | DIAPHRAGM | MANUAL | SS | BS:5156 PN10 | FLANGED | | |
| 70 | Overhead Clarified Water Storage Tank above chemical house | 90GAA01AA571 | 40 | 1 | FLOAT | AUTOMATIC | SS 316 L | | | | |
| 71 | Sea water inlet | 90GBD01AA501 | 15 | 1 | GATE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | sampling |
| 72 | Stilling Chamber | 90GAA01AA510 | 80 | 1 | GATE | MANUAL | DUPLEX SS | API-600 PN10 | FLANGED | | |
| 73 | Flash Mixer | 90GAA01AA511 | 80 | 1 | GATE | MANUAL | DUPLEX SS | API-600 PN10 | FLANGED | | |
| 74 | Clarifier A | 90GAA01AA512 | 15 | 1 | GATE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | sampling |
| 75 | Clarifier A | 90GAA01AA642 | 15 | 1 | GATE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | sampling |
| 76 | Clarifier A | 90GAA01AA513 | 15 | 1 | GATE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | sampling |
| 77 | Clarifier B | 90GAA01AA514 | 15 | 1 | GATE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | sampling |
| 78 | Clarifier B | 90GAA01AA515 | 15 | 1 | GATE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | sampling |
| 79 | Clarifier B | 90GAA01AA516 | 15 | 1 | GATE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | sampling |
| 80 | Clarifier A | 90GAA01AA518 | 15 | 1 | GATE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | sampling |
| 81 | Clarifier B | 90GAA01AA521 | 15 | 1 | GATE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | sampling |
| 82 | Sludge Transfer Pump | 90GAA01AA530 | 15 | 1 | GLOBE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | INSTRUMENT |
| 83 | Sludge Transfer Pump | 90GAA01AA531 | 15 | 1 | GLOBE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | INSTRUMENT |
| 84 | Sludge Transfer Pump | 90GAA01AA533 | 15 | 1 | GLOBE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | INSTRUMENT |
| 85 | Sludge Transfer Pump | 90GAA01AA534 | 15 | 1 | GLOBE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | INSTRUMENT |
| 86 | Sludge Transfer Pump | 90GAA01AA536 | 15 | 1 | GLOBE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | INSTRUMENT |
| 87 | Sludge Transfer Pump | 90GAA01AA537 | 15 | 1 | GLOBE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | INSTRUMENT |
| 88 | Air Blower | 90GAA01AA539 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT |

| SL NO | SERVICE DESCRIPTION/LOCATION | Valve Tag No. | SIZE IN MM/NB | QTY IN NOS | TYPE | OPERATION | BODY MATERIAL | VALVE CLASS/RATING | END CONNECTIOM | MAKE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 89 | Air Blower | 90GAA01AA542 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT |
| 90 | FeCl3 Dosing Tank | 90GAA01AA544 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 91 | FeCl3 Dosing Tank | 90GAA01AA547 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 92 | FeCl3 Dosing Tank | 90GAA01AA550 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 93 | Lime Dosing Tank | 90GAA01AA553 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 94 | Lime Dosing Tank | 90GAA01AA556 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 95 | PE Dosing Tank | 90GAA01AA559 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 96 | PE Dosing Tank | 90GAA01AA562 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 97 | NaOCl Dosing Tank | 90GAA01AA565 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 98 | Overhead Clarified Water Storage Tank above chemical house | 90GAA01AA572 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 99 | FeCl3 Dosing Pump | 90GAA01AA589 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 100 | FeCl3 Dosing Pump | 90GAA01AA591 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 101 | FeCl3 Dosing Pump | 90GAA01AA593 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 102 | FeCl3 Dosing Pump | 90GAA01AA596 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 103 | Lime Dosing Pump | 90GAA01AA599 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 104 | Lime Dosing Pump | 90GAA01AA601 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 105 | Lime Dosing Pump | 90GAA01AA605 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 106 | Lime Dosing Pump | 90GAA01AA608 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 107 | PE Dosing Pump | 90GAA01AA609 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 108 | PE Dosing Pump | 90GAA01AA611 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 109 | PE Dosing Pump | 90GAA01AA613 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 110 | PE Dosing Pump | 90GAA01AA616 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 111 | NaOCl Dosing Pump | 90GAA01AA619 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 112 | NaOCl Dosing Pump | 90GAA01AA621 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 113 | NaOCl Dosing Pump | 90GAA01AA624 | 25 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | |
| 114 | NaOCl Dosing Pump | 90GAA01AA626 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 115 | FeCl3 Dosing Pump | 90GAA01AA629 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 116 | FeCl3 Dosing Pump | 90GAA01AA630 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 117 | Lime Dosing Pump | 90GAA01AA631 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 118 | Lime Dosing Pump | 90GAA01AA632 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 119 | PE Dosing Pump | 90GAA01AA633 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 120 | PE Dosing Pump | 90GAA01AA634 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 121 | NaOCl Dosing Pump | 90GAA01AA635 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 122 | NaOCl Dosing Pump | 90GAA01AA636 | 15 | 1 | GLOBE | MANUAL | SS | API 602 PN10 | SCREWED | | INSTRUMENT (Chemical) |
| 123 | Sludge Transfer Pump | 90GAA01AA637 | 15 | 1 | GLOBE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | INSTRUMENT |
| 124 | Sludge Transfer Pump | 90GAA01AA640 | 15 | 1 | GLOBE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | INSTRUMENT |
| 125 | Sludge Transfer Pump | 90GAA01AA641 | 15 | 1 | GLOBE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | INSTRUMENT |
| 126 | Sea water inlet | 90GAA01AA650 | 15 | 1 | GLOBE | MANUAL | DUPLEX SS | BS 5352 PN10 | SCREWED | | INSTRUMENT |
| 127 | Air Blower | 90GAA01AA538 | 80 | 1 | NRV-LIFT TYPE | AUTOMATIC | SS | BS 5352 PN10 | SCREWED | | |
| 128 | Air Blower | 90GAA01AA541 | 80 | 1 | NRV-LIFT TYPE | AUTOMATIC | SS | BS 5352 PN10 | SCREWED | | |
| 129 | FeCl3 Dosing Pump | 90GAA01AA594 | 40 | 1 | NRV-PISTON | AUTOMATIC | SS | API 602 PN10 | SCREWED | | |
| 130 | FeCl3 Dosing Pump | 90GAA01AA597 | 40 | 1 | NRV-PISTON | AUTOMATIC | SS | API 602 PN10 | SCREWED | | |
| 131 | Lime Dosing Pump | 90GAA01AA603 | 40 | 1 | NRV-PISTON | AUTOMATIC | SS | API 602 PN10 | SCREWED | | |
| 132 | Lime Dosing Pump | 90GAA01AA606 | 40 | 1 | NRV-PISTON | AUTOMATIC | SS | API 602 PN10 | SCREWED | | |
| 133 | PE Dosing Pump | 90GAA01AA614 | 25 | 1 | NRV-PISTON | AUTOMATIC | SS | API 602 PN10 | SCREWED | | |
| 134 | PE Dosing Pump | 90GAA01AA617 | 25 | 1 | NRV-PISTON | AUTOMATIC | SS | API 602 PN10 | SCREWED | | |
| 135 | NaOCl Dosing Pump | 90GAA01AA622 | 25 | 1 | NRV-PISTON | AUTOMATIC | SS | API 602 PN10 | SCREWED | | |

| SL NO | SERVICE DESCRIPTION/LOCATION | Valve Tag No. | SIZE IN MM/NB | QTY IN NOS | TYPE | OPERATION | BODY MATERIAL | VALVE CLASS/RATING | END CONNECTIOM | MAKE | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 136 | NaOCl Dosing Pump | 90GAA01AA627 | 25 | 1 | NRV-PISTON | AUTOMATIC | SS | API 602 PN10 | SCREWED | | |
| 137 | Sludge Transfer Pump | 90GAA01AA529 | 400 | 1 | NRV-SWING | AUTOMATIC | DUPLEX SS | BS 1868 PN10 | FLANGED | | |
| 138 | Sludge Transfer Pump | 90GAA01AA532 | 400 | 1 | NRV-SWING | AUTOMATIC | DUPLEX SS | BS 1868 PN10 | FLANGED | | |
| 139 | Sludge Transfer Pump | 90GAA01AA535 | 400 | 1 | NRV-SWING | AUTOMATIC | DUPLEX SS | BS 1868 PN10 | FLANGED | | |
| 140 | Clarifier A | 90GBD03AA523 | 800 x 800 | 1 | SLUICE GATE | MANUAL | MS+FRP | IS:3042 PN10 | | | Outlet |
| 141 | Clarifier B | 90GBD03AA524 | 800 x 800 | 1 | SLUICE GATE | MANUAL | MS+FRP | IS:3042 PN10 | | | Outlet |
| 142 | Clarified water storage tank | 90GAA01AA526 | 800 x 800 | 1 | SLUICE GATE | MANUAL | MS+FRP | IS:3042 PN10 | | | |
| 143 | Clarified water storage tank | 90GAA01AA527 | 800 x 800 | 1 | SLUICE GATE | MANUAL | MS+FRP | IS:3042 PN10 | | | |
| 144 | Sludge Sump Inlet of Compartment-1 | 90GAA01AA643 | 300 x 300 | 1 | SLUICE GATE | MANUAL | MS+FRP | IS:3042 PN10 | | | |
| 145 | Sludge Sump Inlet of Compartment-2 | 90GAA01AA644 | 300 x 300 | 1 | SLUICE GATE | MANUAL | MS+FRP | IS:3042 PN10 | | | |
| 146 | Sludge Transfer Pump Sump | 90GAA01AA645 | 300 x 300 | 1 | SLUICE GATE | MANUAL | MS+FRP | IS:3042 PN10 | | | |
| 147 | Sludge Transfer Pump Sump | 90GAA01AA646 | 300 x 300 | 1 | SLUICE GATE | MANUAL | MS+FRP | IS:3042 PN10 | | | |
| 148 | Clarifier A | 90GAA01AA519 | 150 | 1 | TELESCOPIC GATE | MANUAL | MS | As per mfg standard | FLANGED | | Telescopic Sludge Bleed |
| 149 | Clarifier B | 90GAA01AA522 | 150 | 1 | TELESCOPIC GATE | MANUAL | MS | As per mfg standard | FLANGED | | Telescopic Sludge Bleed |

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: FN | REV | DATE | ALTERED: FN |
|---|---|---|---|---|---|
| 0 | 04.09.18 | CHECKED: MI | 01 | 09.01.2019 | CHECKED: MI |

STATUS : CONTRACT

JOB NO.: 412

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2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

# PIPING SPECIFICATION FOR PT PLANT

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | FAISAL N | FN | 14.05.2019 |
| CHKD | MUAZZAM I | MI | 14.05.2019 |
| APPD | ASLAM A | AA | 14.05.2019 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | PE-V0-412-158-A024 | 03 |
| DATE | | | | | | | | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/PS/PTP/18/318 | |

NO. OF SHEETS 1 EXCLUDING COVER PAGE

| OTOKLIN GLOBAL BUSINESS LIMITED | PIPING SPECIFICATION FOR PT PLANT | | |
|---|---|---|---|
| CLIENT | BHARAT HEAVY ELECTRICALS LTD. | BHEL DOC NO.: PE-V0-412-158-A024 | REV NO:- 03 |
| PROJECT | PRE TREATMENT PLANT, 2X660 MW ENNORE STPP | OTOKLIN DOC NO:- OGBL/OC-983/PS/PTP/18/318 | |
| | | MADE BY FN / CHKD BY MI / APPD BY AA | |
| CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED | | SUB-CONTRACTOR: WTE INFRA PROJECT PVT LTD. | |

| Sr No. | Description | Material MOC /Standard |
|---|---|---|
| **FOR SEA WATER TRANSFER (R1)** | | |
| 1 | Upto 150NB and below | UPVC IS 4985. **(R2)** |
| 2 | 800 NB SEA WATER INLET | 800 NB line upto valve control station will be provided as CS pipe with corrocoat and the rest Bypass line and buried piping will be provided in GRP MOC **(R3)** |
| **FOR DOSING PUROPSE & SERVICE WATER** | | |
| 1 | 25NB & 40 NB (DOSING) | CPVC SCH 10 (Except for NaOCl SCH 80) |
| 2 | 25 NB (SERVICE WATER) | GI/ IS1239 |
| **FOR SLUDGE TRANSFER LINE PUROPSE AND AIR BLOWER LINE.** | | |
| 1 | 400 NB | UPVC IS 4985/HDPE |
| 2 | 80 NB & 50NB | UPVC IS 4985. |
| **FOR SLUDGE TRANSFER LINE FROM STILLING CHAMBER & FLASH MIXER** | | |
| 1 | 80 NB | CPVC SCH 10 **(R3)** |

**PIPE WALL THICKNESS**

In case of carbon steel materials, the nominal wall thickness of pipeline shall not be less than the minimum acceptable values given below:

| NB mm (inch) | 15 (1/2) | 30 (3/4) | 25 (1) | 32 (1¼) | 40 (1.5) | 50 (2) | 65 (2.5) | 80 (3) | 100 (4) | 125 (5) |
|---|---|---|---|---|---|---|---|---|---|---|
| Min. thickness, mm | 3.2 | 3.2 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 4.0 | 4.5 | 5.4 |
| NB mm (inch) | 150 (6) | 200 (8) | 250 (10) | 300 (12) | 350 (14) | 400 (16) | 450 (18) | 500 (20) | 600 (24) | |
| Min. thickness, mm | 5.4 | 6.35 | 6.35 | 6.35 | 7.1 | 7.1 | 7.1 | 8.0 | 8.0 | |

| | | |
|---|---|---|
| > NB 600 mm to NB 900 mm | - | 8.0 mm |
| > NB 900 mm to NB 1200 mm | - | 10.0 mm |
| > NB 1200 mm to 1400 mm | - | 12.0 mm |
| > NB 1400 mm to 1600 mm | - | 14.0 mm |
| > NB 1600 mm to NB 2200 mm | - | 16.0 mm |
| > NB 2200 mm | - | 18.0 mm |

**PIPE JOINTS**

In general all water lines 50 mm NB and above, are to be joined generally by buttwelding except the locations where valves/fittings are to be installed with flanged connections and below 50mm NB by socket welding unless mentioned otherwise specifically.

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

# TECHNICAL DATA SHEET FOR AGITATOR

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | FAISAL N | FN | 27-03-19 |
| CHKD | MUAZZAM I | MI | 27-03-19 |
| APPD | ASLAM A | AA | 27-03-19 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. PE-V0-412-158-A026 | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/TDS/AGR/PTP/18/320 | 0 |
| DATE | | | | | | | | NO. OF SHEETS 9 EXCLUDING COVER PAGE | |

| OTOKLIN GLOBAL BUSINESS LIMITED | DATA SHEET OF AGITATORS | | |
|---|---|---|---|
| LOI NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018 | | PROJECT DOC NO:- PE-V0-412-158-A026 | REV : 00 |
| CLIENT | **BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TDS/AGR/PTP/18/320 | |
| PROJECT | **PRE TREATMENT PLANT ENNORE** | MADE BY FN / CHKD BY MI / APPD BY AA | |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | **SUB-CONTRACTOR: WTE INFRA PROJECTS PVT LTD.** | |

| **A** | **TECHNICAL SPECIFICATIONS** | |
|---|---|---|
| | **Material Of Construction** | |
| 1 | Impeller | Duplex SS |
| 2 | Bottom Shaft | Duplex SS |
| 3 | Mounting flange | Cast Iron, IS210, FG260 |
| 4 | Motor Type | TEFC 3 Phase ,415 V |
| 5 | Motor RPM | 1440 |

**B** **LIST OF AGITATORS**

| SL NO | DESCRIPTION | Tank Size / MOC | Quantity | RPM | Motor Rating |
|---|---|---|---|---|---|
| **1** | FeCl3 dosing Tank | 2.83 X2.83 X1.43 SWD+0.3FB (L X W X H ) /RCC | 3 No | 100 | 0.75 KW |

| PREPARED BY: FN | CHKD BY/ APPD. BY:MI/AA | DATE: 31/08/2018 | SHEET NO:- 1 OF 5 |
|---|---|---|---|

| OTOKLIN GLOBAL BUSINESS LIMITED | DATA SHEET OF AGITATORS | | |
|---|---|---|---|
| LOI NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018 | | PROJECT DOC NO:- PE-V0-412-158-A026 | REV : 00 |
| CLIENT | **BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TDS/AGR/PTP/18/320 | |
| PROJECT | **PRE TREATMENT PLANT ENNORE** | MADE BY FN / CHKD BY MI / APPD BY AA | |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | **SUB-CONTRACTOR: WTE INFRA PROJECTS PVT LTD.** | |

| **A** | **TECHNICAL SPECIFICATIONS** | |
|---|---|---|
| | **Material Of Construction** | |
| 1 | Impeller | SS-316 |
| 2 | Bottom Shaft | SS-316 |
| 3 | Mounting flange | Cast Iron, IS210, FG260 |
| 4 | Motor Type | TEFC 3 Phase ,415 V |
| 5 | Motor RPM | 1440 |

| **B** | **LIST OF AGITATORS** | | | | |
|---|---|---|---|---|---|
| **SL NO** | **DESCRIPTION** | **Tank Size / MOC** | **Quantity** | **RPM** | **Motor Rating** |
| **1** | Lime dosing Tank | 2X2X1.43 SWD+0.3FB (L X W X H ) /RCC | 2 No | 100 | 0.75 KW |

| PREPARED BY: FN | CHKD BY/ APPD. BY:MI/AA | DATE: 31/08/2018 | SHEET NO:- 2 OF 5 |
|---|---|---|---|

| OTOKLIN® GLOBAL BUSINESS LIMITED | DATA SHEET OF AGITATORS | | |
|---|---|---|---|
| LOI NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018 | | PROJECT DOC NO:- PE-V0-412-158-A026 | REV : 00 |
| CLIENT | **BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TDS/AGR/PTP/18/320 | |
| PROJECT | **PRE TREATMENT PLANT ENNORE** | MADE BY FN | CHKD BY MI / APPD BY AA |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | **SUB-CONTRACTOR: WTE INFRA PROJECTS PVT LTD.** | |

| **A** | **TECHNICAL SPECIFICATIONS** | |
|---|---|---|
| | **Material Of Construction** | |
| 1 | Impeller | SS-316 |
| 2 | Bottom Shaft | SS-316 |
| 3 | Mounting flange | Cast Iron, IS210, FG260 |
| 4 | Motor Type | TEFC 3 Phase ,415 V |
| 5 | Motor RPM | 1440 |

**B** **LIST OF AGITATORS**

| SL. NO | DESCRIPTION | Tank Size / MOC | Quantity | RPM | Motor Rating |
|---|---|---|---|---|---|
| **1** | PE dosing Tank | 2 X 2 X 1.43 SWD+0.3FB (L X W X H ) /RCC | 2 No | 100 | 0.75 KW |

| PREPARED BY: FN | CHKD BY/ APPD. BY:MI/AA | DATE: 31/08/2018 | SHEET NO:- 3 OF 5 |
|---|---|---|---|

| OTOKLIN® GLOBAL BUSINESS LIMITED | DATA SHEET OF AGITATORS | | |
|---|---|---|---|
| LOI NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018 | | PROJECT DOC NO:- PE-V0-412-158-A026 | REV : 00 |
| CLIENT | **BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TDS/AGR/PTP/18/320 | |
| PROJECT | **PRE TREATMENT PLANT ENNORE** | MADE BY FN | CHKD BY MI / APPD BY AA |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | **SUB-CONTRACTOR: WTE INFRA PROJECTS PVT LTD.** | |

| **A** | **TECHNICAL SPECIFICATIONS** | |
|---|---|---|
| | **Material Of Construction** | |
| 1 | Impeller | SS-316 |
| 2 | Bottom Shaft | SS-316 |
| 3 | Mounting flange | Cast Iron, IS210, FG260 |
| 4 | Motor Type | TEFC 3 Phase ,415 V |
| 5 | Motor RPM | 1440 |

**B** **LIST OF AGITATORS**

| SL. NO | DESCRIPTION | Tank Size / MOC | Quantity | RPM | Motor Rating |
|---|---|---|---|---|---|
| **1** | NaOCl dosing Tank | 0.8x(1.0 SWD+0.3 FB) (D X H ) / FRP | 1 No | 100 | 0.37 KW |

| PREPARED BY: FN | CHKD BY/ APPD. BY:MI/AA | DATE: 31/08/2018 | SHEET NO:- 4 OF 5 |
|---|---|---|---|

| OTOKLIN® GLOBAL BUSINESS LIMITED | **DATA SHEET OF AGITATORS** | | |
|---|---|---|---|
| LOI NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018 | | PROJECT DOC NO:- PE-V0-412-158-A026 | REV : 00 |
| CLIENT | **BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TDS/AGR/PTP/18/320 | |
| PROJECT | **PRE TREATMENT PLANT ENNORE** | MADE BY FN | CHKD BY MI / APPD BY AA |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | **SUB-CONTRACTOR: WTE INFRA PROJECTS PVT LTD.** | |

| **A** | **TECHNICAL SPECIFICATIONS** | |
|---|---|---|
| | **Material Of Construction** | |
| 1 | Impeller | Duplex SS |
| 2 | Bottom Shaft | Duplex SS |
| 3 | Mounting flange | Cast Iron, IS210, FG260 |
| 4 | Motor Type | TEFC 3 Phase ,415 V |
| 5 | Motor RPM | 1440 |

**B** **LIST OF AGITATORS**

| SL. NO | DESCRIPTION | Tank Size / MOC | Quantity | RPM | Motor Rating |
|---|---|---|---|---|---|
| **1** | Flash Mixer Tank | 4.4 X 4.4 X 4 SWD+0.5 FB (L X W X H ) /RCC | 1 No | 200 | 3.7 KW |

| PREPARED BY: FN | CHKD BY/ APPD. BY:MI/AA | DATE: 31/08/2018 | SHEET NO:- 5 OF 5 |
|---|---|---|---|

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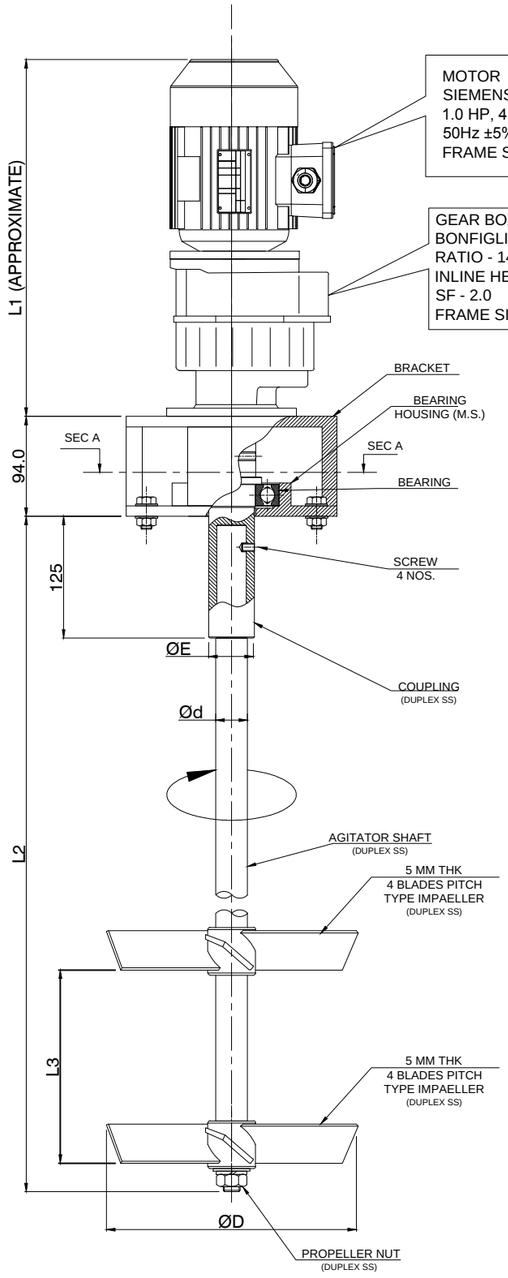
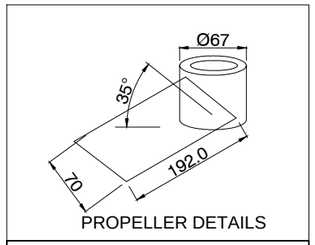
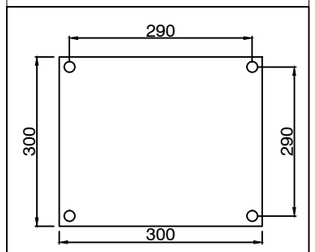


PROPELLER DETAILS



DETAILS OF MOUNTING PLATE

| SR. NO | ITEM | SIZE |
|---|---|---|
| 1 | VESSEL SIZE | 2830X2830X 1730 |
| 2 | MOTOR RPM | 1440 RPM |
| 3 | AGITATOR SHAFT RPM | 100 RPM |
| 4 | ØD | Ø450mm |
| 5 | Ød | Ø40mm |
| 6 | L1 | 500mm |
| 7 | L2 | 1680mm |
| 8 | L3 | 600mm |

MAKE: OTOKLIN GLOBAL BUSINESS LIMITED

NOTE:
1) IMPELLER ALONG WITH SHAFT TO BE INSERT THROUGH OPEN VESSEL.
2) ALL PAINTING TO BE DONE AS PER APPROVED PE-V0-412-158-A092 PAINTING SPECIFICATION
3) NO LOAD TEST IN AIR AT OUR WORK

ANGULAR TOLERANCE IN PLAN ±1°
OPEN DIAMETER MACHINE TOLERANCE ±0.5

| REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | APPD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |

JOB NO. 412
STATUS CONTRACT
DISTRIBUTION
TO
No.OFF

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

CONTRACTOR: OTOKLIN GLOBAL BUSINESS LTD
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT CODE | | NAME | SIGN | DATE |
|---|---|---|---|---|
| MAX | DRN | FAISAL N | FN | 27-03-19 |
| | DESN | FAISAL N | FN | 27-03-19 |
| | CHD | MUAZZAM I | MI | 27-03-19 |
| | APPD | ASLAM A | AA | 27-03-19 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

BHEL DOC NO.
PE-V0-412-158-A026

TITLE
GAD FOR AGITATOR FECL3 TANK

OGBL DOC NO.
OGBL/OC-983/TDS/AGR/PTP/18/220

DEPT. SCALE
SIGN
DATE

SHEET 6 OF 9 REV 0

SIZE-A1

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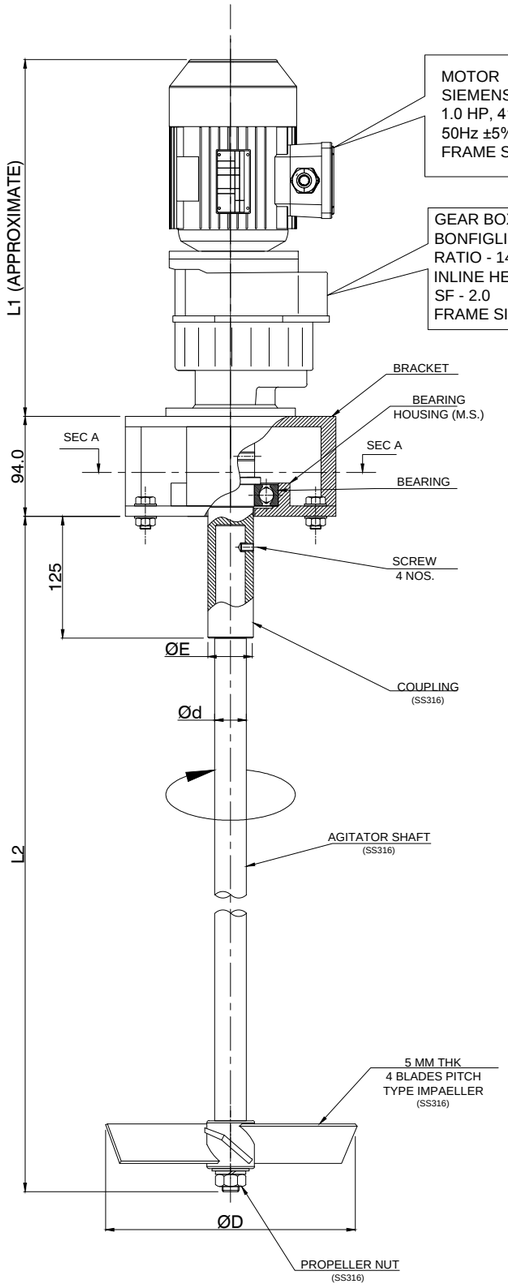
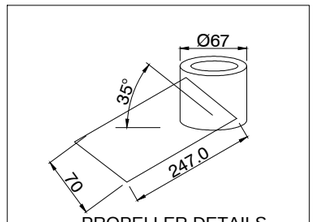
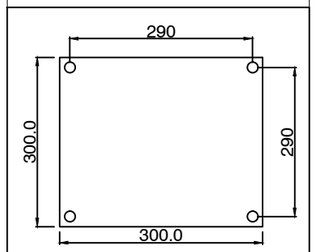



PROPELLER DETAILS




DETAILS OF
MOUNTING PLATE

| SR. NO | ITEM | SIZE |
|---|---|---|
| 1 | VESSEL SIZE | 2000X2000X 1730 |
| 2 | MOTOR RPM | 1440 RPM |
| 3 | AGITATOR SHAFT RPM | 100 RPM |
| 4 | ØD | Ø560mm |
| 5 | Ød | Ø35 mm |
| 6 | L1 | 500mm |
| 7 | L2 | 1680mm |

## MAKE: OTOKLIN GLOBAL BUSINESS LIMITED

NOTE:
1) IMPELLER ALONG WITH SHAFT TO BE INSERT THROUGH OPEN VESSEL.
2) ALL PAINTING TO BE DONE AS PER APPROVED PE-V0-412-158-A092 PAINTING SPECIFICATION
3) NO LOAD TEST IN AIR AT OUR WORK

ANGULAR TOLERANCE IN PLAN ±1°
OPEN DIAMETER MACHINE TOLERANCE ±0.5

| REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

| REV | DATE | ALTD | CHD | APPD |
|---|---|---|---|---|
| | | | | |

JOB NO. 412
STATUS CONTRACT
DISTRIBUTION
TO
No.OFF

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

CONTRACTOR: OTOKLIN GLOBAL BUSINESS LTD
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT CODE | | NAME | SIGN | DATE |
|---|---|---|---|---|
| MAX | DRN | FAISAL N | FN | 27-03-19 |
| | DESN | FAISAL N | FN | 27-03-19 |
| | CHD | MUAZZAM I | MI | 27-03-19 |
| | APPD | ASLAM A | AA | 27-03-19 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

BHEL DOC NO.
PE-V0-412-158-A026

TITLE
GAD FOR AGITATOR LIME/PE DOSING TANK

DEPT. SCALE
SIGN
DATE

OGBL DOC NO.
OGBL/OC-963/TDS/AGR/PTP/16/320

SHEET 7 OF 9 REV 0

SIZE-A1

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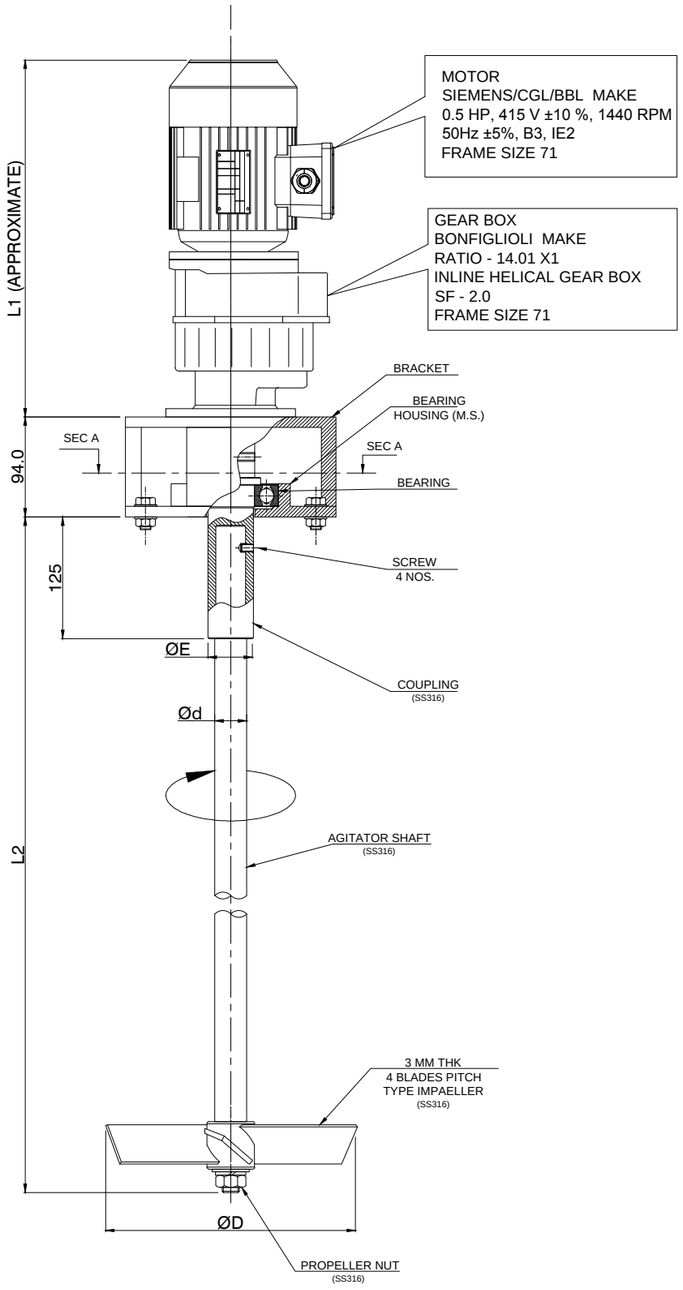
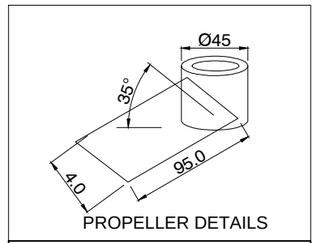
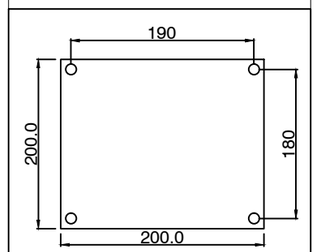
DRAWING NO.

CUSTOMERS DRAWING NO.




PROPELLER DETAILS




DETAILS OF MOUNTING PLATE

| SR. NO | ITEM | SIZE |
|---|---|---|
| 1 | VESSEL SIZE | Ø800X1300 |
| 2 | MOTOR RPM | 1440 RPM |
| 3 | AGITATOR SHAFT RPM | 100 RPM |
| 4 | ØD | Ø240 mm |
| 5 | Ød | Ø28 mm |
| 6 | L1 | 450 mm |
| 7 | L2 | 1320 mm |

## MAKE: OTOKLIN GLOBAL BUSINESS LIMITED

NOTE:
1) IMPELLER ALONG WITH SHAFT TO BE INSERT THROUGH OPEN VESSEL.
2) ALL PAINTING TO BE DONE AS PER APPROVED PE-V0-412-158-A092 PAINTING SPECIFICATION
3) NO LOAD TEST IN AIR AT OUR WORK

ANGULAR TOLERANCE IN PLAN ±1°
OPEN DIAMETER MACHINE TOLERANCE ±0.5

| REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | APPD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |

JOB NO. 412
STATUS CONTRACT
DISTRIBUTION
TO
No.OFF

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

CONTRACTOR: OTOKLIN GLOBAL BUSINESS LTD
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT CODE | | NAME | SIGN | DATE |
|---|---|---|---|---|
| MAX | DRN | FAISAL N | FN | 27-03-19 |
| | DESN | FAISAL N | FN | 27-03-19 |
| | CHD | MUAZZAM I | MI | 27-03-19 |
| | APPD | ASLAM A | AA | 27-03-19 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

BHEL DOC NO.
PE-V0-412-158-A026

TITLE
GAD FOR AGITATOR NaOCL DOSING TANK

DEPT. SCALE
SIGN
DATE

OGBL DOC NO.
OGBL/OC-968/TDS/AGR/PTP/18/S20

SHEET 8 OF 9 REV 0

SIZE-A1

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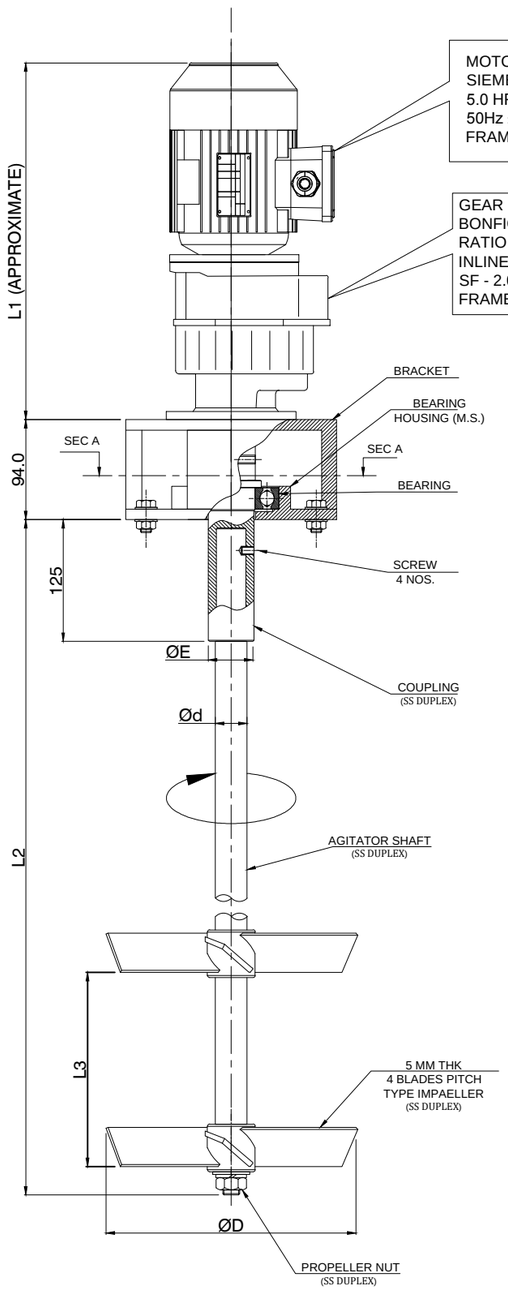
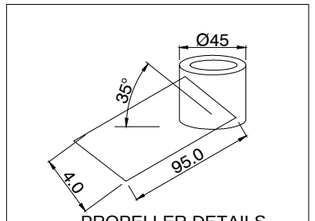
DRAWING NO.

CUSTOMER'S DRAWING NO.

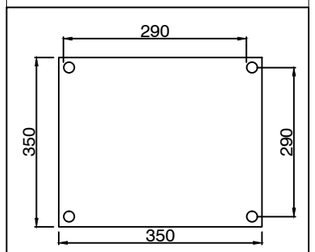
FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM



PROPELLER DETAILS



DETAILS OF MOUNTING PLATE

| SR. NO | ITEM | SIZE |
|---|---|---|
| 1 | VESSEL SIZE | 4400X4400X 4500 |
| 2 | MOTOR RPM | 1440 RPM |
| 3 | AGITATOR SHAFT RPM | 200 RPM |
| 4 | ØD | Ø550 mm |
| 5 | Ød | Ø65 mm |
| 6 | L1 | 650 mm |
| 7 | L2 | 4450 mm |
| 8 | L3 | 1200mm |

## MAKE: OTOKLIN GLOBAL BUSINESS LIMITED

NOTE:
1) IMPELLER ALONG WITH SHAFT TO BE INSERT THROUGH OPEN VESSEL.
2) ALL PAINTING TO BE DONE AS PER APPROVED PE-V0-412-158-A092 PAINTING SPECIFICATION
3) NO LOAD TEST IN AIR AT OUR WORKS

ANGULAR TOLERANCE IN PLAN ±1°
OPEN DIAMETER MACHINE TOLERANCE ±0.5

| REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

| REV | DATE | ALTD | CHD | APPD |
|---|---|---|---|---|
| | | | | |

JOB NO. 412
STATUS CONTRACT
DISTRIBUTION
TO
No.OFF

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

CONTRACTOR: OTOKLIN GLOBAL BUSINESS LTD
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT CODE | | NAME | SIGN | DATE |
|---|---|---|---|---|
| MAX | DRN | FAISAL N | FN | 27-03-19 |
| | DESN | FAISAL N | FN | 27-03-19 |
| | CHD | MUAZZAM I | MI | 27-03-19 |
| | APPD | ASLAM A | AA | 27-03-19 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

BHEL DOC NO.
PE-V0-412-158-A026

TITLE
GAD FOR AGITATOR FLASH MIXER TANK

OGBL DOC NO.
OGBL/OC-983/TDS/AGR/PTP/18/320

DEPT.
SCALE
SIGN
DATE

SHEET 9 OF 9 REV 0

SIZE-A1

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

# BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

## TECHNICAL DATA SHEET OF HOIST

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | FAISAL N | FN | 05-11-18 |
| CHKD | MUAZZAM I | MI | 05-11-18 |
| APPD | ASLAM A | AA | 05-11-18 |

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | PE-V0-412-158-A027 | 01 |
| DATE | | | | | | | | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/TDS/HWTC/PTP/18/321 | |

NO. OF SHEETS 6 EXCLUDING COVER PAGE

| OTOKLIN GLOBAL BUSINESS LIMITED | DATA SHEET OF ELECTRIC HOIST | | |
|---|---|---|---|
| LOA NO: - PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018. | | PROJECT DOC NO:- PE-V0-412-158-A027 | Rev No:- 01 |
| CLIENT | **BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TDS/HWTC/PTP/18/321 | |
| PROJECT | **Pre Treatment Plant, Ennore** | MADE BY: FN / CHKD BY: MI | APPD BY: AA |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | | |

**TECHNICAL SPECIFICATION OF ELECTRIC WIRE ROPE HOISTS**

| Sr. No | Description | |
|---|---|---|
| 1 | Description Of Equipment | Electric Wire Rope Hoists |
| 2 | Capacity | 1 Tonnes |
| 3 | Quantity | 1 No. |
| 4 | Height of Lift | 2.5-4 Mtrs. |
| 5 | Length of Travel | 24 Mtrs. |
| 6 | Location | Chemical House Ground floor (Indoor) (R1) |
| 7 | Ambient Temperature | 50°C. (R1) |
| 8 | Area classification | Safe (Non-Hazardous) Area. |
| 9 | Duty | Class II Duty as per IS:3938-1983 |
| 10 | Operation | From floor, by means of Pendant Push Button Controller suspended from Hoist. |
| 12 | Type of Trolley | Motorized Trolley |
| 13 | Hoisting Speed | 3.0 Mtrs/min |
| 14 | CT Speed | 16.0 Mtrs/min |
| 15 | Hoisting Motor HP | 3.0HP |
| 16 | CT Motor HP | 0.03HP |

| PREPARED BY: FN | CHKD.& APPD.BY:-MI & AA | DATE: 05/11/2018 | SHEET NO:- 1 OF 6 |
|---|---|---|---|

| OTOKLIN GLOBAL BUSINESS LIMITED | DATA SHEET OF ELECTRIC HOIST | | |
|---|---|---|---|
| LOI NO: - PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018. | | PROJECT DOC NO:- PE-V0-412-158-A027 | Rev No:- 01 |
| CLIENT | **BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TDS/HWTC/PTP/18/321 | |
| PROJECT | **Pre Treatment Plant, Ennore** | MADE BY<br>FN | CHKD BY<br>MI / APPD BY<br>AA |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | | |

**TECHNICAL SPECIFICATION OF ELECTRIC WIRE ROPE HOISTS**

| | | |
|---|---|---|
| 17 | Motors | Hoist Motor, High Torque, crane Duty, 40%CDF, TEFC, 416 pole Class; F; insulated suitable for 150 starts/hour Sq. Cage. |
| 18 | Wire Rope | 8 mm. Dia. |
| 19 | Construction | 6x36 Construction, fiber core, Galvanized, as per IS2266 |
| 20 | No. of Falls | 4 Nos. |
| 21 | Factor of Safety | As per IS: 3938. |
| 22 | Limit Switches | MH: Snap Action, CT: Two lever Type. |
| 23 | Brakes | DC-DISC Brake in MH and CT Motion. |
| 24 | Control Panel | Provided on Hoist consisting of Main Contactors, Motor Contactors, Single Phase Preventers with overload relay, fuses, connectors, etc. |
| 25 | Power Supply to the Hoist | Through Trailing Cable Arrangement running On Taught wire. |
| 26 | Hook | Single Shank Forged as per IS: 15560 with spring latch. |
| 27 | Weight of the Hoist | 250 Kgs. Approx. |
| 28 | Power Supply | 415 + 6%V. 3 Phase: 50 + 3% HZ: A.C. |
| 29 | Control Voltage | 110 Volts: Single Phase: 50 H.Z.: A.C. |

| PREPARED BY: FN | CHKD.& APPD.BY:-MI & AA | DATE: 05/11/2018 | SHEET NO:- 2 OF 6 |
|---|---|---|---|

| OTOKLIN GLOBAL BUSINESS LIMITED | DATA SHEET OF ELECTRIC HOIST | | |
|---|---|---|---|
| LOA NO: - PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018. | | PROJECT DOC NO:- PE-V0-412-158-A027 | Rev No:- 01 |
| CLIENT | **BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TDS/HWTC/PTP/18/321 | |
| PROJECT | **Pre Treatment Plant, Ennore** | MADE BY: FN / CHKD BY: MI | APPD BY: AA |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | | |

**TECHNICAL SPECIFICATION OF ELECTRIC WIRE ROPE HOISTS**

| Sr. No | Description | |
|---|---|---|
| 1 | Description Of Equipment | Electric Wire Rope Hoists |
| 2 | Capacity | 1 Tonnes |
| 3 | Quantity | 1 No. |
| 4 | Height of Lift | 2.5-4 Mtrs. |
| 5 | Length of Travel | 28 Mtrs. |
| 6 | Location | Chemical House 1st floor (Indoor) (R1) |
| 7 | Ambient Temperature | 50°C. (R1) |
| 8 | Area classification | Safe (Non-Hazardous) Area. |
| 9 | Duty | Class II Duty as per IS:3938-1983 |
| 10 | Operation | From floor, by means of Pendant Push Button Controller suspended from Hoist. |
| 12 | Type of Trolley | Motorized Trolley |
| 13 | Hoisting Speed | 3.0 Mtrs/min |
| 14 | CT Speed | 16.0Mtrs/min |
| 15 | Hoisting Motor HP | 3.0HP |
| 16 | CT Motor HP | 0.03HP |

| PREPARED BY: FN | CHKD.& APPD.BY:-MI & AA | DATE: 05/11/2018 | SHEET NO:- 3 OF 6 |
|---|---|---|---|

| OTOKLIN GLOBAL BUSINESS LIMITED | DATA SHEET OF ELECTRIC HOIST | | |
|---|---|---|---|
| LOI NO: - PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018. | | PROJECT DOC NO:- PE-V0-412-158-A027 | Rev No:- 01 |
| CLIENT | **BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TDS/HWTC/PTP/18/321 | |
| PROJECT | **Pre Treatment Plant, Ennore** | MADE BY<br>FN | CHKD BY<br>MI / APPD BY<br>AA |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | | |

**TECHNICAL SPECIFICATION OF ELECTRIC WIRE ROPE HOISTS**

| | | |
|---|---|---|
| 17 | Motors | Hoist Motor, High Torque, crane Duty,40%CDF,TEFC,416 pole Class ;F; insulated suitable for 150 starts/hour Sq. Cage. |
| 18 | Wire Rope | 8 mm. Dia. |
| 19 | Construction | 6x36 Construction, fiber core, Galvanized, as per IS2266 |
| 20 | No. of Falls | 4 Nos. |
| 21 | Factor of Safety | As per IS: 3938. |
| 22 | Limit Switches | MH: Snap Action, CT: Two lever Type. |
| 23 | Brakes | DC-DISC Brake in MH and CT Motion. |
| 24 | Control Panel | Provided on Hoist consisting of Main Contactors, Motor Contactors, Single Phase Preventers with overload relay, fuses, connectors, etc. |
| 25 | Power Supply to the Hoist | Through Trailing Cable Arrangement running On Taught wire. |
| 26 | Hook | Single Shank Forged as per IS: 15560 with spring latch. |
| 27 | Weight of the Hoist | 250 Kgs. Approx |
| 28 | Power Supply | 415 + 6%V. 3 Phase: 50 + 3% HZ: A.C. |
| 29 | Control Voltage | 110 Volts: Single Phase: 50 H.Z.: A.C. |

| PREPARED BY: FN | CHKD.& APPD.BY:-MI & AA | DATE: 05/11/2018 | SHEET NO:- 4 OF 6 |
|---|---|---|---|

| OTOKLIN GLOBAL BUSINESS LIMITED | DATA SHEET OF ELECTRIC HOIST | | |
|---|---|---|---|
| LOA NO: - PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018. | | PROJECT DOC NO:- PE-V0-412-158-A027 | Rev No:- 01 |
| CLIENT | **BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TDS/HWTC/PTP/18/321 | |
| PROJECT | **Pre Treatment Plant, Ennore** | MADE BY: FN | CHKD BY: MI / APPD BY: AA |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | | |

**TECHNICAL SPECIFICATION OF ELECTRIC WIRE ROPE HOISTS**

| Sr. No | Description | |
|---|---|---|
| 1 | Description Of Equipment | Electric Wire Rope Hoists |
| 2 | Capacity | 1 Tonnes |
| 3 | Quantity | 1 No. |
| 4 | Height of Lift | 5 Mtrs. |
| 5 | Length of Travel | 6.5 Mtrs. |
| 6 | Location | Sludge Transfer Sump (Outside). (R1) |
| 7 | Ambient Temperature | 50°C. (R1) |
| 8 | Area classification | Safe (Non-Hazardous) Area. |
| 9 | Duty | Class II Duty as per IS:3938-1983 |
| 10 | Operation | From floor, by means of Pendant Push Button Controller suspended from Hoist. |
| 12 | Type of Trolley | Motorized Trolley |
| 13 | Hoisting Speed | 3.0 Mtrs/min |
| 14 | CT Speed | 16.0Mtrs/min |
| 15 | Hoisting Motor HP | 3.0HP |
| 16 | CT Motor HP | 0.03HP |

| OTOKLIN GLOBAL BUSINESS LIMITED | DATA SHEET OF ELECTRIC HOIST | | |
|---|---|---|---|
| LOI NO: - PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018. | | PROJECT DOC NO:- PE-V0-412-158-A027 | Rev No:- 01 |
| CLIENT | **BHARAT HEAVY ELECTRICALS LIMITED** | OTOKLIN DOC NO:- OGBL/OC-983/TDS/HWTC/PTP/18/321 | |
| PROJECT | **Pre Treatment Plant, Ennore** | MADE BY<br>FN | CHKD BY<br>MI / APPD BY<br>AA |
| **CONTRACTOR: OTOKLIN GLOBAL BUSINESS LIMITED** | | | |

**TECHNICAL SPECIFICATION OF ELECTRIC WIRE ROPE HOISTS**

| | | |
|---|---|---|
| 17 | Motors | Hoist Motor, High Torque, crane Duty,40%CDF,TEFC,416 pole Class ;F; insulated suitable for 150 starts/hour Sq. Cage. |
| 18 | Wire Rope | 8 mm. Dia. |
| 19 | Construction | 6x36 Construction, fiber core, Galvanized, as per IS2266 |
| 20 | No. of Falls | 4 Nos. |
| 21 | Factor of Safety | As per IS: 3938. |
| 22 | Limit Switches | MH: Snap Action, CT: Two lever Type. |
| 23 | Brakes | DC-DISC Brake in MH and CT Motion. |
| 24 | Control Panel | Provided on Hoist consisting of Main Contactors, Motor Contactors, Single Phase Preventers with overload relay, fuses, connectors, etc. |
| 25 | Power Supply to the Hoist | Through Trailing Cable Arrangement running On Taught wire. |
| 26 | Hook | Single Shank Forged as per IS: 15560 with spring latch. |
| 27 | Weight of the Hoist | 250 Kgs. Approx. |
| 28 | Power Supply | 415 + 6%V. 3 Phase: 50 + 3% HZ: A.C. |
| 29 | Control Voltage | 110 Volts: Single Phase: 50 H.Z.: A.C. |

| PREPARED BY: FN | CHKD.& APPD.BY:-MI & AA | DATE: 05/11/2018 | SHEET NO:- 6 OF 6 |
|---|---|---|---|

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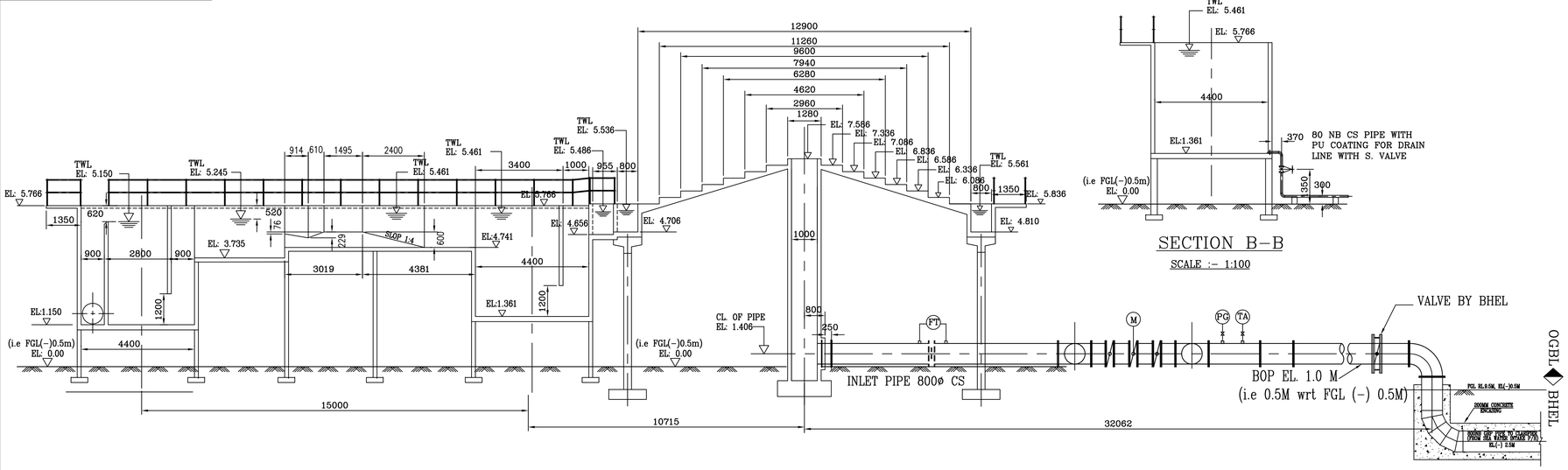
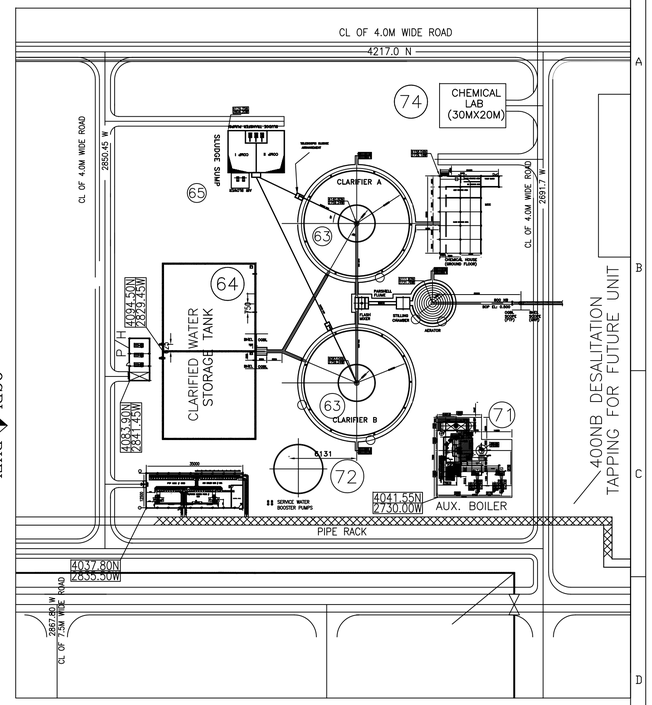
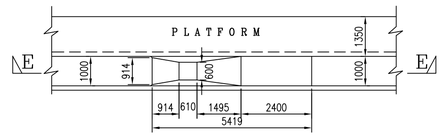
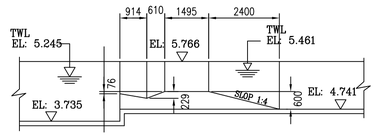



ENLARGED DETAIL OF PARSHALL FLUME

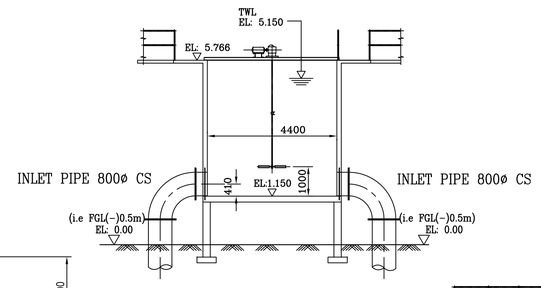



SECTION E−E



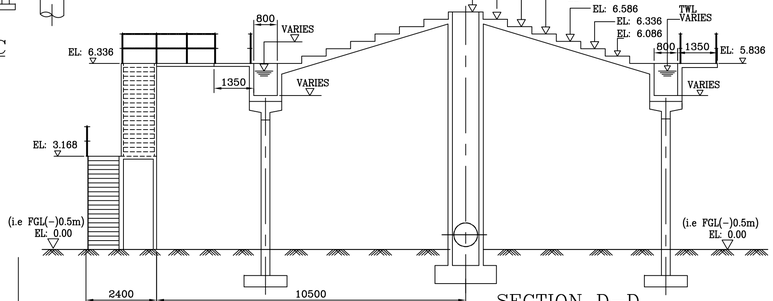

SECTION B−B

SCALE :− 1:100



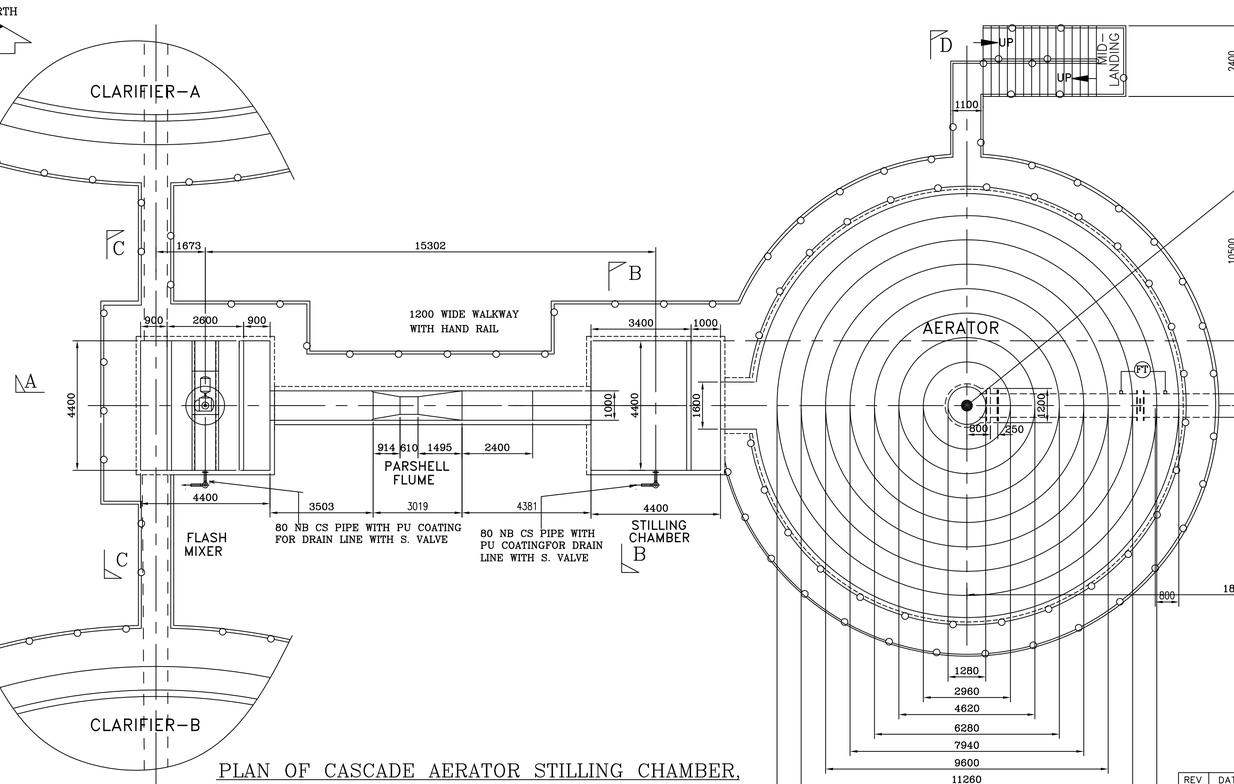

SECTION C−C

SCALE :− 1:1



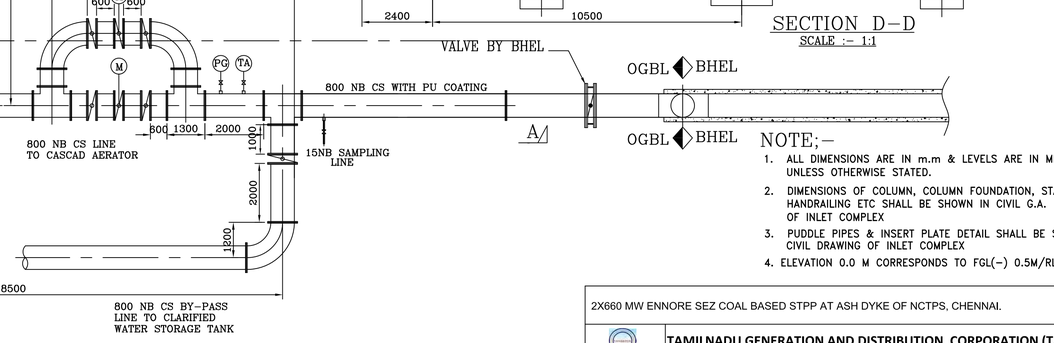

SECTION D−D

SCALE :− 1:1




PLAN OF CASCADE AERATOR STILLING CHAMBER, PARSHALL FLUME AND FLASH MIXER (INLET COMPLEX)

SCALE :− 1:1




NOTE;−

1. ALL DIMENSIONS ARE IN m.m & LEVELS ARE IN METRE UNLESS OTHERWISE STATED.
2. DIMENSIONS OF COLUMN, COLUMN FOUNDATION, STAIR CASE, HANDRAILING ETC SHALL BE SHOWN IN CIVIL G.A. OF INLET COMPLEX
3. PUDDLE PIPES & INSERT PLATE DETAIL SHALL BE SHOWN IN THE CIVIL DRAWING OF INLET COMPLEX
4. ELEVATION 0.0 M CORRESPONDS TO FGL(−) 0.5M/RL 9.5M

| REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | APPD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |

JOB NO. 412
STATUS CONTRACT
DISTRIBUTION
TO
No.OFF

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

CONTRACTOR: OTOKLIN GLOBAL BUSINESS LTD
E−410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022−26732135

| DEPT CODE | | NAME | SIGN | DATE |
|---|---|---|---|---|
| MAX | DRN | FAISAL N | FN | 12−12−18 |
| | DESN | FAISAL N | FN | 12−12−18 |
| | CHD | MUAZZAM I | MI | 12−12−18 |
| | APPD | ASLAM A | AA | 12−12−18 |

BHEL LOA NO: PW/PE/PG/EN1/P−310/17

TITLE: MECH. G.A FOR CASCADE AERATOR, STILLING CHAMBER, FLASH MIXER AND PARSHALL FLUME FOR CLARIFIER

BHEL DOC NO.
PE−V0−412−158−A028

OGBL DOC NO.
OGBL/0C−983/GA/ASFMPL/PTP/18/322

DEPT. | SCALE | SIGN | DATE

SHEET 1 OF 1 | REV 0

SIZE−A1

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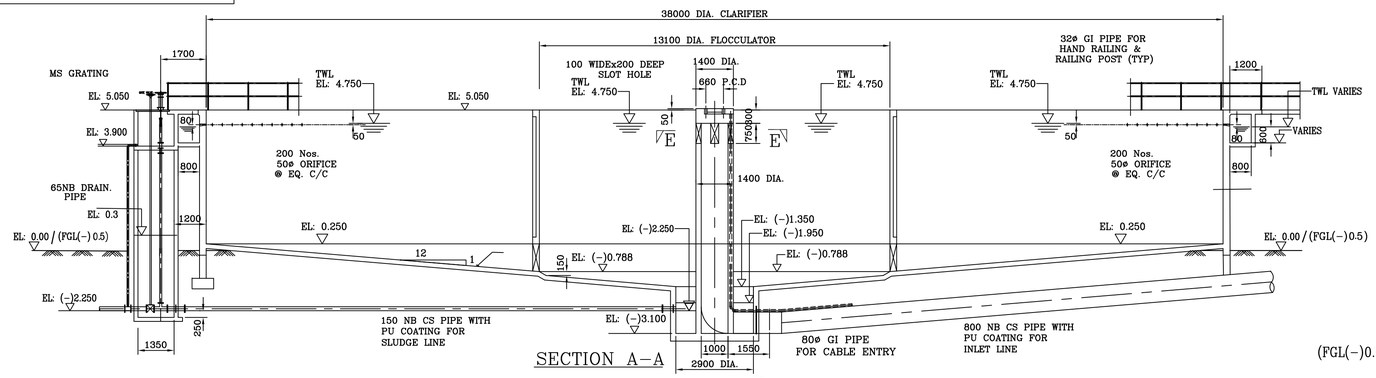
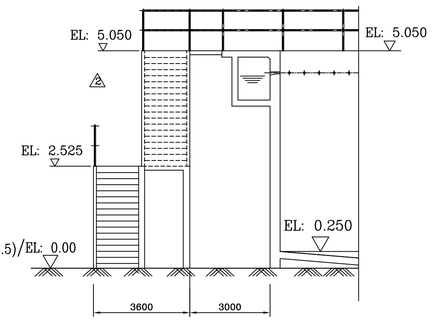
FIRST ANGLE PROJECTION — ALL DIMENSIONS ARE IN MM

DRAWING NO. — CUSTOMER'S DRAWING NO.




SECTION A–A

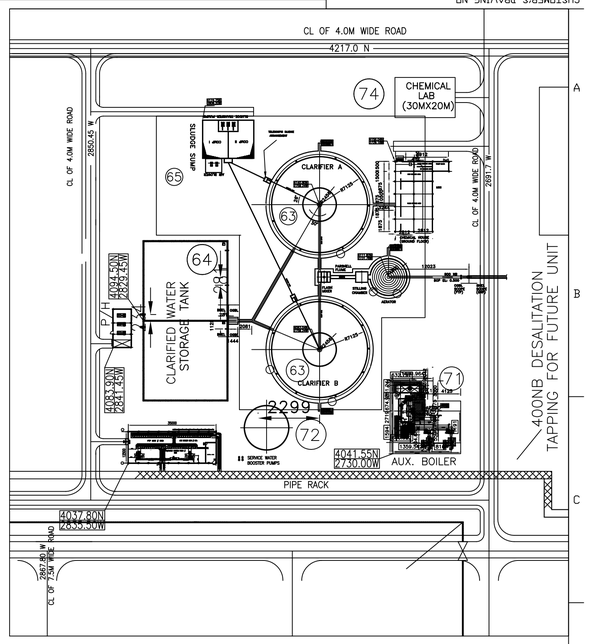


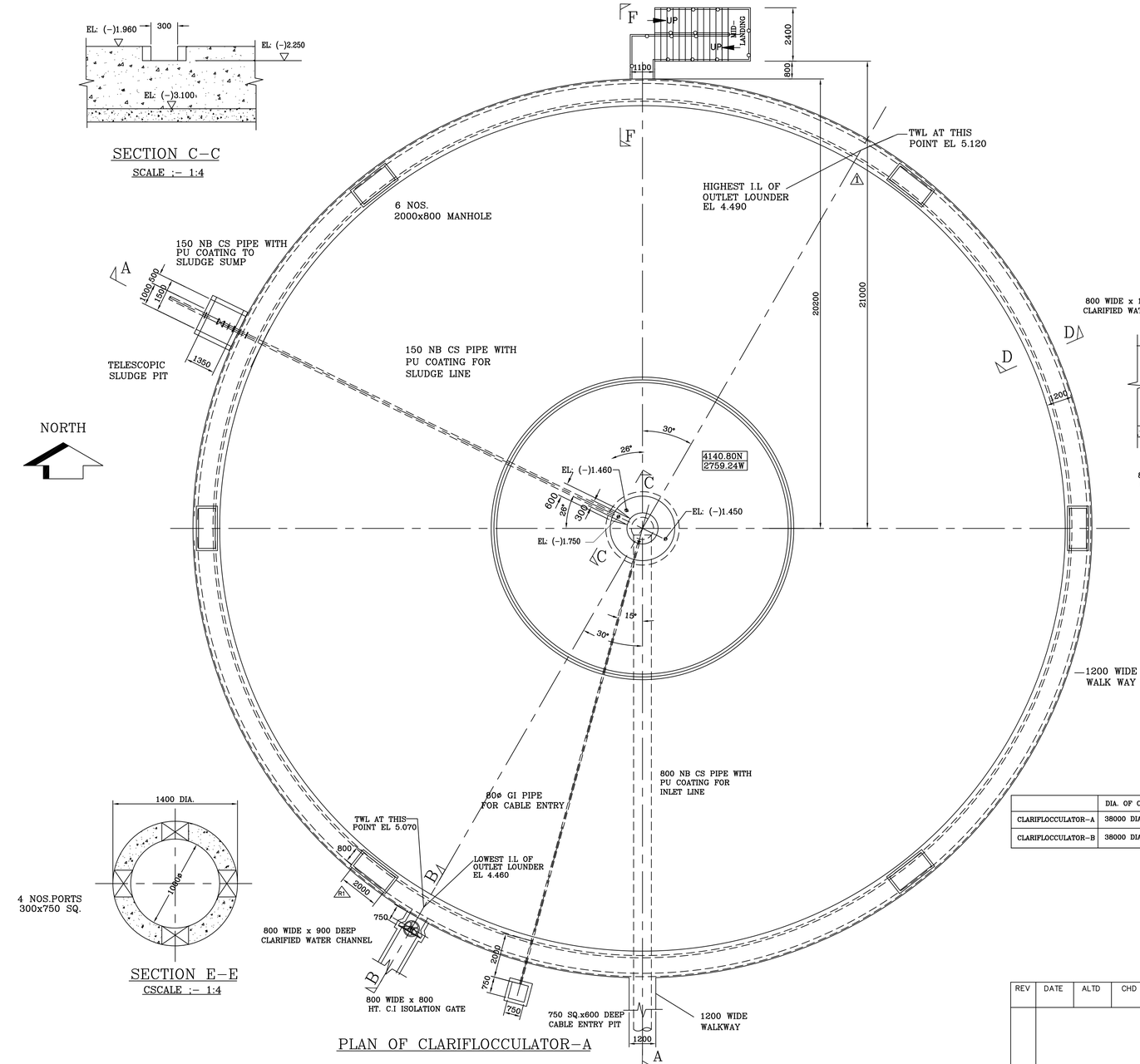

SECTION F–F




SECTION C–C

SCALE :- 1:4



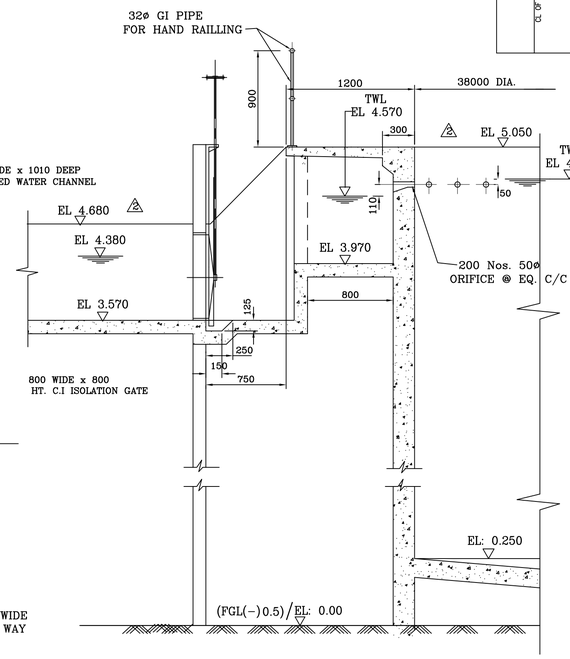




PLAN OF CLARIFLOCCULATOR–A



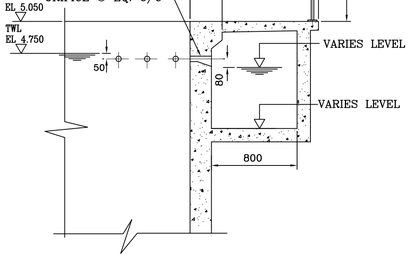

SECTION E–E

CSCALE :- 1:4




SECTION B–B

SCALE :- 1:4




SECTION D–D

SCALE :- 1:4

## NOTES:–

1. ALL DIMENSIONS ARE IN m.m & LEVELS ARE IN METER UNLESS OTHERWISE STATED.
2. THIS DRAWING IS PREPARED BASED ON HYDRAULIC FLOW DIAGRAM (BHEL DRG. NO. PE–V0–412–158–A003)
3. INVERT LEVEL OF VARIOUS CHANNELS HAS BEEN INDICATED IN THE DIAGRAM, WHEREVER FEASABLE. OTHER LEVELS SHALL BE INDICATED IN THE RESPECTIVE G.A DRAWING OF VARIOUS UNITS/STRUCTURES.
4. FOR SIZING & LOCATION OF GATES/VALVES PL. REFER P&ID. OF PRE–TREATMENT PLANT (BHEL DRG. NO. PE–V0–412–158–A001)
5. THE DETAILS OF CLARIFLOCCULATOR–A HAS BEEN SHOWN IN THIS DRAWING. DIMENSIONS AND LEVELS OF CLARIFLOCCULATOR–B WILL BE SAME AS CLF.–1. THE LOCATION & ORIENTATION OF CLF.–A AND CLF.–B HAVE BEEN INDICATED IN KEY PLAN.
6. EL 0.0M CORRESPONDS TO FGL(–) 0.5/RL–9.5M.

| | DIA. OF CLF. | SWD | F.B | DIA. OF FLOCC. | STATIC LOAD (MT) | DYNAMIC LOAD (MT) | FLOCCULATOR DRIVE (KW) | END CARRIAGE DRIVE (KW) |
|---|---|---|---|---|---|---|---|---|
| CLARIFLOCCULATOR–A | 38000 DIA. | 4500 | 300 | 13100 DIA. | X | X | 4x0.37 | 0.75 |
| CLARIFLOCCULATOR–B | 38000 DIA. | 4500 | 300 | 13100 DIA. | X | X | 4x0.37 | 0.75 |

| REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | APPD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

JOB NO. 412
STATUS CONTRACT
DISTRIBUTION
TO
No.OFF

CONTRACTOR: OTOKLIN GLOBAL BUSINESS LTD
E–410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022–26732135

| DEPT CODE | | NAME | SIGN | DATE |
|---|---|---|---|---|
| MAX | DRN | FAISAL N | FN | 14–12–18 |
| | DESN | FAISAL N | FN | 14–12–18 |
| | CHD | MUAZZAM I | MI | 14–12–18 |
| | APPD | ASLAM A | AA | 14–12–18 |

BHEL LOA NO: PW/PE/PG/EN1/P–310/17

TITLE: MECH. GA FOR CLARIFIER & CONNECTING CHANNEL

BHEL DOC NO. PE–V0–412–158–A030

DEPT. SCALE: 1:1 — SIGN — DATE

OGBL DOC NO. OGBL/OC–983/GA/CLA/PTP/18/323

SHEET 1 OF 2 | REV 02

SIZE–A1

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DRAWING NO.

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM

CUSTOMER'S DRAWING NO.



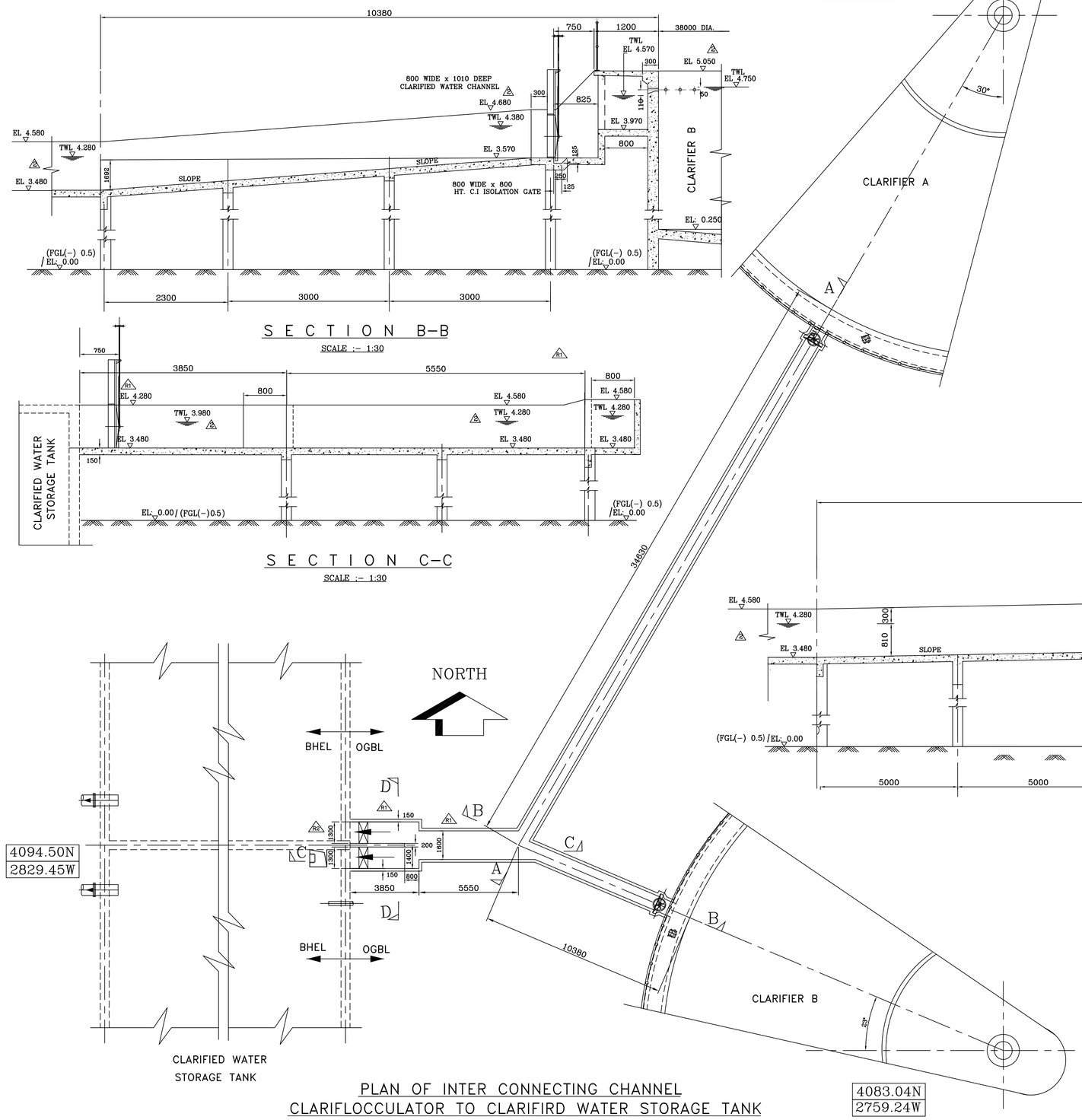

## SECTION B–B

SCALE :– 1:30



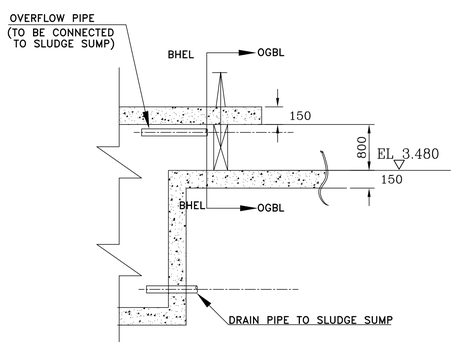

## SECTION C–C

SCALE :– 1:30

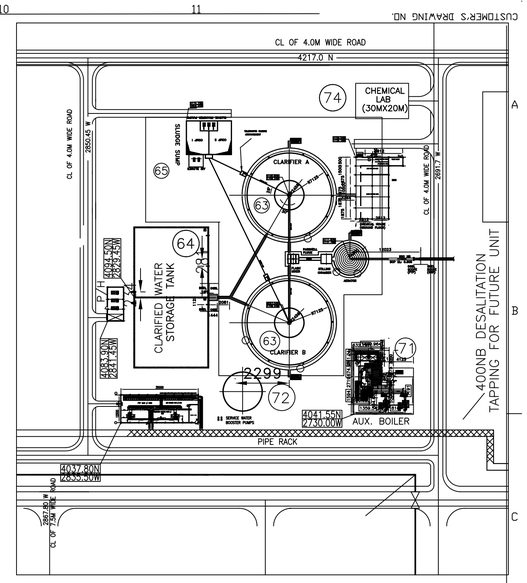


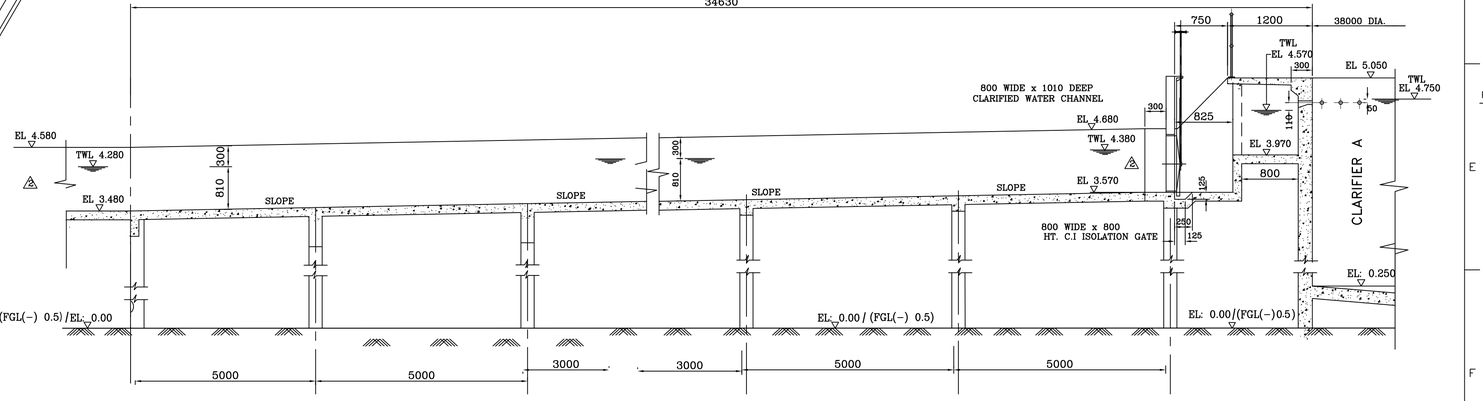

## PLAN OF INTER CONNECTING CHANNEL CLARIFLOCCULATOR TO CLARIFIRD WATER STORAGE TANK

SCALE :– 1:100




## SECTION D–D




## SECTION A–A

SCALE :– 1:30

1. ALL DIMENSIONS ARE IN m.m & LEVELS ARE IN METER UNLESS OTHERWISE STATED.
2. THIS DRAWING IS PREPARED BASED ON HYDRAULIC FLOW DIAGRAM (BHEL DRG. NO. PE–V0–412–158–A003)
3. INVERT LEVEL OF VARIOUS CHANNELS HAS BEEN INDICATED IN THE DIAGRAM, WHEREVER FEASABLE. OTHER LEVELS SHALL BE INDICATED IN THE RESPECTIVE G.A DRAWING OF VARIOUS UNITS/STRUCTURES.
4. FOR SIZING & LOCATION OF GATES/VALVES PL. REFER P&ID. OF PRE–TREATMENT PLANT (BHEL DRG. NO. PE–V0–412–158–A001)
5. THE DETAILS OF CLARIFLOCCULATOR–A HAS BEEN SHOWN IN THIS DRAWING. DIMENSIONS AND LEVELS OF CLARIFLOCCULATOR–B WILL BE SAME AS CLF.–1. THE LOCATION & ORIENTATION OF CLF.–A AND CLF.–B HAVE BEEN INDICATED IN KEY PLAN.
6. EL 0.0M CORRESPONDS TO FGL(–) 0.5/RL–9.5M.

| REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | APPD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

JOB NO. 412
STATUS CONTRACT
DISTRIBUTION
TO
No.OFF

CONTRACTOR: OTOKLIN GLOBAL BUSINESS LTD
E–410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022–26732135

| DEPT CODE | | NAME | SIGN | DATE |
|---|---|---|---|---|
| MAX | DRN | FAISAL N | FN | 14–12–18 |
| | DESN | FAISAL N | FN | 14–12–18 |
| | CHD | MUAZZAM I | MI | 14–12–18 |
| | APPD | ASLAM A | AA | 14–12–18 |

BHEL LOA NO: PW/PE/PG/EN1/P–310/17

TITLE: MECH. GA FOR CLARIFIER & CONNECTING CHANNEL

BHEL DOC NO. PE–V0–412–158–A003

DEPT. SCALE 1:100

SIGN

DATE

OGBL DOC NO. OGBL/OC–983/HFDLC/PTP/18/302

SHEET 2 OF 2 REV 02

SIZE–A1

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

| REV | DATE | ALTERED: | REV | DATE | ALTERED: |
|---|---|---|---|---|---|
| | | CHECKED: | | | CHECKED: |

STATUS : CONTRACT

JOB NO.: 412

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

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)**

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

# BHARAT HEAVY ELECTRICALS LIMITED

PROJECTS ENGINEERING MANAGEMENT,NEW DELHI

OTOKLIN GLOBAL BUSINESS LTD.
E-410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022-26732135

| DEPT. | CODE | SCALE | WEIGHT(KG) | REF DRG. | ITEM |
|---|---|---|---|---|---|
| -- | A | - | - | - | - |

## MECH. GA AND DATA SHEET FOR CLARIFIER BRIDGE MECHANISM

BHEL LOA NO: PW/PE/PG/EN1/P-310/17 DTD. 18.01.2018

| | NAME | SIGN | DATE |
|---|---|---|---|
| PREP | FAISAL N | FN | 08-01-19 |
| CHKD | MUAZZAM I | MI | 08-01-19 |
| APPD | ASLAM A | AA | 08-01-19 |

| DEPT. | | | | | | | CARD CODE | BHEL DRAWING NO. | REV |
|---|---|---|---|---|---|---|---|---|---|
| SIGN | | | N.A. | | | | - | PE-V0-412-158-A033 | 01 |
| DATE | | | | | | | | OTOKLIN-DRG/DOC-NO.. OGBL/OC-983/GA/CBM/PTP/18/324 | |

NO. OF SHEETS 3 EXCLUDING COVER PAGE

| OTOKLIN GLOBAL BUSINESS LIMITED | | TECHNICAL DATASHEET OF CLARIFIER BRIDGE MECHANISM | | |
|---|---|---|---|---|
| CLIENT | **BHARAT HEAVY ELECTRICALS LTD.** | **Project Doc No.:** PE-V0-412-158-A033 | | **Rev :** 01 |
| PROJECT | **Pre Treatment Plant Ennore** | **OTOKLIN DOC NO:-** OGBL/OC-983/GA/CBM/PTP/18/324 | | |
| | | **MADE BY** | **CHKD BY** | **APPD BY** |
| | | FN | MI | AA |

| **Sr.no** | **Component /Parameter** | **UNIT** | **Supplier data** |
|---|---|---|---|
| 1 | Fluid | | Sea Water |
| 2 | Temperature | °C | Ambient |
| 3 | Flow | $m^3/h$ | 1160 |
| | **Operating data** | | |
| 4 | Running time | h/d | continuous |
| 5 | Diameter of Clarifier | m | 38.00 |
| 6 | SWD | m | 4.50 |
| 7 | Free Board | m | 0.30 |
| 8 | Launder Location | | Outside |
| 9 | Diameter of Flocculation Zone | m | 13.10 |
| 10 | Water Depth of Flocculation Zone | m | 4.50 |
| | **Clariflocculator** | | |
| 11 | Type | | Down flow |
| 12 | Tank bottom slope | ° | 1:12 |
| 13 | Peripheral speed | m/min | 3 to4 m/min |
| 14 | Thickness of scrapper blade | mm | min 5.0 |
| 15 | Bridge Width | m | 1.2 |
| 16 | No. of Rings of current collector | | 9 |
| 17 | Walkway | mm | Chequered plates (5mm) |
| 18 | Rating of Drive Head of Motor & RPM | | 1.5 KW X 1440 rpm |
| 19 | Telescopic Bleed Arrangement | | Yes - 80mm dia each |
| 20 | Steps to approach Clarifier Bridge | | Yes |
| | **Flocculator** | | |
| 21 | No. of flocculator per Clarifier | nos | 4 |
| 22 | Type of Flocculators | | Paddle type |
| | Base Frame | | built on Bridge |
| 23 | Motor KW & RPM | rpm | 0.75 KW, 1440 rpm |
| 24 | Gear Box Type | | Flocc 'A' & End 'U' Type |
| 25 | Gear Box Ratio | | 60:1 (R1) |
| | **Material of Construction** | | |
| 26 | Scrapper Assembly | | MS FRP |
| 27 | Walkway Bridge | | MS+CORROCOAT/FRP RESIN LINING |
| 28 | Centre Stilling Cage | | MS FRP |
| 29 | Central bearing housing | | MS/CI |
| 30 | Scraper blades | | MS FRP |

| OTOKLIN GLOBAL BUSINESS LIMITED | | TECHNICAL DATASHEET OF CLARIFIER BRIDGE MECHANISM | | |
|---|---|---|---|---|
| CLIENT | **BHARAT HEAVY ELECTRICALS LTD.** | **Project Doc No.:** PE-V0-412-158-A033 | | **Rev :** 01 |
| PROJECT | **Pre Treatment Plant Ennore** | **OTOKLIN DOC NO:-** OGBL/OC-983/GA/CBM/PTP/18/324 | | |
| | | **MADE BY** | **CHKD BY** | **APPD BY** |
| | | FN | MI | AA |
| 31 | Flocculator paddle | | Duplex SS | |
| 32 | Hanger frame | | MSFRP | |
| 33 | MOC of Squeezer | | Natural Rubber (8-10mmthk) | |
| 34 | MOC of Wheel | | CI with PU/Rubber Lining wheel | |
| 35 | Bolts and Nuts | | SS316L (R1) | |
| | **General** | | | |
| 36 | Const bleed of Dia | | CI 80 mm Dia | |
| 37 | Painting | | As per Approved painting Specification | |

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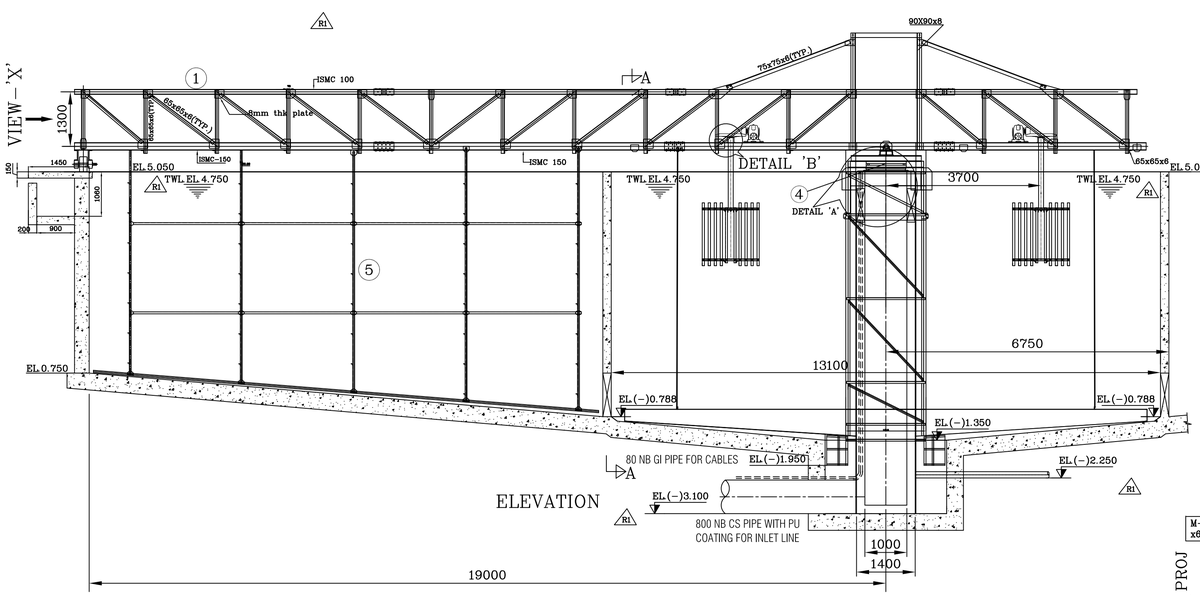
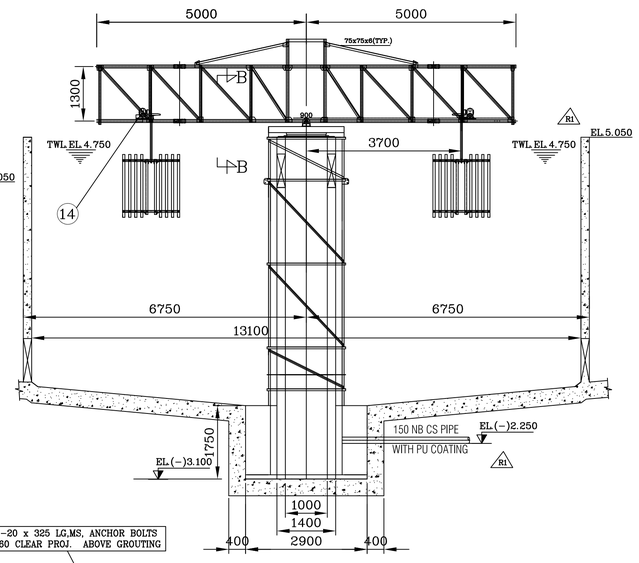
FIRST ANGLE PROJECTION

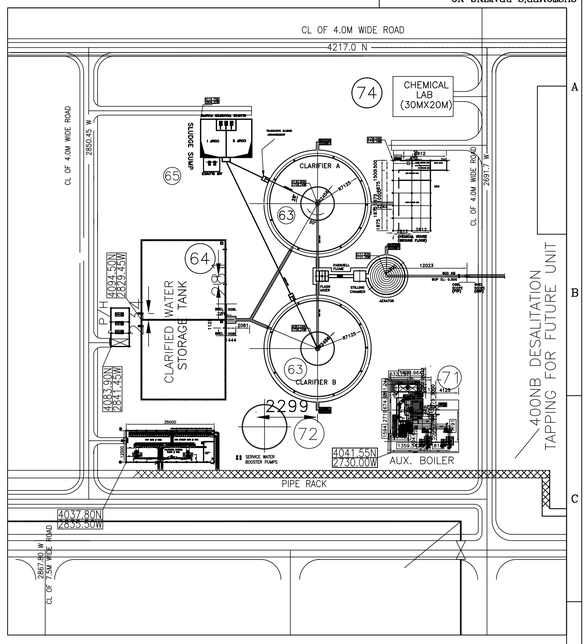
ALL DIMENSIONS ARE IN MM

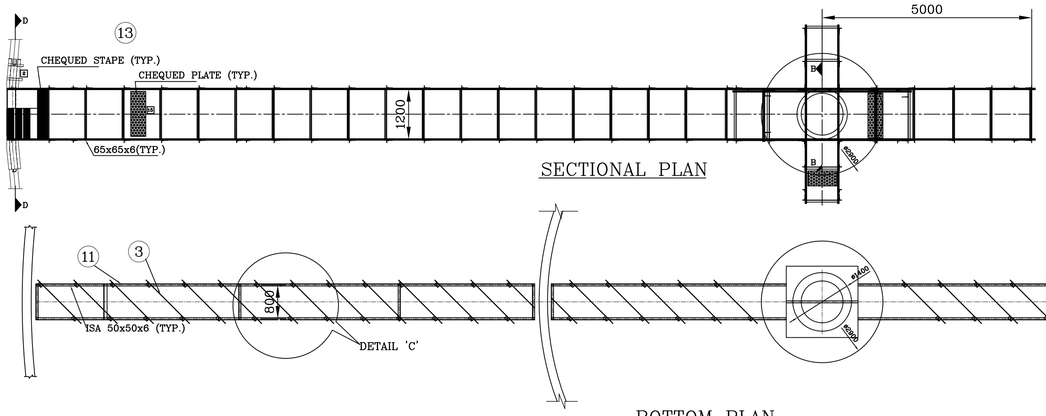
DRAWING NO.

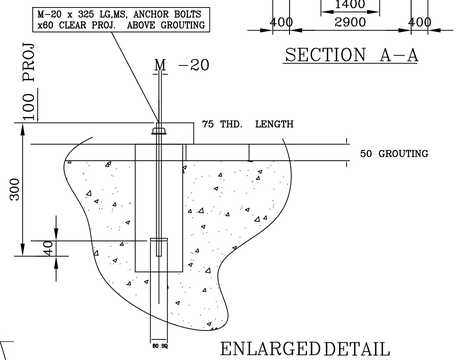
CUSTOMER'S DRAWING NO.

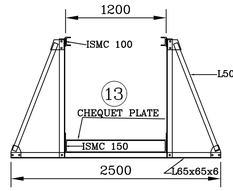


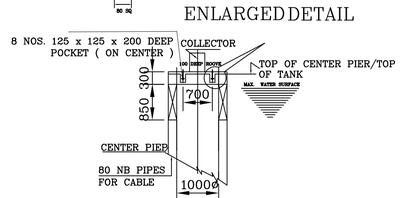



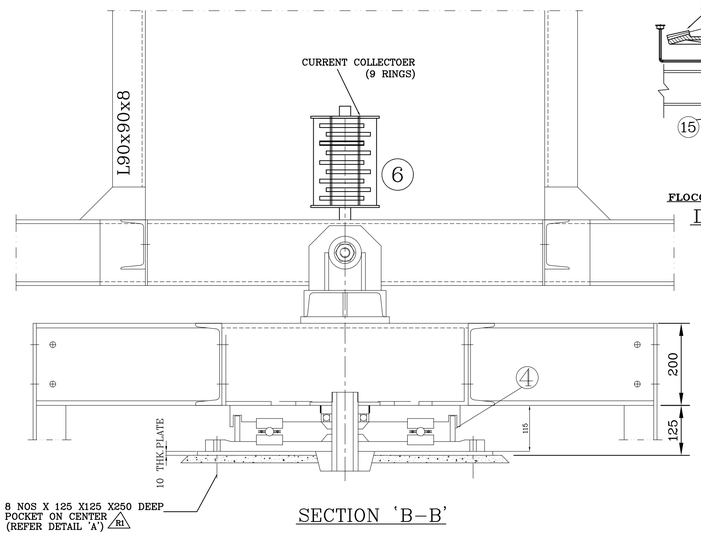



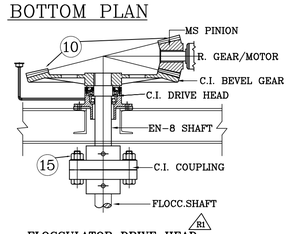



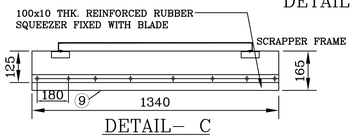



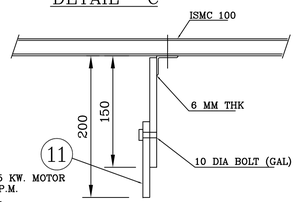



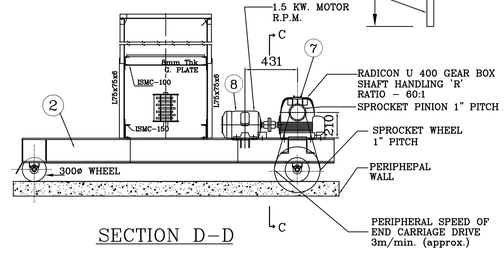



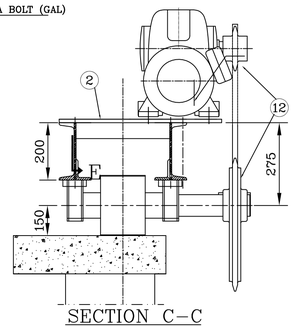




## PARTS OF LIST

| S.NO | DESCRIPTION | QTY | MOC |
|---|---|---|---|
| 1 | BRIDGE | 1 | MS(IS: 2062) + FRP /CORROCOAT |
| 2 | END CARRIAGE DRIVE | 1 | MS(IS: 2062) + FRP /CORROCOAT |
| 3 | SCRAPPER BLADE ASSLY. | – | MS(IS: 2062) +FRP |
| 4 | CENTRAL BEARING HOUSING | 1 | CI/MS |
| 5 | HANGER FRAME | 6 | MS(IS: 2062) +FRP |
| 6 | CURRENT COLLECTOR (6 RINGS) | 1 | METAL FAB R1 |
| 7 | GEARBOX FOR BRIDGE | – | AS PER APPROVED MAKE |
| 8 | MOTOR FOR CARRIAGE DRIVE,(1.5 KW) | – | AS PER APPROVED MAKE |
| 9 | SQUEEZERS, 100x12THK. | – | Natural rubber |
| 10 | BAVEL GEAR & PINION | – | MS/CI |
| 11 | SCRAPER FRAME(INNER&OUTER) | – | |
| 12 | CHAIN SPROCKET AND PINION | – | MS(IS: 2062) |
| 13 | M.S CHEQUERD PLATE | LOT | MS+FRP RESIN COAT. |
| 14 | FLOCCULATOR MOTOR (0.75 KW) | 4 | AS PER APPROVED MAKE |
| 15 | BOLTS & NUTS | LOT | SS 316 L R1 |

NOTES.

1. ALL DIMENSIONS ARE IN m.m & LEVELS ARE IN METER UNLESS OTHERWISE STATED.
2. THIS DRAWING IS PREPARED BASED ON HYDRAULIC FLOW DIAGRAM (BHEL DRG. NO. PE–V0–412–158–A003)
3. FOR SIZING & LOCATION OF GATES/VALVES PL. REFER P&ID. OF PRE–TREATMENT PLANT (BHEL DRG. NO. PE–V0–412–158–A001)
4. THE DETAILS OF CLARIFLOCCULATOR–A HAS BEEN SHOWN IN THIS DRAWING. DIMENSIONS AND LEVELS OF CLARIFLOCCULATOR–B WILL BE SAME AS CLF.– A . THE LOCATION & ORIENTATION OF CLF.–A AND CLF.–B HAVE BEEN INDICATED IN KEY PLAN.
5. FOR MECH. GA OF CLARIFIER MECHANISM REFER DOCUMENT NO. PE–V0–412–158–A030
6. ALL WELDS ARE 6mm THK. FILLET UNLESS NOTED.
7. STRUCTURAL STEEL CONFORMS TO IS : 2062
8. ELO.0M CORRESPONDS TO FGL(–) 0.5/RL 9.5M R1

METAL FABRICATORS
M–24B,ST.NO–8, ANAND PARBAT
INDS.AREA , NEW ROHTAK ROAD
NEW DELHI–110 005

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LTD
POWER GROUP
PROJECTS ENGINEERING MANAGEMENT
NEW DELHI

CONTRACTOR: OTOKLIN GLOBAL BUSINESS LTD
E–410, CRYSTAL PLAZA,OPP. INFINITI MALL
LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022–26732135

| JOB NO. 412 | | | | | |
|---|---|---|---|---|---|
| STATUS CONTRACT | | | | | |
| DISTRIBUTION | | | | | |
| TO | | | | | |
| No.OFF | | | | | |
| REV | DATE | ALTD | CHD | APPD | |

| DEPT CODE MAX | | NAME | SIGN | DATE |
|---|---|---|---|---|
| | DRN | FAISAL N | FN | 08–01–19 |
| | DESN | FAISAL N | FN | 08–01–19 |
| | CHD | MUAZZAM I | MI | 08–01–19 |
| | APPD | ASLAM A | AA | 08–01–19 |

BHEL LOA NO: PW/PE/PG/EN1/P–310/17

BHEL DOC NO.
PE–V0–412–158–A033

TITLE
MECH. GA AND DATA SHEET FOR CLARIFIER BRIDGE MECHANISM

DEPT. | SCALE as shown | SIGN | DATE

OGBL DOC NO.
OGBL/OC–983/GA/CBM/PTP/18/324

SHEET 3 OF 3 | REV 01

SIZE–A1

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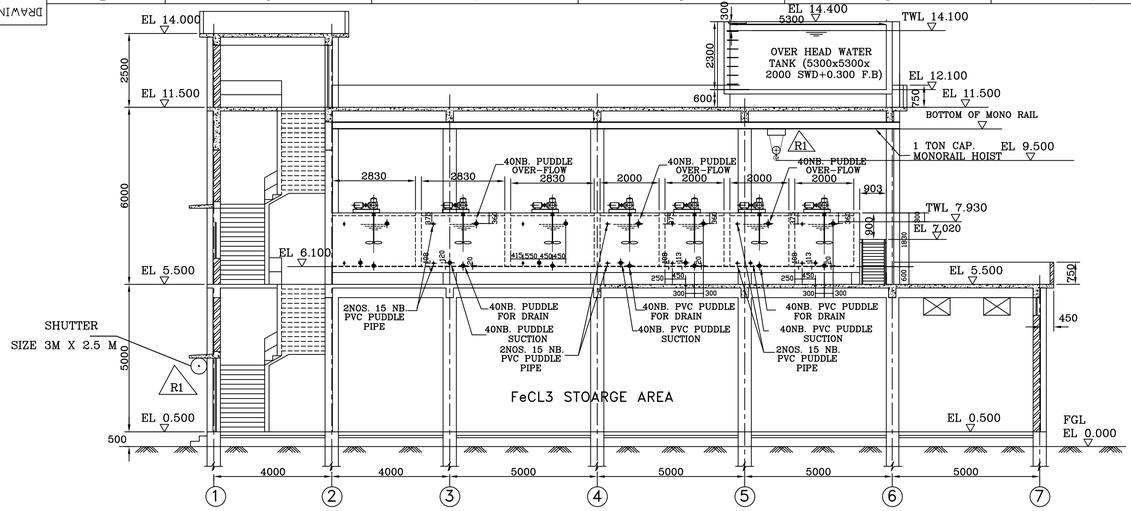
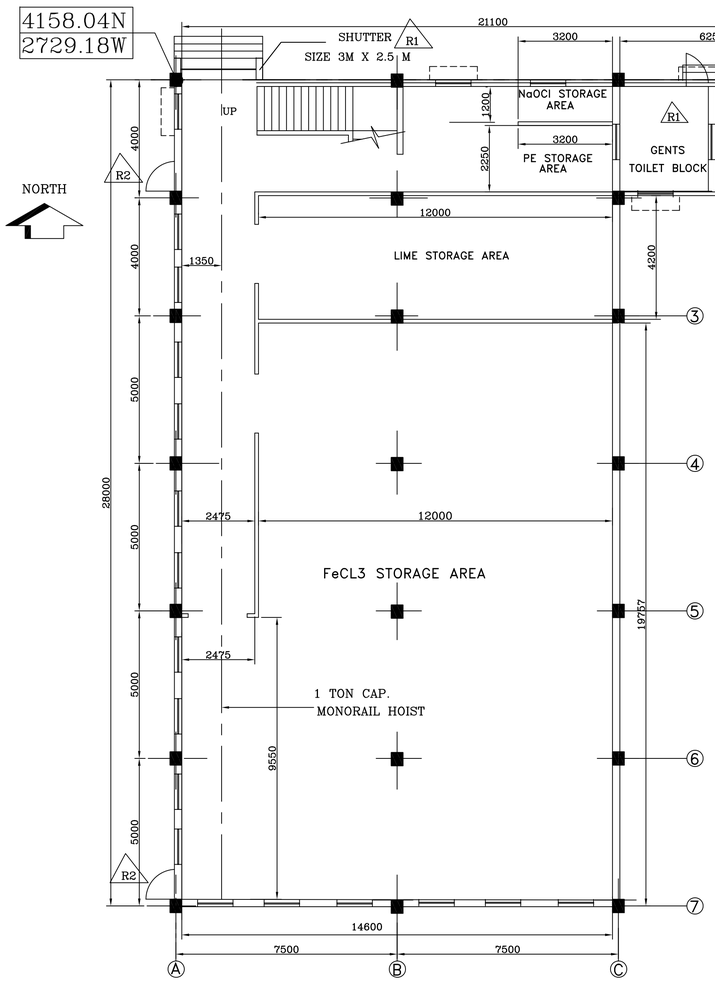
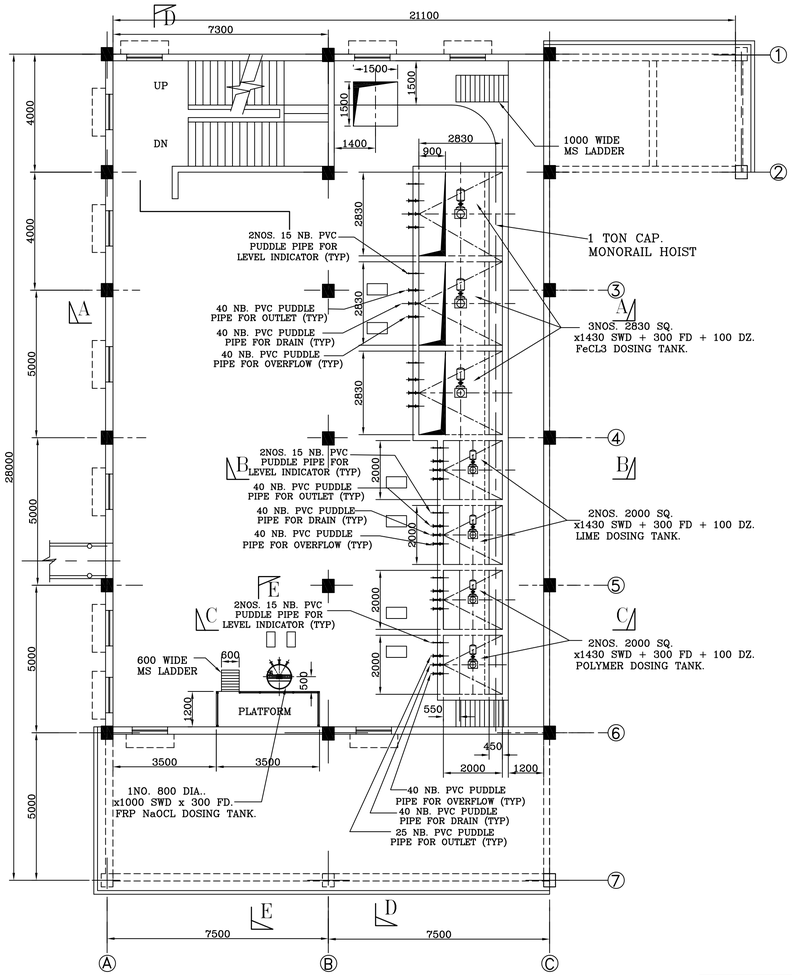
FIRST ANGLE PROJECTION — ALL DIMENSIONS ARE IN MM



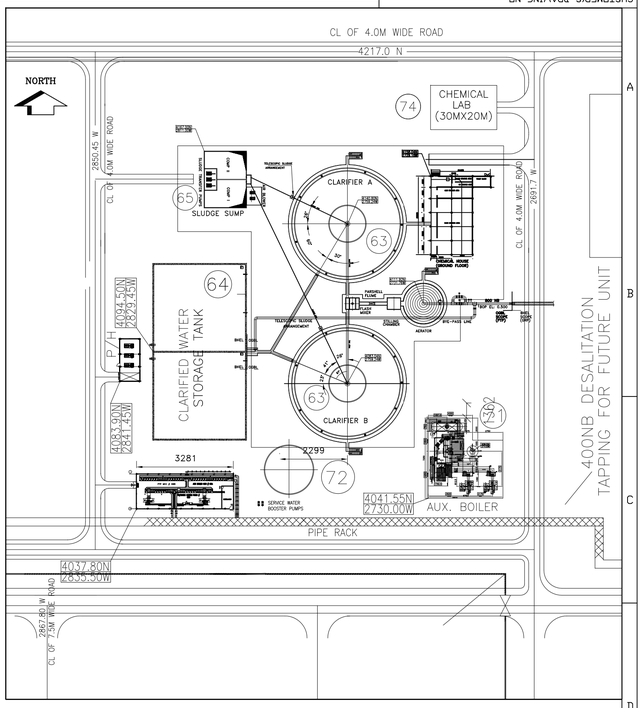

## SECTION D–D



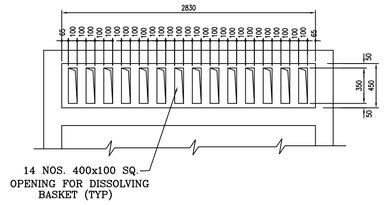

## PLAN OF CHEMICAL HOUSE (GROUND FLOOR)



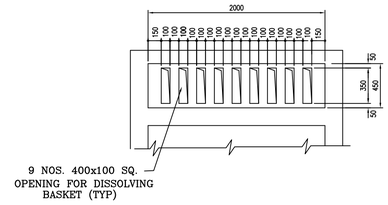

## PLAN OF CHEMICAL HOUSE (1st. FLOOR)




## KEY PLAN




## DET. CUT OUT PLAN OF DISSOLVING BASKET AREA




## DET. CUT OUT PLAN OF DISSOLVING BASKET AREA

## NOTE:–

1. ALL DIMENSIONS ARE IN m.m & LEVELS ARE IN METRE UNLESS OTHERWISE STATED.
2. DIMENSIONS OF COLUMN, COLUMN FFOUNDATION, STAIR CASE, HANDRAILING ETC SHALL BE SHOWN IN CIVIL G.A. OF CHEMICAL HOUSE
3. PUDDLE PIPES & INSERT PLATE DETAIL SHALL BE SHOWN IN THE CIVIL DRAWING OF CHEMICAL HOUSE
4. ALL ELEVATIONS MARKED ARE W.R.T. TG HALL FINISHED FLOOR LEVEL AS 0.0M WHICH CORRESPONDS TO EL 10.0M.

| REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | | REV | DATE | ALTD | CHD | APPD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |

JOB NO. 412
STATUS CONTRACT
DISTRIBUTION
TO
No.OFF

2X660 MW ENNORE SEZ COAL BASED STPP AT ASH DYKE OF NCTPS, CHENNAI.

TAMILNADU GENERATION AND DISTRIBUTION CORPORATION (TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LTD
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LOKHANDWALA LINK ROAD, ANDHERI WEST,
MUMBAI 400 053. Tel No.022–26732135

| DEPT CODE | | NAME | SIGN | DATE |
|---|---|---|---|---|
| MAX | DRN | FAISAL N | FN | 26–09–18 |
| | DESN | FAISAL N | FN | 26–09–18 |
| | CHD | MUAZZAM I | MI | 26–09–18 |
| | APPD | ASLAM A | AA | 26–09–18 |

BHEL LOA NO: PW/PE/PG/EN1/P–310/17 DTD. 18.01.2018

TITLE MECH. GA FOR CHEMICAL HOUSE INCLUDING ALL DOSING TANKS

BHEL DOC NO. PE–V0–412–158–A035

DEPT. SCALE: –1:1

SIGN

DATE

OGBL DOC NO. OGBL/OC–983/GA/CH/PTP/18/325

SHEET 1 OF 2 REV 02

SIZE–A1