2X660 MW ENNORE SEZ STPP, CHENNAI

VOLUME: IIB & III.

TECHNICAL SPECIFICATION
FOR
SEWAGE TREATMENT PLANT.

SPECIFICATION NO.: PE-TS-412-673-A002

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

	TITLE:	BHEL DOCUMENTS NO.: PE-TS-412-673-A002	
	TECHNICAL SPECIFICATION FOR SEWAGE TREATMENT PLANT.		
	2X660 MW ENNORE SEZ STPP, CHENNAI	SECTION -	
		REV. NO. 0.0	DATE:
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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, startup and commissioning spares as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in site transportation, assembly, erection & commissioning, trial run at site, preparation and submission of drawing/documents including "As built" drawings and carrying out performance guarantee test (PG Test) at site & equipment/system guarantee, etc., handover in flawless condition of the **SEWAGE TREATMENT 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, amendment & agreement till placement of order.

Bidders to please note that originally the plant was Designed and Engineered by M/s Pennar Enviro, Hyderabad, however, the Supply and Erection work was not completed. The Civil front has already prepared at site based on the Detailed Engineering Documents submitted by M/s Pennar Enviro 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/under construction 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 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 also 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:

The **Sewage Treatment Plant** and associated accessories shall conform to the technical specification.

2.0 SCOPE OF SUPPLY

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

Broad Supply Scope [Refer P&ID (**Ref. No. PE-V11-412-673-A001**) **and Data Sheet-A for clarity]**:

2.1 Two (2) nos.(1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S1) complete with all instrumentation, valves, piping etc.

2.2 Two (2) nos.(1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S2) complete with all instrumentation, valves, piping etc.

2.3 Two (2) nos.(1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S3) complete with all instrumentation, valves, piping etc.

2.4 Two (2) nos.(1W+1S) submersible grinding type sewage transfer pumps for sewage sump (S4) complete with all instrumentation, valves, piping etc.

2.5 Two (2) nos.(1W+1S) submersible grinding type sewage transfer pumps for common sewage collection sump complete with all instrumentation, valves, piping etc.

2.6 All instrumentation and accessories in sewage sump S1/S2/S3/S4 and all sumps (RCC work in BHEL scope) located inside and outside of STP area.

2.7 All piping, Valves, fittings, insturments, etc as per P&ID (**PE-V0-412-673-A001: P & ID FOR SEWAGE TREATMENT PLANT**).

2.8 Two (2) nos. (1W+1S) oil free type air blowers with electric motor drives for supplying air required for common collection sump, sludge holding tank & equalization tank. Each blower shall be complete with motor, v-belt drive with belt guard, inlet filter/silencer, flexible couplings and discharge snubber, all mounted on a single base. Relief valve(s) shall be provided as required. Acoustic hood for air blowers shall also be provided by the bidder.

2.9 One (1) no. bar screen chamber of MOC RCC (RCC work in BHEL scope) provided with bars (BAR MOC: SS-304 fitted with MS frame) inclined at 60° and spacing between bars shall be 10 mm for screening of incoming sewage.

2.10 One (1) no. oil & grease chamber of MOC RCC (RCC work in BHEL scope) provided with oil & grease trap for removal of oil & grease from the incoming sewage. Mechanical items Baffle arrangement and perforated pipes etc. shall be provided by bidder.

2.11 One (1) no. above ground equalization tank of RCC construction (RCC work in BHEL scope) of minimum retention time of 8 hours located in STP area.

2.12 Two (2) nos.(1W+1S) vertical submersible grinding type FAB/MBBR feed pumps for equalization tank complete with all instrumentation, valves, piping etc.

2.13 All instrumentation and accessories in equalization tank (RCC work in BHEL scope) located in STP area.

2.14 One (1) no. above ground FAB/MBBR reactor of MSRL construction (Capacity as per process requirement) located in STP area. Media for FAB/MBBR reactor shall be of MOC PVC.

2.15 Two (2) nos. (1W+1S) oil free type air blowers with electric motor drives for supplying air required for FAB/MBBR reactor. Each blower shall be complete with motor, v-belt drive with belt guard, inlet filter/silencer, flexible couplings and discharge snubber, all mounted on a single base. Relief valve(s) shall be provided as required. Acoustic hood for air blowers shall also be provided by the bidder.

2.16 One no. above ground tube settler (secondary settler) shall be in bidder' scope. Material of construction of settler shall be MSRL and MOC of media shall be PVC.

2.17 One (1) no. above ground hypo contact cum filter feed tank of RCC construction (RCC work in BHEL scope) located in STP area.

2.18 Two (2) nos.(1W+1S) horizontal centrifugal type filter feed pumps for hypo contact cum filter feed tank complete with all instrumentation, valves, piping etc. for feeding water to Dual media filter & activated carbon filter for tertiary treatment. This pump has to be also cater the backwash requirement of Dual media filter & activated carbon filter
All instrumentation and accessories in hypo contact cum filter feed tank (RCC work in BHEL scope) located in STP area.

2.19 One (1) no. Sodium hypochlorite dosing tank (MOC: PVC) of minimum 100 ltrs. capacity for dosing chemical to hypo contact cum filter feed tank complete with instrumentation, dissolving basket and slow speed (100-200 rpm) agitator of SS-316 construction. MOC of dissolving basket will be SS-316.

2.20 One (1) no. Sodium hypochlorite dosing pump (MOC: PP) along with instrumentation and accessories as per P&ID of sewage treatment plant.

2.21 One (1) no. (1X100%) dual media filter (MOC: FRP) along with filter media, piping, valves, fittings, instrumentation and accessories associated with the same.

2.22 One (1) no. (1X100%) Activated Carbon Filter (MOC: FRP) along with media, carbon trap, piping, valves, fittings, instrumentation and accessories associated with the same.

2.23 One (1) no. above ground treated water tank of RCC construction (RCC work in BHEL scope) of minimum retention time of 8 hours located in STP area.

2.24 One (1) no. above ground treated water tank (RCC work in BHEL scope) complete with all instrumentation and accessories.

2.25 Two (2) nos.(1W+1S) horizontal centrifugal type treated water disposal pumps for treated water tank complete with all instrumentation, valves, piping etc.

2.26 One (1) no. below ground sludge sump (RCC work in BHEL scope) complete with all instrumentation and accessories.

2.27 Two (2) nos.(1W+1S) vertical screw type sludge transfer pumps for sludge sump complete with all instrumentation, valves, piping etc.

2.28 One (1) no. (1X100%) centrifuge of MOC MSEP/CI and wetted parts of SS-304.

2.29 One (1) no. Sodium hypochlorite dosing tank (MOC: HDPE) of 24 hrs. storage capacity for dosing chemical to centrifuge feed line complete with instrumentation, dissolving basket and slow speed (100-200 rpm) agitator of SS-316 construction. MOC of dissolving basket will be SS-316.

2.30 One (1) no. Sodium hypochlorite dosing pump (MOC: PP) along with instrumentation and accessories as per P&ID of sewage treatment plant.

2.31 2 nos. sludge handling trolley (each of 1 CuM Capacity) for manual disposal of sludge cake.

2.32 Sea water intake pump house is located far- off location from BTG island and treatment of the sewage generated from toilets cannot be transferred to main sewage treatment plant, hence dedicated bio-digester and Reed Bed arrangement shall be provided by bidder to cater sewage waste generated from sea water intake pump house. 1 no. bio-digester of MOC FRP (10 mm thick) of capacity 4.5 m3 shall be provided by bidder. 1no. reed bed arrangement of MOC FRP (10 mm thick) of capacity 2.25 m3 shall be provided by bidder.

2.33 Further for over flow of Reed bed arrangement shall be suitably used for horticulture. One no. hose pipe (MOC: PVC) of 10 m length shall be provided for the same.

2.34 The pipes from the individual sewage lifting stations/ sewage sumps (S1, S2, S3 & S4 located outside STP area) to common collection sump located in STP area shall be burried. Further treated water piping from treated water disposal pumps (located in STP area) to horticulture network area shall also be burried. For burried piping wrapping, coating and protection is in bidder's scope & shall be as per IS-10221.

2.35 The pipe inside STP area shall be preferably 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. If buried piping is required, wrapping, coating and protection of all the buried pipe is also in bidder's scope & shall be as per is 10221.

2.36 All steel inserts plates with lugs, rungs, ladder, puddle pipes, bolts, edge angle in desired shape, nuts, sleeves, and all other embedding components etc. as required to grout in BHEL civil works and to support/hold the equipments being supplied under this specification shall be in bidder's scope.

2.37 Monitoring gadgets, instruments and equipments required for maintenance (till carrying out performance guarantee test at site (As applicable) & plant handover.

2.38 4 nos. Chain pulley block / electrical hoist for handling of sewage transfer pumps located outside STP area provided sewage lifting sumps (S1, S2, S3, S4).1 no. Chain pulley block / electrical hoist for handling of common collection sump sewage transfer pump. 1 no. chain pulley block/ Electrical hoist for handling of FAB/MBBR feed pumps. 1 no. chain pulley block/Electrical hoist for handling of Vertical screw sludge transfer pumps. 1 no. chain pulley block/ Electrical hoist for handling of filter feed pump & treated water disposal pumps. 1 no. electric hoist for handling of centrifuge. Selection criterion of chain pulley block/ electric hoist shall be as per ELECTRIC HOIST AND MANUAL HOIST (CHAIN PULLEY BLOCK) specification defined elsewhere in this tender technical specification.

2.39 Media, bar screen chamber, oil & grease trap, media for FAB/ MBBR tank, media for dual media filter, media for activated carbon filter & air grid arrangement for common collection sump, equalization tank, FAB/MBBR tank & Sludge pit.

2.40 Hume Pipe 15 Nos (125 NB Size) each of 6 meter length.

2.41 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.

2.42 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 peration 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.

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

Note: The Mechanical Documents/Drawings already approved as per ANNEXURE-C to be followed by bidder and for that no drawing/documents to be submitted by Bidder. Only those documents not approved or under approval or commented or pending for submission as per ANNEXURE-C shall be submitted by bidder.

3.0 SCOPE OF SERVICES

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

1) Erection and commissioning, unloading, storage and handling at site.
2) Arrangement of all instruments and lab facilities to carry out trial run/commissioning and PG test.
3) Complete grouting for equipment, fixing and any concreting inside the vessels and lining.
4) Any statutory clearance required for the system from MOEF or local pollution control board in bidder's scope.
5) All personnel required during commissioning and PG Test.
6) Performance testing.
7) 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.
8) During DCS logic preparation, logic building & Software testing of STP package, bidder shall depute his personnel at BHEL –EDN or customer office as and when required by customer / BHEL without any delay.

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 shall be provided by bidder.

Note: The Civil Input Documents/Drawings already approved as per ANNEXURE-C to be followed by bidder and for that no drawing/documents to be submitted by Bidder. Only those documents are not approved or under approval or commented or 1st Submission pending as per ANNEXURE-C shall be submitted by bidder.

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: The Electrical Documents/Drawings already approved as per ANNEXURE-C to be followed by bidder and for that no drawing/documents to be submitted by Bidder. Only those documents are not approved or under approval or commented or 1st Submission pending as per ANNEXURE-C shall be submitted by bidder.

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-C to be followed by bidder and for that no drawing/documents to be submitted by Bidder. Only those documents are not approved or under approval or commented or 1st Submission pending as per ANNEXURE-C shall be submitted by bidder..

7.0 TERMINAL POINT AND PIPING [Ref. PE-V0-412-673-A003 (PIPING LAYOUT (INSIDE)), PE-V0-412-673-A004 (YARD PIPING LAYOUT)]"

- Service water line (50 NB) will be provided by BHEL at 5 m distance from STP area. Further distribution inside STP area will be in bidder's scope. Bidder to note that pressure available at terminal point for service water will be 1 kg/ cm2 approx. (max.). for their pump lubrication/ cooling accordingly.

- Piping from Outside STP area to Inside STP area are as listed below.

SL. NO.	FROM	TO	Distance (In meters)
1.	Sewage sump (S1)	STP area common collection sump	800
2.	Sewage sump (S2)	STP area common collection sump	1100
3.	Sewage sump (S3)	STP area common collection sump	550
4.	Sewage sump (S4)	STP area common collection sump	550

Note: For Size of the pipe refer enclosed P&ID (**Ref. No. PE-V0-412-673-A001**) and Pump head shall be as per **PE-V0-412-673-A008-PROCESS SIZING.**

8.0 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).

9.0 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-C to be followed by bidder and for that no documents to be submitted by Bidder. Only those documents are not approved or under approval or commented or 1st Submission pending as per ANNEXURE-C shall be submitted by bidder.

10.0 FUNCTIONAL GUARANTEES (REFER APPROVED PG TEST PROCEDURE ENCLOSED, REF. PE-V0-412-673-A031).

11.0 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.

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

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

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

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

- Compliance certificate.(Stamped & Signed)
- Schedule of Declaration. (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: All major drawings/documents shall be approved by BHEL/Customer during detailed engineering. Stage. Successful vendor shall comply with the comment of the BHEL/Customer without price & delivery implication.

Note-3: 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-4: The above Note-1, 2 and 3 shall be applicable for Electrical and C&I also.

TABLE - A

INFLUENT WATER (RAW SEWAGE) AND GUARANTEED TREATED EFFLUENT WATER QUALITY:

A) INFLUENT WATER (RAW SEWAGE) QUALITY			
S.No.	**Parameter**	**Unit**	**Value (Range)**
1	**General**		
a	BOD5	ppm (mg/L)	300
b	COD	ppm (mg/L)	600
c	OIL & GREASE	ppm (mg/L)	<50
d	TSS	ppm (mg/L)	300
e	COLIFORM	---	10^6-10^7 (MPN/1000 ml)
f	pH	---	7-8
g	TEMPERATURE	DEG C	AMBIENT
h	NH4-N	ppm (mg/L)	NIL
i	Total N	ppm (mg/L)	NIL
B) **GUARANTEED TREATED EFFLUENT WATER QUALITY**			
1	**General**		
a	BOD5	ppm (mg/L)	<=10
b	COD	ppm (mg/L)	<=100
c	OIL & GREASE	ppm (mg/L)	10-20
d	TSS	ppm (mg/L)	<=20
e	COLIFORM	---	<10^3 (MPN/1000 ml)
f	pH	---	6.5-8
g	TEMPERATURE	DEG C	AMBIENT
h	NH4-N	ppm (mg/L)	<=5
i	Total N	ppm (mg/L)	<=10

MANDATORY SPARES

TABLE-B

Sl. No.	Name of Items	Unit	QUANTITY
1.0	**CIRL DIAPHRAGM VALVE**		
a)	Complete valve	Nos.	Two (2) Nos. each of different size of valve in the system
b)	Diaphragm	Nos.	Five (5) Nos. each of different sizes valves
c)	Valve spindle	Nos.	Two (2) Nos. each of different sizes valves
2.0	**OTHER TYPE VALVE (EXCEPT CONTROL VALVE)**		
a)	Complete valve	No.	One (1) No. each of different size of valve in the system
b)	Sampling & needle valve	Nos.	Four (4) Nos. each type & size
c)	Pressure Gauge	Nos.	Two (2) Nos. for each Range/Type
3.0	**LEVEL GAUGE**		
a)	Glass Tube	Nos.	Five (5) Nos. for each size
b)	Off-set valve	Nos.	Two (2) Nos. for each size
4.0	**MAINTENANCE SPARES**		
a)	Pressure Gauge	Nos.	Two (2) Nos. for each Range / Type
b)	Flow Indicator (Bypass / on line type)	Nos.	Two (2) Nos. for each size
c)	Float	No.	One (1) No. for each size
d)	Meter tube	No.	One (1) No. for each size
e)	Gaskets	Nos.	Three (3) Nos.
5.0	**PH INSTRUMENT**		
a)	Complete meter with cell & accessories	No.	One (1) No. for each size
b)	Neon lamp	Nos.	Eight (8) Nos. for each size.
c)	Power supply card	No.	One (1) No. for each size
d)	Amplifier PCB	No.	One (1) No. for each size
e)	Controller PCB	No.	One (1) No. for each size
f)	Transformer	No.	One (1) No. for each size
g)	Relay	No.	One (1) No. for each size
h)	Meter movement	No.	One (1) No. for each size
i)	Electrodes Assembly	No.	One (1) No. for each size
6.0	**MOTORS – BEARINGS**	Set	One (1) Set each for drive end and Non-drive end.
7.0	**415 V MOTORS**		
a)	Terminal plates	Nos.	10 Nos. each for small motors upto 30 kW & 4 Nos. each for more than 30 kW
b)	Heaters	Set	2 sets
c)	Greasing arrangements	Set	4 sets each type of motor
d)	Motor of each type and rating	No.	10% of the installed quantity or minimum 1 number whichever be higher
e)	Bearings (DE and NDE) for each type and rating of motor	Set	4 sets
8.0	**MEASURING INSTRUMENTS**		
8.01	Indicators, Recorders, Electrical Metering and Skid Mounted Instruments**:**		
(i)	Indicators, recorders and meters offered from each model for the project. These instruments shall be supplied with three sets of blank scales.	Nos.	10 % of Installed of each type/Model or a minimum of one number for each model and type, whichever is more

(ii)	For skid mounted instruments (As applicable)	Nos.	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
8.02	Temperature Elements and Thermo wells		
(i)	Thermocouple /RTD elements	Nos.	10% spare for each type and length of element furnished with thermocouple / RTD assemblies, or a minimum of one number of each type & length, whichever is more.
(ii)	Thermo wells	Nos.	10% for each type of temperature sensors or a minimum of one for each type, whichever is more
8.03	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.	Nos.	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.
9.0	**Erection hardware**		
9.01	Instrument valves	Nos.	Ten (10) percent of each type & Size installed
9.02	Condensate pots of each type & Size installed	Nos.	Ten (10) percent of total number of Installed or four numbers whichever is higher.
9.03	Manifold	Nos.	Ten (10) percent of each type & Size installed
9.04	Fittings	Nos.	Ten (10) percent of each type & Size installed
10.0	ELECTRICAL HOISTS		
10.1	Brake Lining	Sets	2 sets of each type
10.2	Rope Guide and Rope Tightener	No	1 No of each type
10.3	Limit Switch	Sets	2 Sets of each type and size
10.4	Gear Box / Gear Set	Sets	2 sets of each type
10.5	Drum Bearing	Sets	1 Set of each type and rating
11.0	**Mandatory spares not covered above**		
11.1	Bidder to supply 10% or 1 no. (Whichever is more) of each type of sensor/instrument, instrumentation /mechanical fittings etc. for the 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

Sl No.	THE BREAK UP (%) OF SUPPLY PRICES OF ETP PACKAGE IN THE BBU SHALL BE IN LINE WITH THE BELOW PROVIDED DETAILS:	
1.1	Lump sum firm price for supply of Atmospheric tanks, pressure vessels inclusive of all taxes, duties and other levies as applicable.	8 % of Total Supply Price.
1.2	Lump sum firm price for supply of Valves inclusive of all taxes, duties and other levies as applicable.	20 % of Total Supply Price.
1.3	Lump sum firm price for supply of Instruments inclusive of all taxes, duties and other levies as applicable.	21 % of Total Supply Price.
1.4	Lump sum firm price for supply of Pumps inclusive of all taxes, duties and other levies as applicable.	20% of Total Supply Price.
1.5	Lump sum firm price for supply of Piping and Fittings inclusive of all taxes, duties and other levies as applicable.	3 % of Total Supply Price.
1.6	Lump sum firm price for supply of agitators, strainers, blowers inclusive of all taxes, duties and other levies as applicable.	10 % of Total Supply Price.
1.7	Lump sum firm price for supply of centrifuge, media for DMF & ACF, tube settler etc. inclusive of all taxes, duties and other levies as applicable.	10 % of Total Supply Price.
1.8	Lump sum firm price for supply of Balance items inclusive of all taxes, duties and other levies as applicable.	8 % of Total Supply Price.

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.

DATA SHEET-A

Sl. No.	DESCRIPTION	
1.0	**Capacity of STP**	75 m3/day
2.0	**Common Collection Sump**	
i)	Numbers Required	One (1) no.
ii)	Capacity	10 m3
iii)	MOC	RCC
iv)	Type of Aeration	Coarse Bubble Diffused Aeration Type
v)	Type of Diffusers	Coarse bubble diffusers with retrievable arrangement
vi)	No. of Diffusers	As per system requirement
vii)	No. of chain pulley block/electric hoist and capacity	One no., chain pulley bock or electrical hoist as per specification requirement, capacity as per specification requirement.
viii)	Handrail	To be provided by bidder
3.0	**Common Collection Sump Pumps**	
i)	Numbers Required	2 nos. (1W+1S)
ii)	Type	Non-clog sump pumps ,Submersible grinder type
iii)	Flow	4.0 m3/hr
iv)	Head	As per process requirement
v)	Particle Size	Up to 20 mm
vi)	MOC	Casing – Cast Iron to IS 210 FG 260 Impeller- SS304
vii)	Drive Motor	Induction motor, 415V, 3 Φ, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
4.0	**Screen Chamber**	
i)	Numbers required	1 no.
ii)	Bar screen chamber MOC	RCC
iii)	Bar screen chamber capacity	As per process requirement
iv)	Type	Perforated sheet
v)	Cleaning	Manual
vi)	Angle of inclination	60°
vii)	Bar MOC	SS-304 fitted with MS frame
viii)	Velocity	<1.0 m/sec
ix)	Spacing of bar`	10 mm
5.0	**Oil & Grease chamber**	
i)	Numbers required	1 no.
ii)	Oil & grease chamber MOC	RCC
iii)	Oil & grease chamber capacity	As per process requirement

6.0	**Oil & Grease Trap**	
i)	Numbers Required	One (1) no.
ii)	Flow	3.5 m3/hr
iii)	MOC	RCC with baffle arrangements
iv)	Perforated pipe MOC	PVC/CS
7.0	**Equalization Tank**	
i)	Numbers Required	1 no.
ii)	Flow	3.5 m3/hr.
iii)	Detention Time	8 hours
iv)	MOC of Tank	RCC
v)	Depth	2.5 m
vi)	Type of Aeration	Coarse Bubble Diffused Aeration Type
vii)	Type of Diffusers	Coarse bubble diffusers with retrievable arrangement
viii)	No. of Diffusers	As per system requirement
ix)	No. of chain pulley block/electric hoist and capacity	One no., chain pulley bock or electrical hoist as per specification requirement, capacity as per specification requirement.
x)	Handrail	To be provided by bidder
8.0	**Common Air Blowers for Equalization Tank /Sludge Sump /Common Collection Sump**	
i)	Numbers Required	2 nos. (1W+1S)
ii)	Type of Blower	Twin lobe type
iii)	Flow	To cater Air requirement for Equalization tank & Sludge Sump & Common Collection Sump
iv)	Head	As per process requirement
v)	MOC	CI to IS 210 Gr. FG 260
vi)	Accessories	NRV, Pressure Gauge, Safety valves
vii)	Drive Motor	Induction motor, 415V, 3 Φ, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
viii)	Common Base plate/ mounting plate	MS as per IS 2062
9.0	**FAB/MBBR Feed Pumps**	
i)	Numbers Required	2 nos. (1W+1S)
ii)	Type	Vertical Submersible Grinder type Pumps
iii)	Flow	4.0 m3/hr
iv)	Head	As per process requirement
v)	MOC	Casing – Cast Iron to IS 210 FG 260 Impeller & shaft - SS304
vi)	Particle Size	Up to 10 mm
vii)	Drive Motor	Induction motor, 415V, 3 Φ, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
10.0	**FAB/MBBR Reactor**	
i)	Numbers Required	One(1) no.

ii)	Flow	3.5 m3/hr.
iii)	Food to Microorganism(F/M) Ratio	0.1-0.15 Kg BOD/ Kg MLSS/ **day**
iv)	MLSS (Mixed Liquor Suspended Solids)	3000-6000 mg/l
v)	MOC of Tank	MSRL
vi)	Depth	Minimum 4-5 m
vii)	Type of Aeration	Coarse Bubble Diffused Aeration Type
viii)	Type of Diffusers	Coarse bubble diffusers with retrievable arrangement
ix)	No. of Diffusers	As per system requirement
x)	FAB/MBBR Media	PVC
xi)	Media Qty	As per system requirement
xii)	Free Board	500 mm
xiii)	Volume (in m3)	As per process requirement
11.0	**Air Blowers for FAB/MBBR Tank**	
i)	Numbers Required	2 nos. (1W+1S)
ii)	Type of Blower	Twin lobe type
iii)	Flow	To cater Air requirement of FAB/MBBR tank
iv)	Head	As per process requirement
v)	MOC	CI to IS 210 Gr. FG 260
vi)	Accessories	NRV, Pressure Gauge, Safety valves
vii)	Drive Motor	Induction motor, 415V, 3 Φ, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
viii)	Common Base plate/ mounting plate	MS as per IS 2062
12.0	**Tube settler (Secondary Settler)**	
i)	Numbers Required	One (1) no.
ii)	Flow	3.5 m3/ hr.
iii)	Surface flow rate	2 m3/ m2/hr.
iv)	MOC of settler	MSRL
iv)	Quantity of tube settler media	As per process requirement
v)	MOC of media	PVC
vi)	Free board	500 mm
13.0	**Hypo Contact Cum Filter Feed Tank**	
i)	Numbers Required	One (1) no.
ii)	Capacity	As per Process requirement
iii)	MOC	RCC
iv)	Handrail	To be provided by bidder
14.0	**Hypo Dosing System**	
14.1	**Hypo Dosing Tank**	
i)	Numbers Required	One (1) no.
ii)	Capacity	100 liters OR 24 hour storage requirement @2 ppm dosing rate whichever is higher
iii)	MOC	PVC
14.2	**Hypo Dosing Pump**	
i)	Quantity	One (1) no.
ii)	Capacity	0-6 LPH or 2 ppm continuous dosing rate requirement whichever is higher
iii)	Type	Metering Pump
iv)	MOC	PP
v)	Drive Motor	Induction motor, 415V, 3 Φ, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615

15.0	**Filter Feed Pumps**	
i)	Quantity	Two (2X100%) nos. (1W+1S)
ii)	Type & Operation	Horizontal Centrifugal, Continuous
iii)	Suction condition	Flooded.
iv)	Capacity	4.0 m3/hr.
v)	Head	As per process requirement
vi)	Material of Construction	
	• Casing	Cast Iron IS:210 Gr FG 260
	• Impeller	Stainless steel CF 8M
	• Shaft & Shaft sleeve material	Stainless steel SS Gr. 304 & SS316
	• Packing seal	Mechanical type
	• Drive motor	Induction motor, 415V, 3 Φ, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
	• Common base plate	Carbon steel IS:2062
vii)	Noise level	85 DBA
viii)	Vibration	As per HIS
ix)	RPM	1500 approx.
x)	Drive motor	Induction Motor 415V, 3 Phase, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
xi)	Interconnecting Piping Material	Carbon Steel with Rubber lining.
16.0	**Dual Media Filter**	
i)	Quantity	1 no.
ii)	Capacity	3.5 m3/hr.
iii)	Surface flow rate	10 m3/hr./m2
iv)	Size	As per process requirement
v)	Design pressure	6 Kg/ cm2 (g)
vi)	MOC	FRP
vii)	Media	Graded quartz sand free from carbonates and other foreign material and anthracite.
viii)	Rising Space(Free board)	100 %
17.0	**Activated Carbon Filter**	
i)	Quantity	1 no.
ii)	Capacity	3.5 m3/hr.
iii)	Surface flow rate	12 m3/hr./m2
iv)	Size	As per process requirement
v)	Design pressure	6 Kg/ cm2 (g)
vi)	MOC (Shell & Dish)	FRP
vii)	Media	Activated Carbon
viii)	Supporting Media	Graded Gravel
ix)	Minimum Bed depth	1200 mm
x)	Rising Space(Free board)	100 %
18.0	**Treated Water Tank**	

i)	Number required	1 no.
ii)	Capacity (Effective)	28 m3
iii)	Flow	3.5 m3/hr.
iv)	Detention Time	8 Hrs.
v)	MOC of tank	RCC
vi)	Depth	2.5 m- 4 m
vii)	Handrail	To be provided by bidder
19.0	**Treated Water Disposal Pumps**	
i)	Quantity	Two (2X100%) nos. (1W+1S)
ii)	Type & Operation	Horizontal Centrifugal, Continuous
iii)	Suction condition	Flooded.
iv)	Capacity	4.0 m3/hr.
v)	Head	As per process requirement
vi)	Material of Construction	
	• Casing	Cast Iron IS:210 Gr FG 260
	• Impeller	Stainless steel CF 8M
	• Shaft & Shaft sleeve material	Stainless steel SS Gr. 304 & SS316
	• Packing seal	Mechanical type
	• Drive motor	Induction Motor 415V, 3 Phase, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
	• Common base plate	Carbon steel IS:2062
vii)	Noise level	85 DBA
viii)	Vibration	As per HIS
ix)	RPM	1500 Approx.
x)	Drive motor	Induction Motor 415V, 3 Phase, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
xi)	Interconnecting Piping Material	Carbon Steel with Rubber lining.
20.0	**Sludge Sump (waste Pit)**	
i)	Number required	1 no.
ii)	MOC & type	RCC, Under Ground, Outdoor Location
iii)	Capacity (Effective)	As per Process requirement
iv)	Instrumentation	As per P&ID
v)	Inside Protection	5 mm thick coal tar epoxy screened lining
vi)	No. of chain pulley block/electric hoist and capacity	One no., chain pulley bock or electrical hoist as per specification requirement, capacity as per specification requirement.
vii)	Handrail	To be provided by bidder
21.0	**Sludge transfer Pumps**	
i)	Quantity	Two (2X100%) nos. (1W+1S)
ii)	Type	Vertical Screw Pumps
iii)	Location	Outdoor
iv)	Service	Intermittent
v)	Suction condition	Flooded.
vi)	Rated Flow	As per process requirement or 2 m3/hr whichever is

		higher.
vii)	Head	As per process requirement
viii)	Type of fluid handled	Sludge from system
ix)	Material of Construction	
	• Casing	2% Ni-CI to IS:210 Gr FG 260
	• Rotor	SS-316
	• Stator	Nitrile/EPDM
	• Shaft	SS-316
	• Drive motor	Induction Motor 415V, 3 Phase, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
x)	Noise level	85 DBA
xi)	Vibration	As per HIS
xii)	RPM	1500 Approx.
xiii)	Drive motor	Induction Motor 415V, 3 Phase, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
22.0	**Centrifuge**	
i)	Quantity	One (1) number (1X100%)
ii)	Type	Decanter
iii)	Inlet concentration	2%
iv)	Outlet concentration	20% (min.)
v)	Capacity	As per process requirements
vi)	Liquid handled	Secondary sludge
vii)	Material of construction	Wetted parts: SS304 Other parts : MSEP/CI
viii)	Motor	IP-55 with outdoor installation,3 phase,415 V,TEFC type squirrel cage induction motor, Rating as per requirement, Energy Efficiency Class IE-3 as per IS : 12615
ix)	Base Frame	MS Fabricated (
x)	Accessories	Suitable piping, valves, pressure gauge at delivery pulley, V-belt drive, foundation bolts etc.
xi)	No. of electric hoist and capacity	One no., Capacity as per specification requirement.
23.0	**Hypo Dosing System for centrifuge**	
23.1	**Hypo Dosing Tank**	
i)	Numbers Required	One (1) no.
ii)	Capacity	24 hour storage requirement @2 ppm dosing rate (minimum) or as per process requirement whichever is higher
iii)	MOC	HDPE
23.2	**Hypo Dosing Pump**	
i)	Quantity	One (1) no.
ii)	Capacity	2 ppm continuous dosing rate requirement
iii)	Type	Metering Pump
iv)	MOC	PP
v)	Drive Motor	Induction motor, 415V, 3 Φ, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615
24.0	**Sewage Sumps (Outside STP Area)**	
i)	Sewage sump S1, S2, S3, S4	Capacity as per P&ID
ii)	MOC	RCC
iii)	Type	Covered at top, below ground
iv)	Accessories	Coarse bar screen (MOC : MSEP) at each sump location

v)	Handrail	To be provided by bidder
vi)	No. of chain pulley block/electric hoist and capacity	One no. at each sump location , chain pulley bock or electrical hoist as per specification requirement, capacity as per specification requirement.
25.0	**Sewage Transfer Pumps(Outside STP Area)**	
i)	Type	Vertical submersible grinder type,
ii)	Quantity per sump	2 X 100 %
iii)	Capacity	As per P & ID of Sewage Treatment plant
iv)	MOC casing	Cast Iron to IS 210 FG 260
v)	MOC impeller	Stainless Steel AISI 304
vi)	MOC shaft	SS 410
vii)	Drive Motor	Induction motor, 415V, 3 Φ, 50 Hz, TEFC, Energy Efficiency Class IE-3 as per IS : 12615

Further bidder to provide 1 no. Common chain pulley block (portable type) for handling of filter feed pump & treated water disposal pumps alongwith motor as per specification requirement, capacity shall be selected based on heaviest pump with motor weight from the above listed two drives & as per specification requirement.

For piping and valves specification please refer PE-V0-412-673-A045 (TECHNICAL DATASHEET FOR PIPING MATERIAL), PE-V0-412-673-A021 (Valve Schedule) and PE-V0-412-673-A010 (DATA SHEET OF VALVE) enclosed.

SECTION – C2

(SPECIFIC TECHNICAL REQUIREMENTS FOR ELECTRICAL)

ELECTRICAL EQUIPMENT SPECIFICATION

TECHNICAL SPECIFICATION

FOR

SEWAGE 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) Electrical Load data format.

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

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)

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

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

REV-0,

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)

PACKAGES: SEWAGE TREATMENT PLANT
SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT
PROJECT: 2X660 MW ENNORE SEZ STPP, CHENNAI

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	 BHEL BHEL BHEL	 BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, optical fibre etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system 100/ 50 mm cable trays/ Conduits/ Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs, as per approved layout drawing during contract stage.
7	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
8	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	
10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
11	Below grade grounding	BHEL	BHEL	
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: SEWAGE TREATMENT PLANT
SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT
PROJECT: 2X660 MW ENNORE SEZ STPP, CHENNAI

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) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable and electronic earthing cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Electrical Equipment & cable tray layout drawings	Vendor	-	For ensuring cabling requirements are met, vendor shall furnish Electrical equipment layout & cable tray layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Cabling arrangement of the same (wherever overhead cable trays, trenches, cable ducts, conduits etc.) shall be decided during contract stage. Electrical equipment layout & cable tray layout drawing shall be subjected to BHEL/ customer approval without any commercial implications to BHEL.
18	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

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

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 **PE-V0-412-673-A002: P & ID FOR SEWAGE TREATMENT PLANT.**
- Any other instrument not listed but required to complete the system.

2.0 BASIC CONTROL PHILOSOPHY :

The FAB/MBBR based sewage treatment plant operation & control shall be carried out from the DDCMIS based control system (BHEL Scope).

DDCMIS based control system for FAB/MBBR based sewage treatment plant shall be located in the STP area. Sewage transfer pumps installed in various sewage lifting sumps (S1, S2, S3 & S4) other than STP area shall be controlled from nearest control system (BHEL Scope).

All pumps shall be fitted with check valves and pressure gauge on the discharge side. All pump shall be tripped automatically in case of low level in the pits/tanks and shall be start manually.

Annunciations for high level in pits/tanks shall be provided.

Similarly, air blowers (located at Sewage treatment plant area) shall be suitably interlocked with DDCMIS based control system.

The control philosophy of various systems is described below. However, for all the systems, following basic process related interlocks, alarms /pre-warning signals shall be implemented in the control system as per system requirement.

a) Among the equipments, it shall be possible to select a specific pump or tank or sump for working/standby/ maintenance etc. through control system.

b) PERMISSIVE & INTERLOCKS:

(i) Starting & tripping of pumps with respect to liquid level in the respective sump/tanks or liquid pressure in the suction lines.

(ii) Starting & tripping of agitators with respect to liquid level in the respective tanks.

(iii) Starting & tripping of pumps (which are provided with forced water lubrication) with respect to lubricating water flow (through low pressure/ low flow signal as the case may be).

(iv) Tripping of pumps when the discharge pressure is very high to avoid operation of the pump under shutoff head.

(v) Stopping/ tripping of equipments due to abnormal parameters related to safety of equipments

like high vibration, very high bearing lubrication water (and /or oil) temperature to the drive/pumps, very high bearing temperature of the of pump/drive etc. as applicable based on the recommendations of Equipment Supplier.

(vi) Capacity of the metering pump shall be controllable from 10-100% continuously by adjusting the stroke length manually by a micro meter dial calibrated for 0–100% of pump capacity integral with the pump.

(vii) Various annunciations related to low level of the chemical tanks & sumps shall be provided.

C) <u>ALARMS /SIGNALS</u>

(i) Abnormal parameters such as low & high level in tanks/sumps, high pressure at pump discharge, low header pressure, low lubrication water flow to pumps (provided with forced water lubrication system) etc.

(ii) Failure of starting of equipments such as pumps, blowers etc. upon start command.

(iii) Tripping of equipments due to protection logic.

In addition, the control system shall facilitate the operator to know the status of various equipments (Whether equipment is running or stopped or tripped etc., whether the equipment is selected for operation/ standby duty /maintenance mode etc. as the case may be).

Number of signals / Annunciation shall be provided in DDCMIS and the same shall be decided During Detailed Engineering stage.

Note: For Detail Control Philosophy please refer **PE-V0-412-673-A020 (Operation & Control Philosophy).**

SECTION-D

(GENERAL TECHNICAL REQUIREMENT)

SECTION-D1

(GENERAL TECHNICAL REQUIREMENT FOR MECHANICAL)

1.0 INTRODUCTION

The function of the Sewage Treatment Plant is to collect all sanitary sewage originating in the plant, perform treatment and transfer the treated water horticulture / irrigation. Sewage treatment in general carried out to reduce the solid contents of the sewage, and change the character of the sewage so that it can be reused.

Sanitary wastes are collected from the buildings that contain sanitary facilities by gravity. Sanitary lift stations shall be used to forward the waste to an onsite sewage treatment plant. Solid wastes shall be hauled offsite.

2.0 PROCESS DESCRIPTION (GENERAL)

The sewage treatment plant shall be designed as per guidelines of CPHEEO Manual. The anticipated no. of users shall be 2000 persons. The sewage treatment plant shall be designed to handle a flow of 75Kld considering average per capita consumption of 45lpcd with 80% of used water generated as sewage.

2.1 The Sewage Treatment Plant treatment scheme shall be modular type based on FAB (Fluidized Aerobic Bioreactor)/MBBR (Moving Bed Bio Reactor) technology followed by disinfection by Hypo and necessary tertiary treatment prior to reuse in horticulture purpose. Aerobic biological sludge generated shall be thickened in the tube settler and aerobically digested/dried in a sludge sump and then transferred to filter press. The dry sludge shall be disposed manually by Customer. The Process Flow Diagram / P & ID is enclosed for reference.

The sewage treatment plant shall consist of following treatment components:

2.1.1 **Pre-Treatment**, which consists of raw sewage collection and pumping & screening of incoming sewage & oil & grease removal from the collected sewage.

Preliminary Treatment:

- Coarse screens for screening incoming sewage
- Oil & Grease Trap
- Equalization cum holding tank

2.1.2 **Biological Treatment**, comprising of aeration followed by clarification and Dosing of sodium hypochlorite in the hypo contact cum filter feed tank.

Aeration System:

- Aerobic Biological treatment in the FAB/MBBR Tank with fine bubble diffused aeration.
- Transfer of treated partially treated sewage to the Clarification system.

Clarification System:

- Settling of digested sludge in the Tube Settler.
- Transfer & storage of clarified water to the Hypo Contact Cum Filter Feed Tank.
- Dosing of Sodium Hypochlorite in the Hypo Contact Cum Filter Feed Tank.
- Dosing of Sodium Hypochlorite sludge feed line to centrifuge.

2.1.3 **Sludge Handling System**

- Transfer of sludge to the sludge sump from FAB/MBBR tank & tube settler.
- Transfer of sludge to centrifuge through sludge transfer pumps.
- Transfer a part of sludge to FAB/MBBR tank to maintain MLSS through discharge line of sludge transfer pumps.
- Transfer of centrate or filtrate to the equalization tank.
- Transfer of waste water generated through DMF & ACF to the equalization tank.
- Disposal of sludge as cakes by sludge trolley.

2.1.4 Tertiary Treatment:

• Polishing of treated sewage by DMF& ACF.
• Transfer of Polished sewage water for horticulture.

Detailed description of each treatment step is given below:

The various raw sewages shall be collected by gravity at local sewage lifting stations at different areas and the same to be pumped by using 2 Nos (1W+1S) Sewage Lifting Pumps to an underground common collection sump located in sewage treatment plant area.

Collected raw sewage shall be pumped from the common collection sump using 2 Numbers (1W+1S) common collection non-clog type sump Pumps to the equalization Tank after passing through the bar screen chamber & oil grease chamber provided with oil & grease trap. In bar screen chamber (MOC: RCC) the coarse screens present in the raw incoming sewage shall be subject to screening & oil & grease chamber (MOC: RCC) shall be provided with Oil & grease trap for removal of oil & grease from the raw incoming sewage.

The Sewage Lifting Pumps shall be of submersible and heavy duty grinding type which shall cut and grind solids present in raw sewage into small fragments. The Sewage Lifting Pumps shall automatically START at high level in the Sewage Collection Pit and STOP at low level.

The common collection sump shall also be provided with a coarse air bubble diffuser and an airline tapping from the Air Blower delivery header so as to allow continuous aeration in order to protect the STP Package against unpleasant odours.

2 numbers (1W+1S) Air Blowers common for common collection sump, Equalization tank & sludge sump shall be provided to supply air through an underwater piping grid and fine air bubble membrane diffusers.

Centrate produced from centrifuge shall be transferred to Equalization tank.

2 numbers (1W+1S) vertical submersible FAB/MBBR feed pumps shall be provided in equalization tank to transfer sewage from equalization tank to FAB/MBBR reactor. 1no. FAB/MBBR reactor of MSRL construction alongwith 2 numbers (1W+1S) Air Blowers for FAB/MBBR tank to supply air through an underwater piping grid and fine air bubble membrane diffusers to FAB/MBBR reactor.

1 number tube settler of MSRL construction for Settling of digested sludge in the Tube Settler.

1 number of Hypo contact cum filter feed tank of MOC RCC shall be provided for storage of clarified water after clarification process. Further 1 no. hypo dosing system consists of 1 number Hypo dosing tank of MOC PVC along with 1 number hypo dosing pump shall be provided for dosing of sodium hypo chloride inside the hypo contact cum filter feed tank. Over flow connection from the Hypo contact cum filter feed tank shall be connected through pipe to plant drain.

Further 2 numbers (1W+1S) horizontal centrifugal type filter feed pumps shall be provided for feeding clarified water after clarification process for tertiary treatment through dual media filter & activated carbon filter.
1 number dual media filter & 1no. Activated carbon filter shall be provided for the tertiary treatment of clarified water after clarification process. Backwash & waste water generated from dual media filter & activated carbon filter shall be transferred to the equalization tank.

1 number treated water tank over ground (MOC RCC) shall be there for storage of final treated water after tertiary treatment. Further 2 numbers (1W+1S) horizontal centrifugal type treated water disposal pumps shall be provided for transferring the treated water for gardening purpose.

1 number sludge sump of (MOC RCC underground) for storage of sludge generated from FAB/MBBR tank & tube settler shall be provided. 2 nos. (1W+1S) of vertical screw type sludge transfer pumps for feeding sludge from sludge sump to centrifuge. Further 1 number hypo dosing system consists of 1 number Hypo dosing tank

alongwith 1 number hypo dosing pump shall be provided for dosing of sodium hypo chloride during feeding of sludge to centrifuge.

Sodium hypochlorite solution dosing shall be carried out into the hypo contact cum filtered feed tank & feeding line to centrifuge to control the BOD.

Further 2 number trolley mounted arrangement shall be provided for disposal of sludge cake generated from centrifuge.

The stabilized sludge shall be free of offensive odours.

Sea water intake pump house is located far- off location from BTG island and treatment of the sewage generated from toilets cannot be transferred to main sewage treatment plant, hence dedicated bio-digester and Reed Bed arrangement shall be provided to cater sewage waste generated from sea water intake pump house. Over flow of Reed bed arrangement shall be suitably used for horticulture. One no. hose pipe (MOC: PVC) of 10 m length shall be provided for the same.

2.2 SIZING CRITERIA FOR BIO TOILET

As per CPHEEO norms, an average flow of 45 liters per capita per day has been adopted.

Bio digester capacity are calculated as per the following table.

Sl no:	Buildings/Facilities (As per Plot Plan)	No. of people	Sewage generated in m3	Capacity of Bio digester envisaged (m3) *	Capacity of Reed bed envisaged (m3)
1.0	Sea water intake pump house	30	4.05	4.5 m3	2.25 m3

*Three days retention has been considered.

Sr. no.	System provided	BIO-DIGESTER			REED BED ARRANGEMENT		
	Building/Area Covered	Quantity	Effective capacity	MOC & Type	Quantity	Effective capacity	MOC & Type
2.0	**BD-RD 1 for** Sea water intake pump house	1 number	4.5 cum, (Designed for 30 people)	MOC: FRP (10 mm thick) Type: Supplier specific design	1 number	2.25 cum	MOC: FRP (10 mm thick) Type: Supplier specific design
3.0	PIPING						
3.1	Sewage pipe MOC			uPVC			
3.2	Treated water pipe MOC			uPVC			

3.0 SEWAGE GENERATION AND CHARACTERISTICS

The Sewage Treatment Plant is designed for the following sewage flow rate and characteristics are as follows:

Persons Envisaged : 2000 [45 Ltrs/Capita (lpcd) as per CPHEEO, 1993].
Flow Rate : 75 M^3/day (Max). (Considering 80% of used water generated as sewage)

SECTION-D2

(GENERAL TECHNICAL REQUIREMENT FOR ELECTRICAL)

REFER:

1) PE-V0-412-673-A036 (DATA SHEET FOR MOTOR).
2) PE-V0-412-673-A019 (ELECTRICAL LAOD DATA)
3) PE-V0-412-673-A018 (CABLE SCHEDULE AND INTERCONNECTION)

SECTION-D3

(GENERAL TECHNICAL REQUIREMENT FOR C&I)

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 glands 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 SS316 for other services
- Diaphragm	:	316 SS
- Measurement element	:	Teflon seal
- Valves	:	Carbon steel for non-corrosive Applications SS316 for corrosive applications.
Output signal	:	4 to 20 m Amp. DC (Two wires) HART Compatible
Local Indicator	:	LCD indicator (5 digit) with scale of Engg. unit
Overall Accuracy	:	± 0.04% or better of Span for BTG package ± 0.065% or better of Span for BOP packages ± 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) Quarter (1/4) inch NPT 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 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	:	± 0.25% of span or better
Resolution	:	± 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. 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 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 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 b) Hand wheel. c) Air filter regulator with gauge. d) Volume Booster. e) Limit Switches. f) Positioner with Input, Output and supply pressure gauges. g) Pilot Solenoid Valve (Double Coil type) 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 ii) Bar Graph 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 ii. Channel to Channel online Isolation shall be provided 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 Suitable for mosaic grid 24x48 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 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

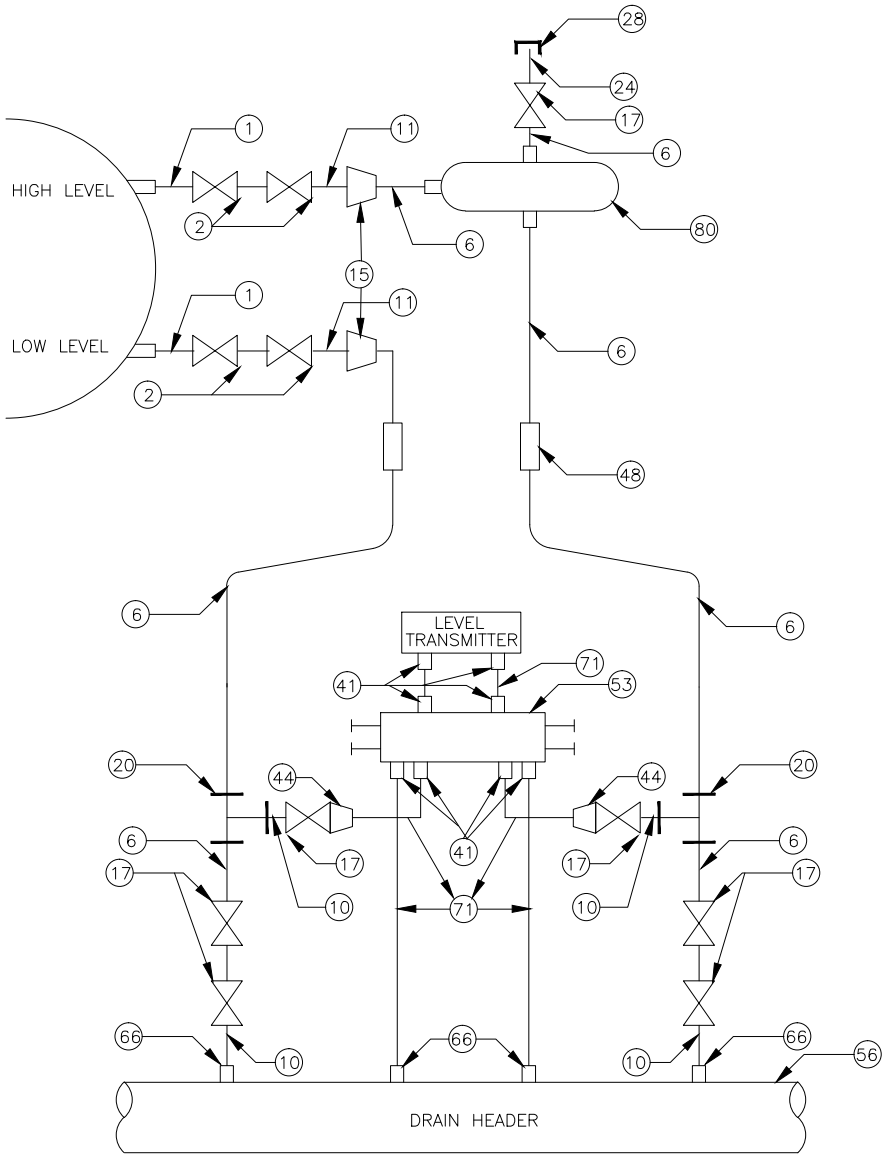
SENSOR

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 I/E/UR
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

ZONE	MARK	REVISIONS	DATE	CIVIL	MECH.	ELEC.	C&I	H.O.D.
	A	PRELIMINARY	25.04.13				SLN	
	0	PARTICULARS						

APPROVED

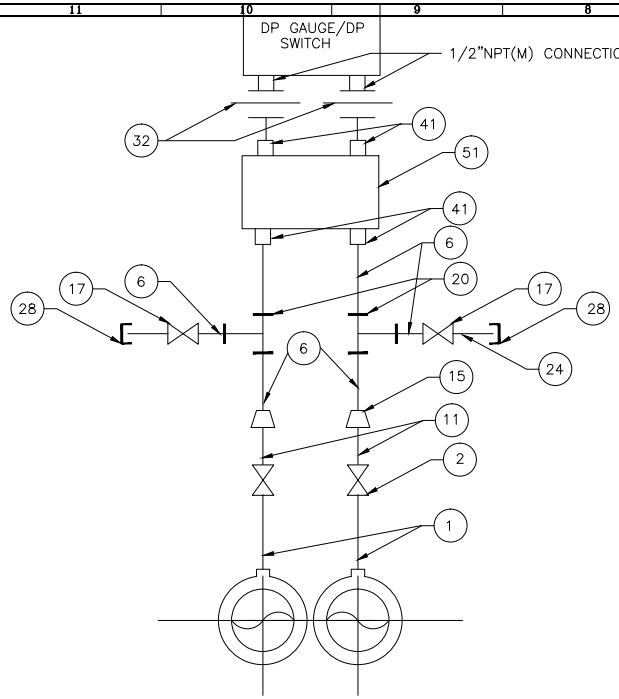
DESEIN
CONSULTING ENGINEERS
NEW DELHI - INDIA

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 LEVEL TRANSMITTERS
FOR BID PURPOSE ONLY:

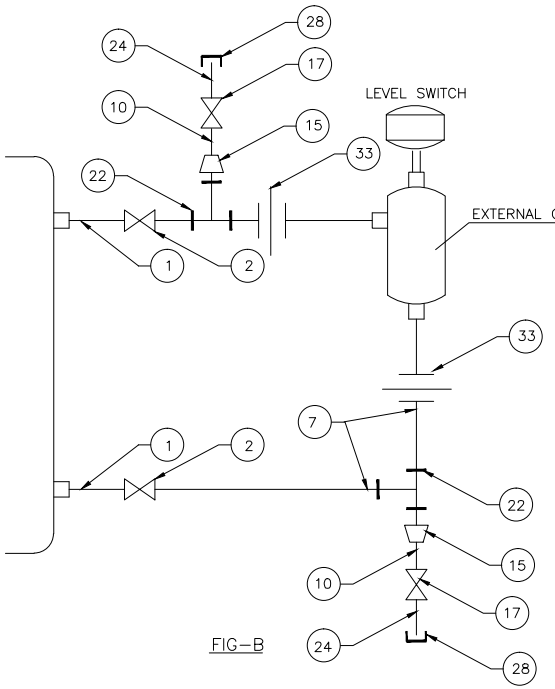
	NAME	SIGN.	DATE
CAD/DRAWN	VIKAS		23.04.13
DESIGNED	SKM/SN		23.04.13
CHECKED	S.K.M.		24.04.13
SCALE	N.T.S.		
JOB. No.	D-4027		
DWG.No.	114-04-0110		REV. 0

Sheet No. 13 of 19

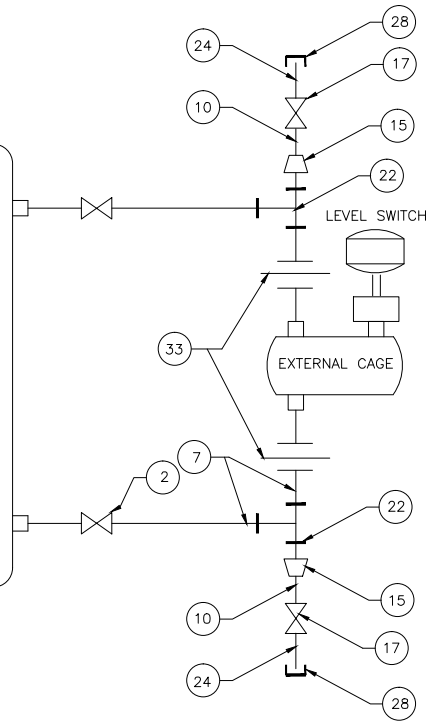
SR. No. PARTY
PRINT DISTRIBUTION



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.

NOTICE

ZONE	MARK	REVISIONS	DATE	CIVIL	MECH.	ELEC.	C&I	H.O.D.
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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 DIFF. PRESS. SWITCH/GAUGE/LEVEL SWITCHES
FOR BID PURPOSE ONLY

	NAME	SIGN.	DATE
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CHECKED	S.K.M.		24.04.13
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JOB. No. D–4027
DWG.No. 114–04–0108 Sheet No. 11 of 19
REV. 0

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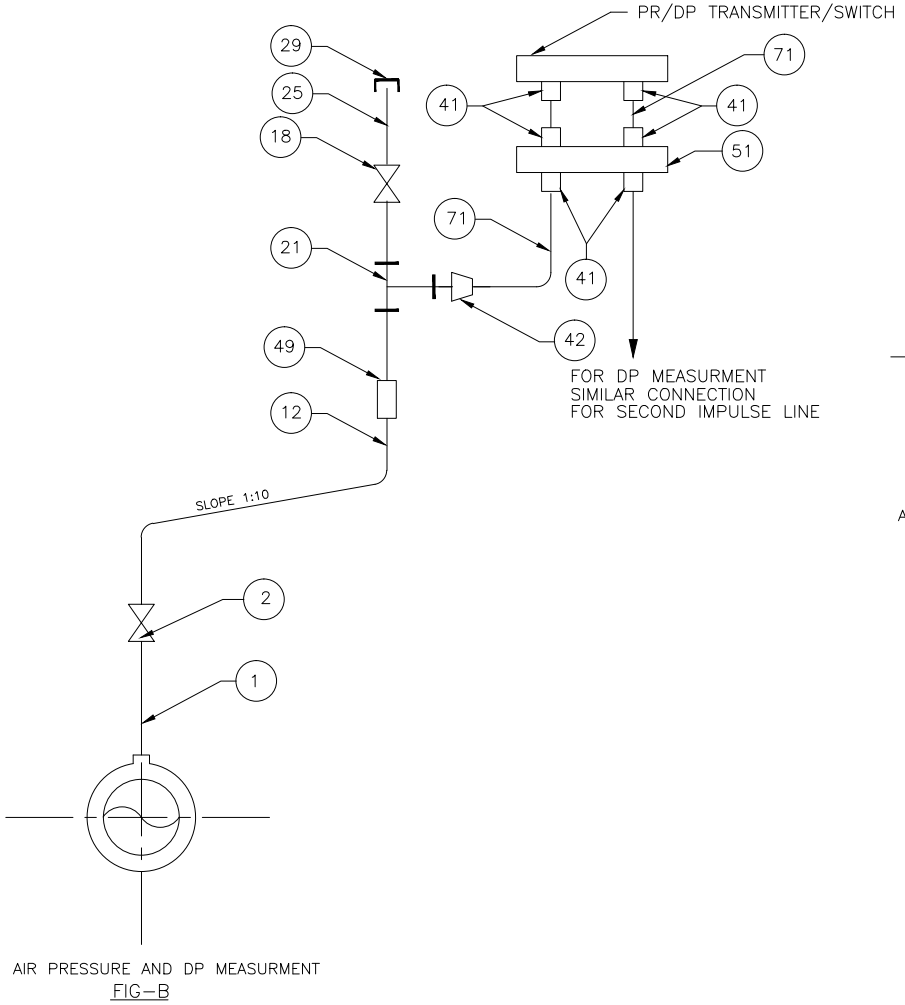
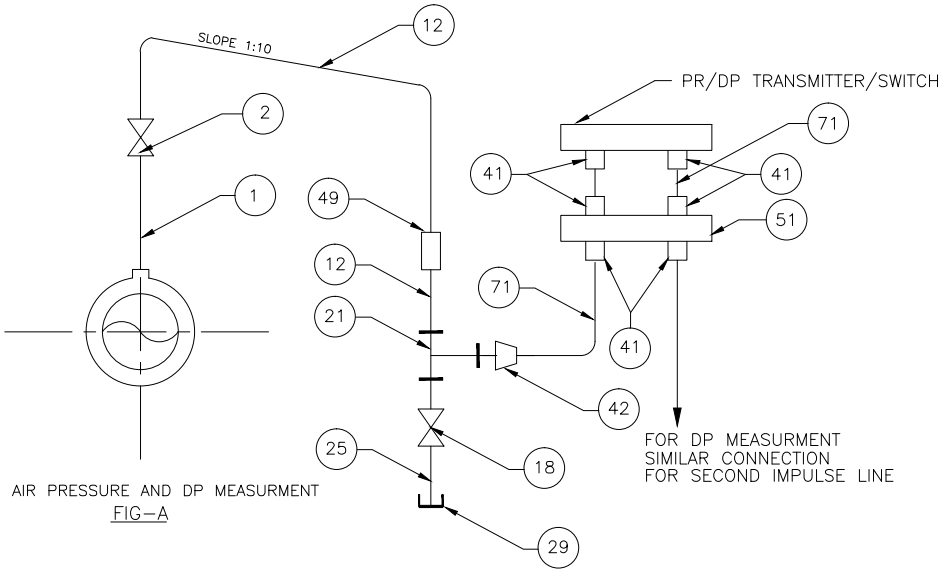


AIR PRESSURE AND DP MEASURMENT
FIG–B



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
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.

NOTICE

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TITLE :– INST. DRAWING FOR PRESS. & DIFF. PRESS. TRANSMITTERS/SWITCH (AIR SERVICE)
FOR BID PURPOSE ONLY:

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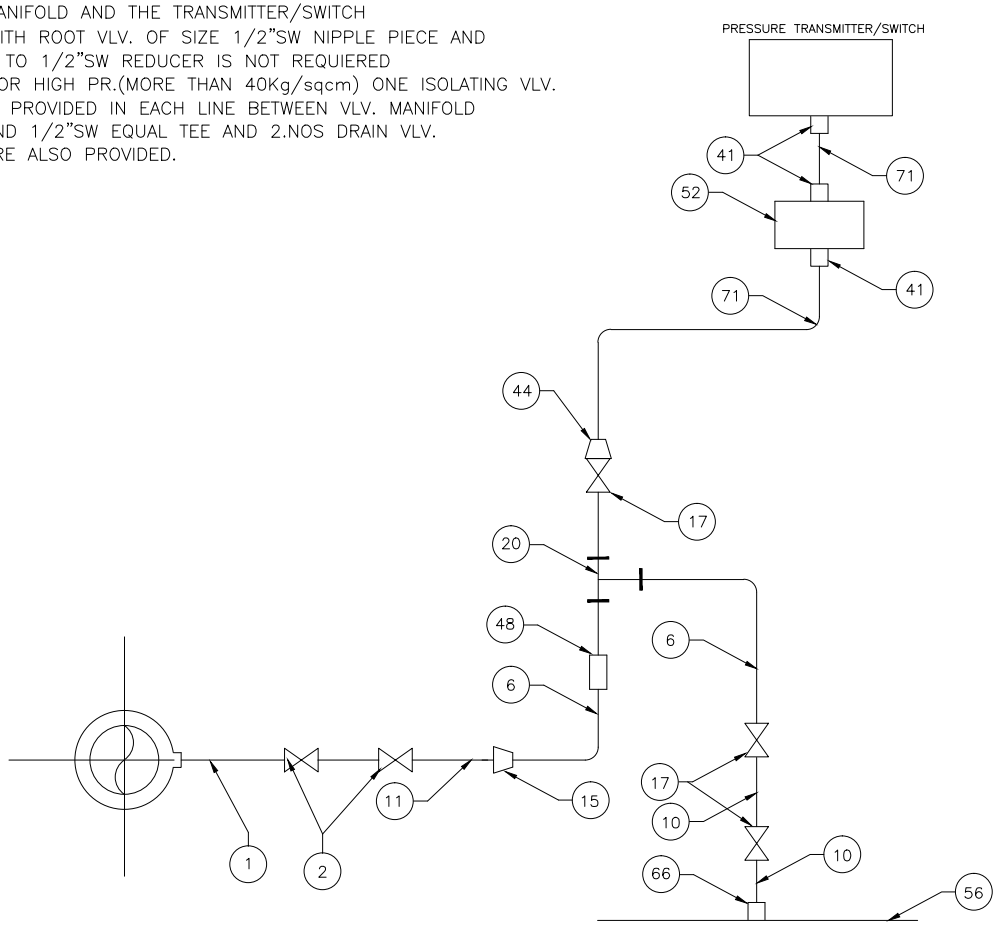
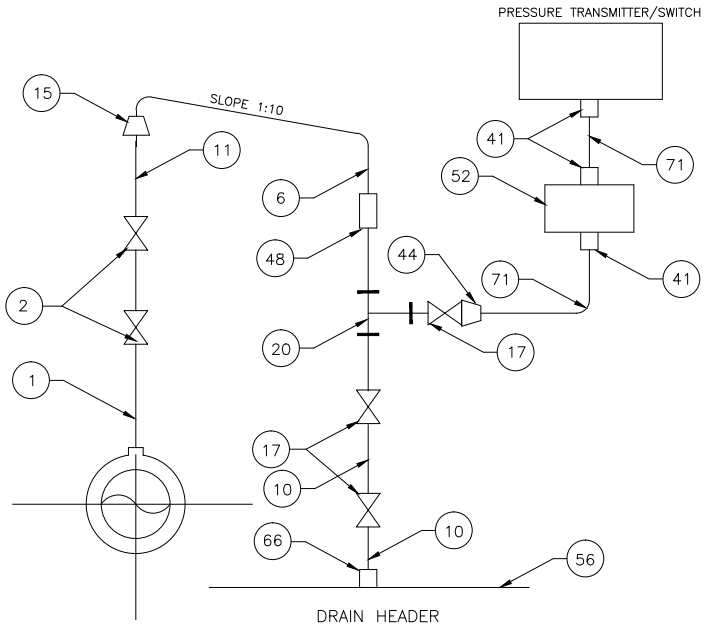
NOTE:–

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.

NOTICE

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TITLE :– INST. DRAWING FOR PRESS. & DIFF.PRESS. TRANSMITTERS/SWITCH (STEAM & LIQUID SERVICE)

FOR BID PURPOSE ONLY:

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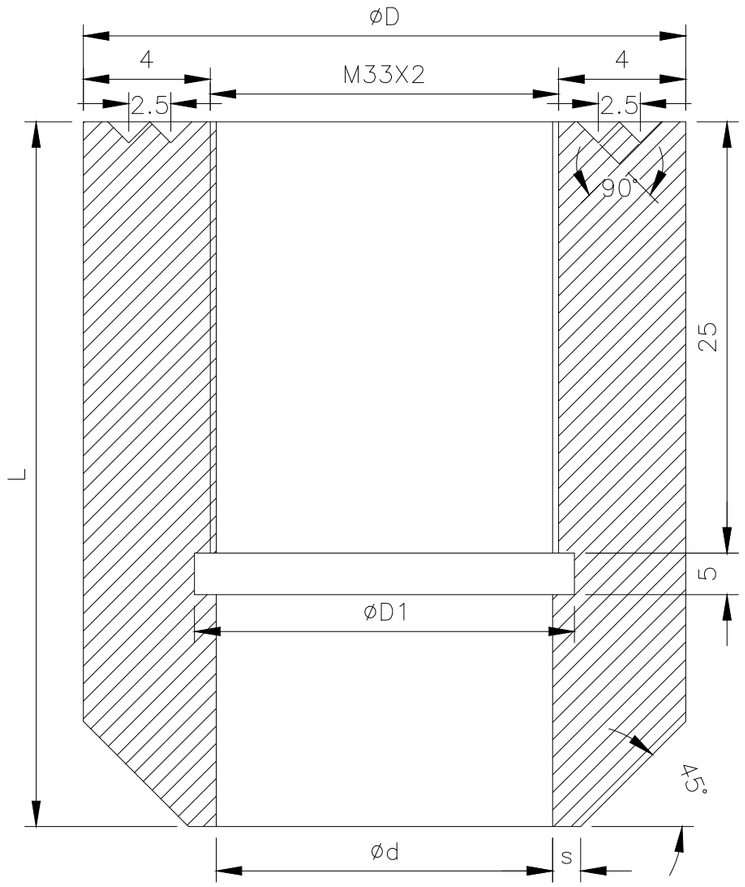
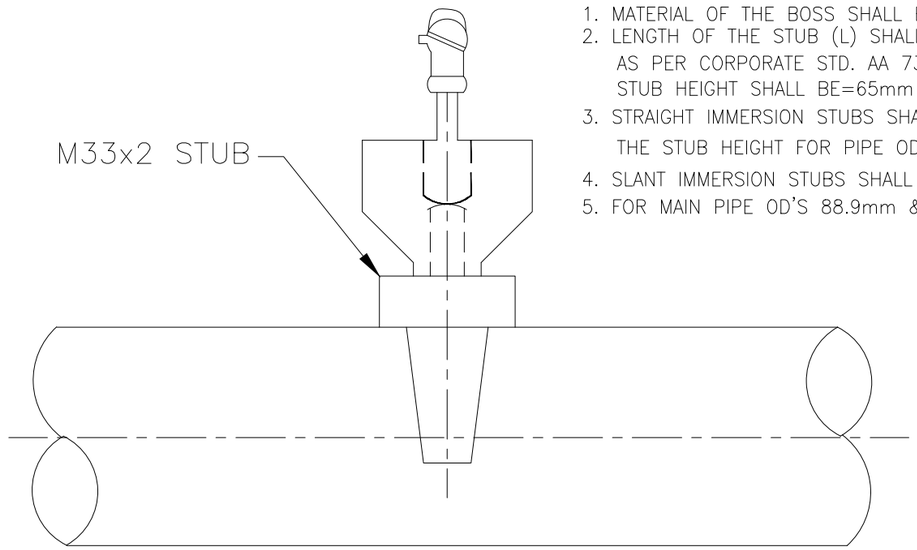
DWG.No. 114–04–0104 REV. 0

Sheet No. 7 of 19



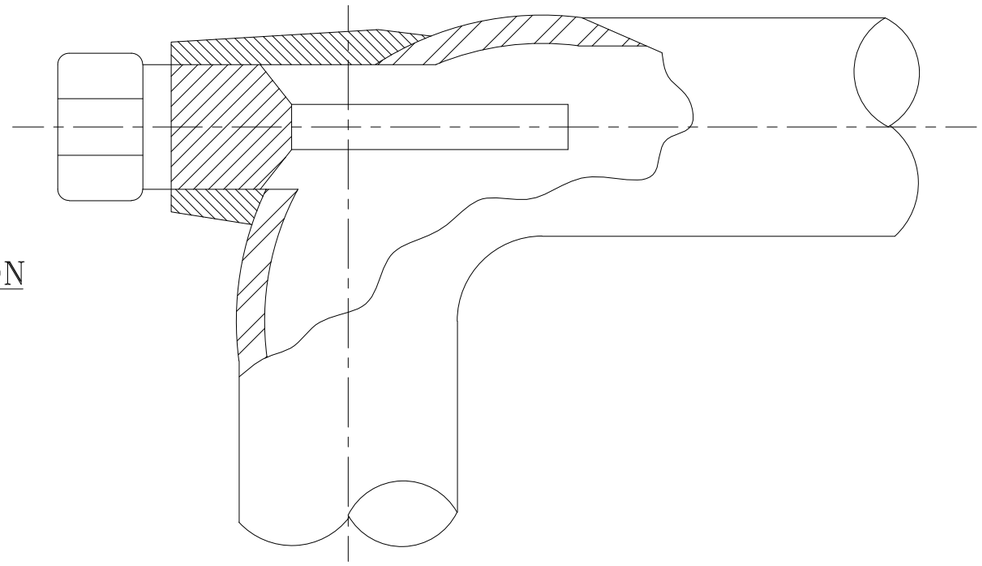
TEMPERATURE STUB FOR STRAIGHT IMMERSION

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.

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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:

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DWG.No. 114-04-0111 — REV. 0

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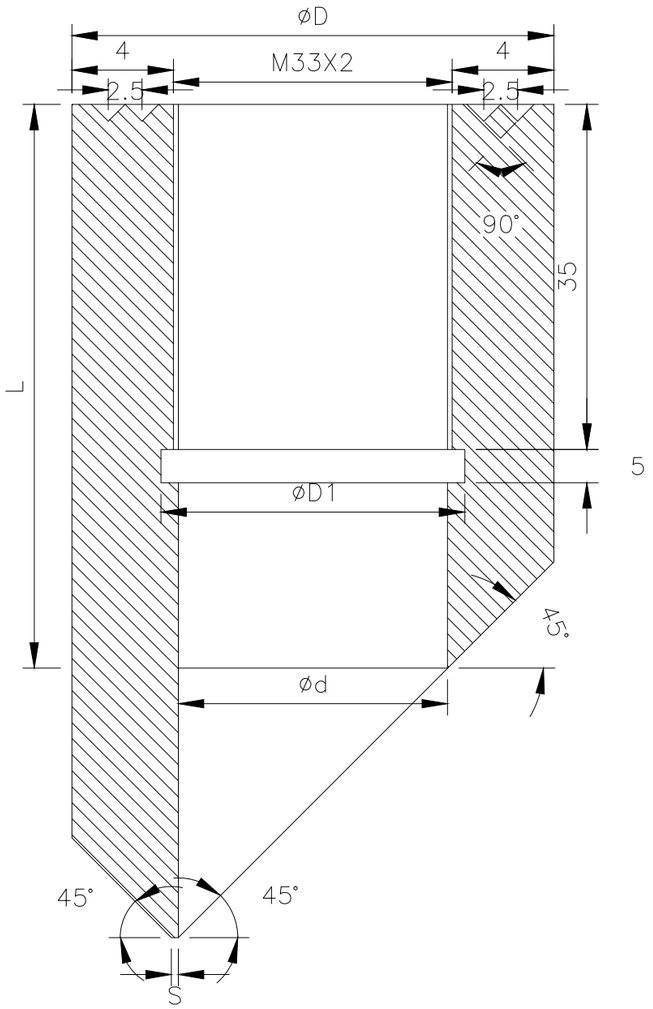
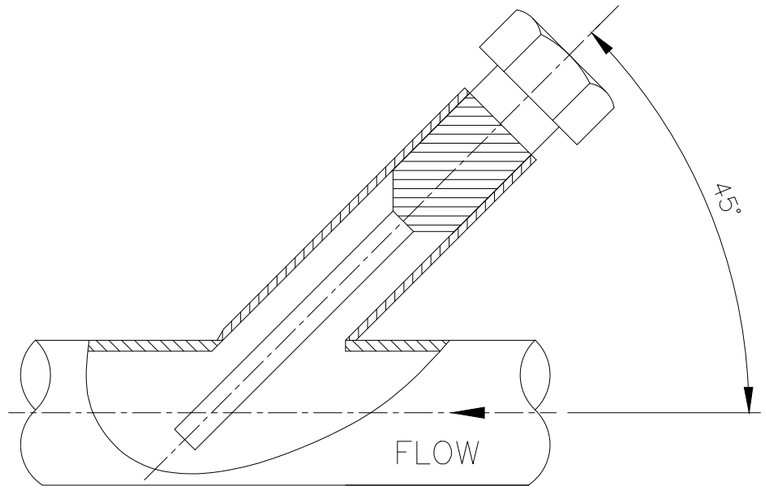


TEMPERATURE STUB FOR SLANT IMMERSION

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

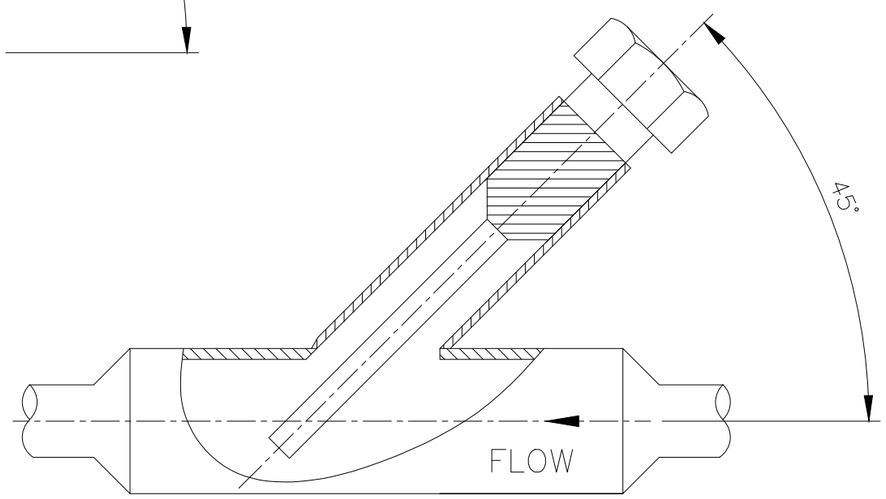
NOTE :–

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.



INSTALLATION TYPE–3

(FOR MAIN PIPE OD 88.9mm TO 159mm)



INSTALLATION TYPE–4

(FOR MAIN PIPE OD 88.9mm & BELOW)

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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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 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/Cm²g, 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 ASTM A182, Gr. F22 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. Pressure Measurement

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.

SITE STORAGE AND PRESERVATION (ANNEXURE-B)

SITE STORAGE AND PRESERVATION GUIDELINES

FOR

MECHNANICAL BOPs

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

PROJECT ENGINEERING MANAGEMENT, POWER SECTOR

BHARAT HEAVY ELECTRICALS LIMITED-NOIDA

CONTENT

1. SCOPE OF THE DOCUMENT

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

2. PURPOSE OF STORAGE & PRESERVATION

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

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

a) GENERAL STORAGE REQUIREMENTS

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

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

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

b) GENERAL PRESERVATION REQUIREMENTS

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

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.

11. Following preservatives/preservation methods can be used depending upon type of equipment

    a. Rust preventive fluid (RPF)

    b. Rust protective paints

    c. Tarpaulin covers, in case of outdoor storage

    d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –

    - Ingress of moisture and corrosion damages.
    - Damage to protective coating.
    - Open ends in pipes, vessels and equipment -
        - In case any open ends are noticed, same shall be capped.

2. Any damages to equipment / materials.

    - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
    - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

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

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

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

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

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

iii Open storage (O)

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

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

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

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

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

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

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

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H_2SO_4)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

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

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

5. CONCLUSION

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

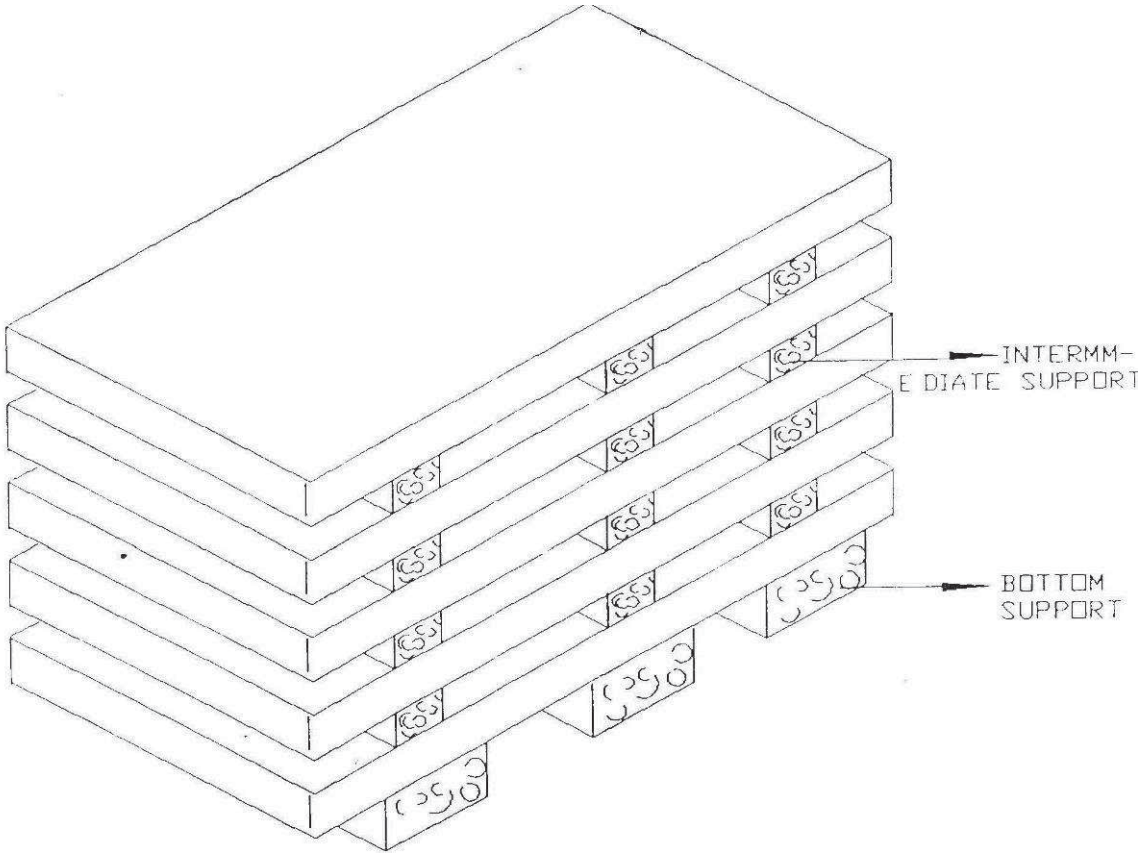


Figure – 1 – PLATE STACKING ARRANGEMENT

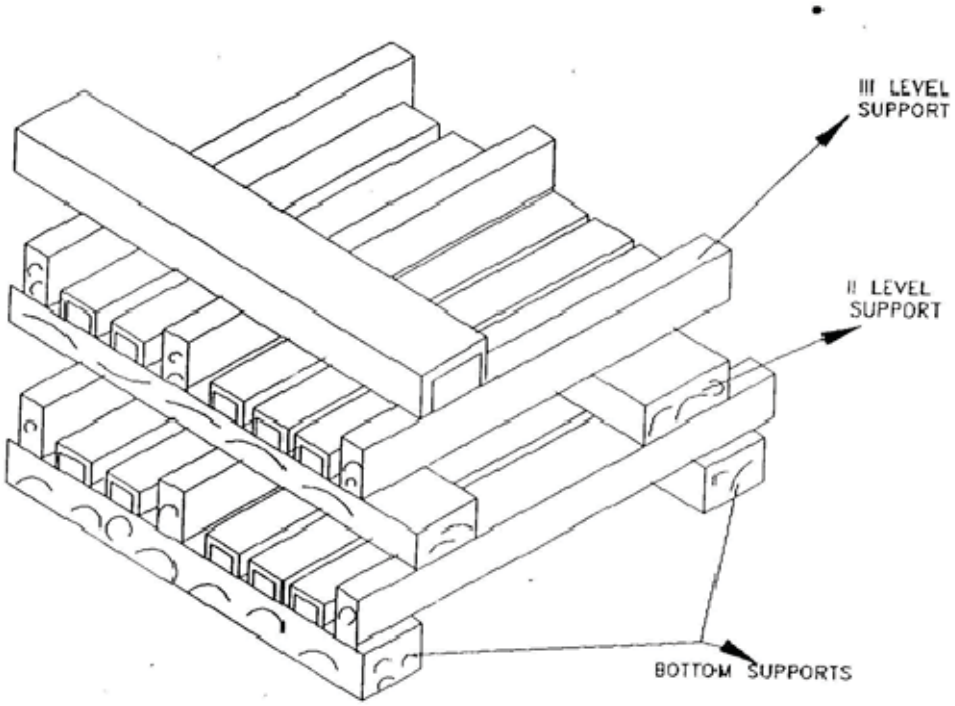


Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT

ALREADY APPROVED DOCUMENTS (SUBMITTED BY M/S CWL)

(ANNEXURE-C)

NOTE:

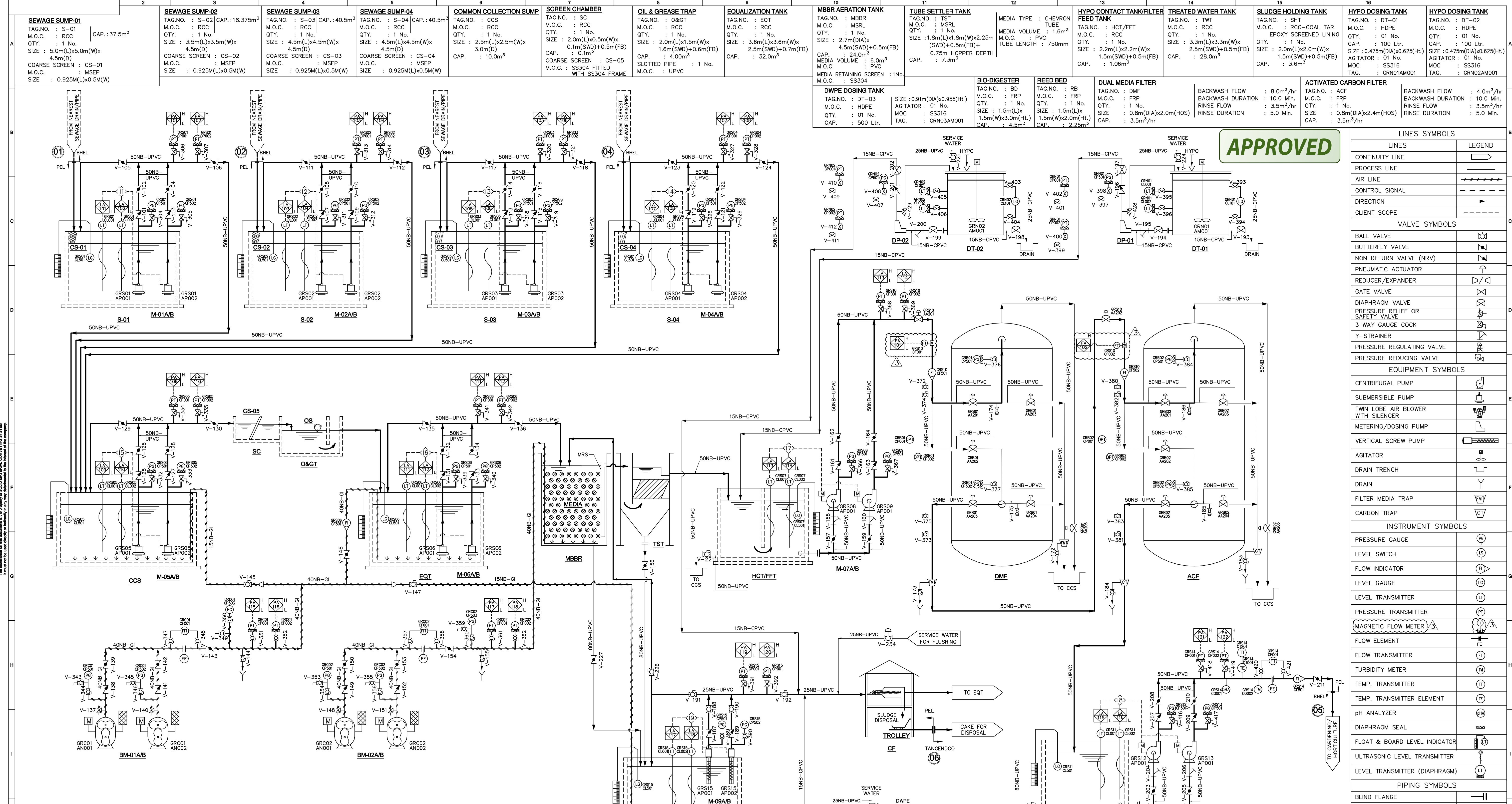
1) BIDDER CAN ALSO GO WITH OTHER MAKE/SUB-VENDOR ITEMS FOR WHICH THE MODIFICATION WORK ON EXISTING CIVIL FOUNDATION TO BE TAKEN CARE BY BIDDER AT SITE.
2) THE MAKE OF ITEMS SHALL BE AS PER ENCLOSED APPROVED SUB VENDOR LIST (**PE-V0-412-673-A025**). HOWEVER, ANY ADDITIONAL SUB-VENDOR REQUIRED THE SAME SHALL BE SUBJECT TO BHEL/CUSTOMER APPROVAL DURING DETAILED ENGINEERING WITHOUT ANY COMMERCIAL/DELIVERY IMPLICATION TO BHEL/CUSTOMER.

MDL FOR STP			
SL NO	**DOC NO.**	**TITLE**	**Final Status**
1	PE-V0-412-673-A001	P&I Diagram for Sewage Treatment Plant	Approved
2	PE-V0-412-673-A002	Layout of SewageTreatment Plant	Approved
3	PE-V0-412-673-A008	PROCESS DESIGN AND SIZING CALCULATION INCLUDING PRESSURE DROP CALCULATIONS (STP)	Approved
4	PE-V0-412-673-A020	Operation & Control Philosophy SEWAGE TREATMENT PLANT	Approved
5	PE-V0-412-673-A034	MECH. GA OF LAMELLA TUBE SETTLER CLARIFIER FOR SEWAGE TREATMENT PLANT	Approved
6	PE-V0-412-673-A036	TECHNICAL DATA SHEET OF MOTOR for SEWAGE TREATMENT PLANT	Approved
7	PE-V0-412-673-A038	I/O LIST FOR STP	Approved
8	PE-V0-412-673-A007	HFD FOR SEWAGE TREATMENT PLANT	Approved
9	PE-V0-412-673-A005A	MECH. GA DRAWINGS OF ALL SEWAGE SUMPS AND TANKS FOR SEWAGE TREATMENT PLANT (Part-1)	Approved
10	PE-V0-412-673-A005B	MECH. GA DRAWINGS OF ALL SEWAGE SUMPS AND TANKS FOR SEWAGE TREATMENT PLANT (Part-2)	Approved
11	PE-V0-412-673-A005C	MECH. GA DRAWINGS OF ALL SEWAGE SUMPS AND TANKS FOR SEWAGE TREATMENT PLANT (Part-3)	Approved
12	PE-V0-412-673-A011	TECHNICAL DATA SHEET OF SUBMERSIBLE PUMPS SEWAGE TREATMENT PLANT	Approved
13	PE-V0-412-673-A014	TECHNICAL DATA SHEET OF BLOWERS SEWAGE TREATMENT PLANT	Approved
14	PE-V0-412-673-A015	TECHNICAL DATA SHEET FOR METERING PUMPS FOR SEWAGE TREATMENT PLANT	Approved
15	PE-V0-412-673-A016	Data Sheet of Agitator FOR SEWAGE TREATMENT PLANT	Approved
16	PE-V0-412-673-A017	Instrument Schedule SEWAGE TREATMENT PLANT	Approved
17	PE-V0-412-673-A018	Cable Shedule & INTERCONNECTION FOR SEWAGE TREATMENT PLANT	Approved
18	PE-V0-412-673-A019	ELECTRICAL LOAD DATA SEWAGE TREATMENT PLANT	Approved
19	PE-V0-412-673-A021	Valve Schedule SEWAGE TREATMENT PLANT	Approved
20	PE-V0-412-673-A023	Painting Schedule FOR SEWAGE TREATMENT PLANT	Approved
21	PE-V0-412-673-A025	INSPECTION CATEGORISATION PLAN AND SUB VENDOR LIST	Approved
22	PE-V0-412-673-A030	ERECTION PROCEDURE SEWAGE TREATMENT PLANT	Approved
23	PE-V0-412-673-A031	PG TEST FOR SEWAGE TREATMENT PLANT	Approved
24	PE-V0-412-673-A039	GA DRAWING OF MBR AERATION TANK	Approved
25	PE-V0-412-673-A040	GA DRAWING OF HYPO DOSING TANKS	Approved
26	PE-V0-412-673-A041	DATASHEET & GA FOR DIFFUSER & TUBE SETTLER MEDIA	Approved
27	PE-V0-412-673-A042	DATASHEET & GA FOR CENTRIFUGE	Approved

28	PE-V0-412-673-A043	DATASHEET & GA OF DUAL MEDIA FILTER & ACTIVATED CARBON FILTER	Approved
29	PE-V0-412-673-A045	TECHNICAL DATASHEET FOR PIPING MATERIAL	Approved
30	PE-V0-412-673-A047	GA DRAWING & DATASHEET FOR BIO DIGESTER SYSTEM	Approved
31	PE-V0-412-673-A049	Control Scheme for Sewage Treatment plant	Approved
32	PE-V0-412-673-A027	QAP FOR METERING PUMPS WITH MOTOR FOR SEWAGE TREATMENT PLANT	Approved
33	PE-V0-412-673-A028	QAP FOR BLOWERS WITH MOTOR FOR SEWAGE TREATMENT PLANT	Approved
34	PE-V0-412-673-A033	QAP FOR LAMELLA CLARIFIER TUBE SETTLER FOR SEWAGE TREATMENT PLANT	Approved
35	PE-V0-412-673-A051	QAP For Agitator with motor for Sewage Treatment Plant	Approved
36	PE-V0-412-673-A052	QAP of Centrifuge for Sewage Treatment Plant	Approved
37	PE-V0-412-673-A035	QAP FOR VALVES SEWAGE TREATMENT PLANT	Re Submission Pending
38	PE-V0-412-673-A003	PIPING LAYOUT OF STP (INSIDE AREA)	Re Submission Pending
39	PE-V0-412-673-A004	YARD PIPING LAYOUT OF STP	Re Submission Pending
40	PE-V0-412-673-A010	DATA SHEET OF VALVES SEWAGE TREATMENT PLANT	Re Submission Pending
41	PE-V0-412-673-A012A	Technical Data Sheet of Screw and Horizontal Centrifugal Pumps- STP (Part-1) (Vertical Screw Pumps for STP)	Re Submission Pending
42	PE-V0-412-673-A048	INSTRUMENT HOOK UP DRAWING FOR SEWAGE TREATMENT PLANT	Re Submission Pending
43	PE-V0-412-673-A013B	TDS-INSTRUMENTS - PRESSURE GAUGES - STP (Part-2)	Re Submission Pending
44	PE-V0-412-673-A037	CABLE TRAY/ TRENCH & CONDUIT ROUTING DIAGRAM OF STP	First Submission Due
45	PE-V0-412-673-A013	TECHNICAL DATA SHEET- INSTRUMENTS SEWAGE TREATMENT PLANT	First Submission Due
46	PE-V0-412-673-A022	O & M Mannual FOR SEWAGE TREATMENT PLANT	First Submission Due
47	PE-V0-412-673-A044	PIPING SUPPORT LAYOUT FOR SEWAGE TREATMENT PLANT	First Submission Due
48	PE-V0-412-673-A012B	Technical Data Sheet of Screw and Horizontal Centrifugal Pumps- STP (Part-2) (Horizontal Centrifugal Pumps)	First Submission Due
49	PE-V0-412-673-A026	QAP FOR SUBMERSIBLE PUMP WITH MOTOR	First Submission Due

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN MM



TERMINATION POINTS			
S.No.	TERMINAL POINTS	DESCRIPTION	FLOW AND PRESSURE
1	SEWAGE WATER INLET	AT THE INLET OF SEWAGE SUMP, S-01	ATM
2	SEWAGE WATER INLET	AT THE INLET OF SEWAGE SUMP, S-02	ATM
3	SEWAGE WATER INLET	AT THE INLET OF SEWAGE SUMP, S-03	ATM
4	SEWAGE WATER INLET	AT THE INLET OF SEWAGE SUMP, S-04	ATM
5	TREATED SEWAGE WATER	FROM TREATED WATER DISPOSAL PUMP TO HORTICULTURE NETWORK (MAX. DISTANCE PIPING 500 MTR.)	4 m3/hr @ 1.0–1.5 kg/cm2
6	DEWATERED SLUDGE	AT THE CENTRIFUGE SLUDGE OUTLET	ATM
7	INSTRUMENT AIR (PNEUMATIC AIR LINE)	AT THE ONE POINT WITH IN BATTERY LIMIT (MAX. 5 MTR.)	1–5 m3/hr @ 5.0–6.0 Kg/cm2
8	SERVICE WATER	AT THE ONE POINT WITH IN BATTERY LIMIT (MAX. 5 MTR.)	3–5 m3/hr @ 2.0 Kg/cm2
9	SEWAGE WATER INLET	AT THE INLET OF BIO DIGESTER, BD	ATM
10	TREATED SEWAGE WATER	AT THE OUTLET OF REED BED TO GARDENING (MAX. DISTANCE PIPING 10 MTR.)	ATM
11	DRAINS & OVERFLOW	AT THE RESPECTIVE DRAIN TRENCHES TO COMMON SEWAGE COLLECTION SUMP	ATM
12	CHEMICALS	AT THE INLET OF RESPECTIVE DOSING TANKS	---

CHARACTERISTICS OF RAW SEWAGE (INLET)			
S.No.	PARAMETERS	UNIT	VALUES
1	pH	–	7.0–8.0
2	TSS	mg/L	300
3	COD	mg/L	600
4	BOD (5 DAYS)	mg/L	300
5	OIL & GREASE	mg/L	<50
6	NH4–N	mg/L	–
7	N–TOTAL	mg/L	–
8	COLIFORM	MPN/1000ml	10^6–10^7
9	TEMPERATURE	°C	AMBIENT

CHARACTERISTICS OF TREATED SEWAGE (OUTLET)			
S.No.	PARAMETERS	UNIT	VALUES
1	pH	–	6.5–8.0
2	TSS	mg/L	≤20
3	COD	mg/L	≤100
4	BOD (5 DAYS)	mg/L	≤10
5	OIL & GREASE	mg/L	10–20
6	NH4–N	mg/L	≤5
7	N–TOTAL	mg/L	≤10
8	COLIFORM	MPN/1000ml	≤10^3
9	TEMPERATURE	°C	AMBIENT

NOTE: –

1. ALL THE CAPACITIES OF TANKS PROVIDED IN THE P&ID ARE EFFECTIVE CAPACITIES.
2. PLEASE NOTE THAT ALL THE SEWAGE, TREATED SEWAGE, SERVICE WATER LINES/PIPING WITH IN PLANT BOUNDARY ARE BEEN CHANGED TO INDUSTRIAL GRADE PVC MOC. HENCE THERE IS NO REVISION MARKING HAS DONE FOR THE FOLLOWING.

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

OWNER :- TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED

OWNER'S CONSULTANT:- DESEIN PRIVATE LIMITED, DESEIN HOUSE, NEW DELHI

BHARAT HEAVY ELECTRICALS LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA

PENNAR ENVIRO — Re-engineering Water, Environment & Energy — Floor No. 3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad - 500 084, www.pennarenviro.com

DEPT.	CODE	SCALE	WEIGHT(KG)	VENDOR DRAWING NO.
--	--	NTS	-	PEL-12171037-PRO-PID-001

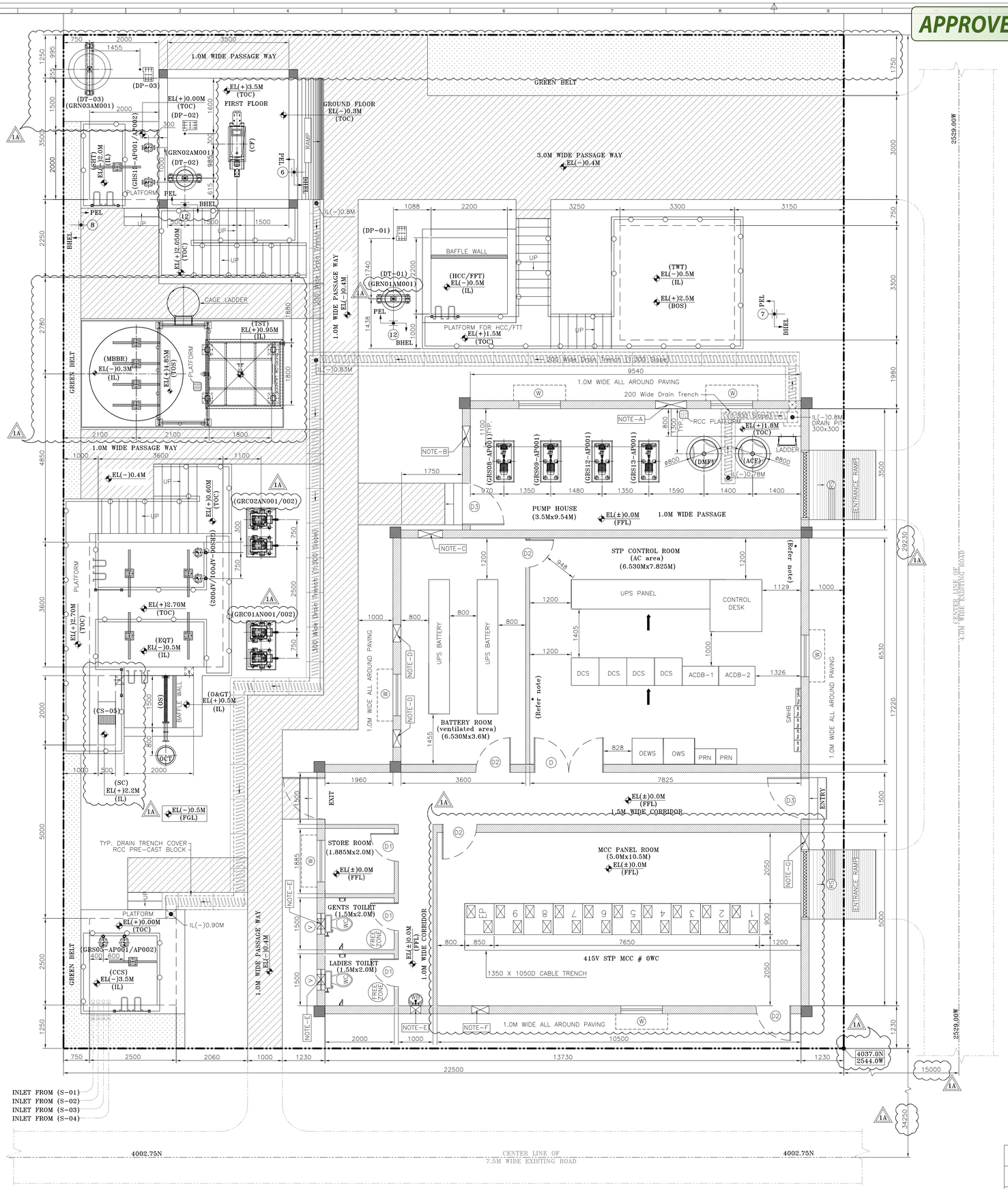
TITLE: P & ID FOR 75 KLD SEWAGE TREATMENT PLANT

	NAME	DATE
PREP	KLNR	17.04.18
CHKD	GSK	17.04.18
CHKD	HE	17.04.18
APPD	HO	17.04.18

BHEL DRAWING NO. PE-V0-412-673-A001, REV R3

SIZE-A0

APPROVED



NOTES :–

1. ALL DIMENSIONS ARE IN mm AND LEVELS ARE IN METER UNLESS OTHERWISE NOTED.
2. FGL (−)0.50M.
3. PLANT FINISH GRADED LEVEL (FGL) SHALL BE RL (+) 9.5M. POWER HOUSE (TG BUILDING) FINISH GROUND FLOOR LEVEL IS EL (±)0.00M. WHICH CORR. TO RL (+)10.0M.
4. FOR PUMPS ALL THE DIMENSION INDICATED FROM DISCHARGE OF PUMPS.
5. ALL ROTATING EQUIPMENT ARE IN HOLD.
6. ALL CIVIL DESIGN & CONSTRUCTION ARE IN CLIENT'S SCOPE.

REFERENCE DRAWINGS :–

1. P&ID :–PEL–12171037–PRO–PID–001 / PE–V0–412–673–A001
2. HFD :–PEL–12171037–PRO–HFD–003 / PE–V0–412–673–A007

TEXT LEGENDS :–

IL	:–INVERT LVL.
EL	:–ELEVATION.
FFL	:–FINISHED FLOOR LEVEL.
FGL	:–FINISHED GROUND LEVEL.
TYP	:–TYPICAL.
TOC	:–TOP OF CONCRETE.
TOS	:–TOP OF STEEL.
BOS	:–BOTTOM OF SLAB.

LINE LEGENDS:–

PLANT BOUNDARY

BHEL / PEL — BATTERY LIMIT SYMBOL

TERMINATION POINTS

TP	DESCRIPTION	LOCATION	FLOW / PRESSURE	END CONN.
1	SEWAGE WATER INLET	AT THE INLET OF SEWAGE SUMP, S-01	ATM	-
2	SEWAGE WATER INLET	AT THE INLET OF SEWAGE SUMP, S-02	ATM	-
3	SEWAGE WATER INLET	AT THE INLET OF SEWAGE SUMP, S-03	ATM	-
4	SEWAGE WATER INLET	AT THE INLET OF SEWAGE SUMP, S-04	ATM	-
5	TREATED SEWAGE WATER	FROM TREATED WATER DISPOSAL PUMP TO HORTICULTURE NETWORK (MAX. DISTANCE PIPING 500 MTR.)	4 M3/HR @ 1.0-1.5 KG/CM2	
6	DEWATERED SLUDGE	AT THE CENTRIFUGE SLUDGE OUTLET	ATM	
7	INSTRUMENT AIR (PNEUMATIC AIR LINE)	AT ONE POINT (5 METER MAX. DISTANCE FROM STP PLANT BATTERY LIMIT)	1-5 M3/HR @ 5.0-6.0 KG/CM2	25NB FLANGED
8	SERVICE WATER	AT ONE POINT (5 METER MAX. DISTANCE FROM STP PLANT BATTERY LIMIT)	3-5 M3/HR @ 2.0 KG/CM2	50NB FLANGED
9	SEWAGE WATER INLET	AT THE INLET OF BIO DIGESTER, BD	ATM	
10	TREATED SEWAGE WATER	AT THE OUTLET OF REED BED TO GARDENING (MAX. DISTANCE PIPING 10 MTR.)	ATM	
11	DRAINS & OVERFLOW	AT THE RESPECTIVE DRAIN TRENCHES TO COMMON SEWAGE COLLECTION SUMP	ATM	
12	CHEMICALS	AT THE INLET OF RESPECTIVE DOSING TANKS	-	

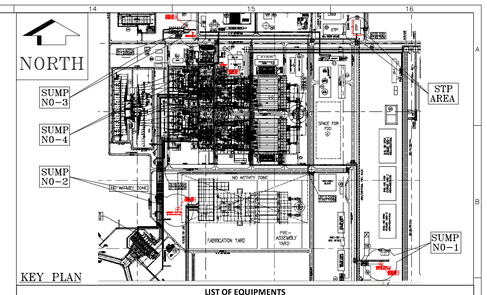
NOTES FOR CONTROL ROOM:

1. WALL (MARKED WITH '*') TO BE CONSTRUCTED AFTER ERECTION OF BATTERY/PANELS.
2. MINIMUM CLEAR HEIGHT OF 3.0 MTR IS REQUIRED FOR ERECTION OF PANELS.

➡ FRONT OF THE PANEL

NOTES FOR HVAC :–

A. 1NO. 900mmx700mm WALL OPENING FOR INLET LOUVER BOTTOM OF OPENING SHALL BE 800mm ABOVE FFL.
B. 1NO. 600x600mm WALL OPENING FOR EXHAUST FAN BOTTOM OF OPENING SHALL BE 2500mm ABOVE FFL OR AT SUITABLE HEIGHT CLEARING WALL BEAM
C. 1NO. 700mmx700mm WALL OPENING FOR INLET LOUVER BOTTOM OF OPENING SHALL BE 800mm ABOVE FFL.
D. 2NOS. 500x500mm WALL OPENING FOR EXHAUST FAN BOTTOM OF OPENING SHALL BE 2500mm ABOVE FFL OR AT SUITABLE HEIGHT CLEARING WALL BEAM. THIS MAY ACCORDINGLY BE SHOWN IN ELEVATION DRAWING.
E. 3NOS. 300 DIA WALL OPENING FOR EXHAUST FAN BOTTOM OF OPENING AT 2400mm FROM FFL.
F. 1NO. 500mmx500mm WALL OPENING FOR SUPPLY AIR FAN BOTTOM OF OPENING SHALL BE 800mm ABOVE FFL.
G. 1NO. 500mmx500mm WALL OPENING FOR GRAVITY DAMPER BOTTOM OF OPENING SHALL BE 2400mm ABOVE MCC FFL.



KEY PLAN

LIST OF EQUIPMENTS

TAG NO	DESCRIPTION	SIZE / CAPACITY	MOC	QTY
		(RCC TANKS)		
S-01	Sewage Sump-01	5.0 m (L) X 5.0 m (W)X 4.5 m (D)	RCC	1
S-02	Sewage Sump-02	3.5 m (L) X 3.5 m (W)X 4.5 m (D)	RCC	1
S-03	Sewage Sump-03	4.5 m (L) X 4.5 m (W)X 4.5 m (D)	RCC	1
S-04	Sewage Sump-04	4.5 m (L) X 4.5 m (W)X 4.5 m (D)	RCC	1
CCS	Common Collection Sump	2.5 m (L) X 2.5 m (W)X 3.0 m (D)	RCC	1
SC	Screen Chamber	2.0 m (L) X 0.5 m (W)X 0.1 m (SWD) + 0.5 m FB	RCC	1
O&GT	Oil & Grease Trap	2.0 m (L) X 1.5 m (W)X 1.6 m (SWD) + 0.6 m FB	RCC	1
EQT	Equalization tank	3.6 m (L) X 3.6 m (W)X 2.5 m (SWD) + 0.7 m FB	RCC	1
HCC/FFT	HYPO CONTACT CUM FILTER FEED TANK	2.2 m (L) X 2.2 m (W)X 1.5 m (SWD) + 0.5 m FB	RCC	1
SHT	Sludge Holding Tank	2.0 m (L) X 2.0 m (W)X 1.5 m (SWD) + 0.5 m FB	RCC -coal tar epoxy screened lining	1
TWT	Treated Water tank	3.3 m (L) X 3.3 m (W)X 2.5 m (SWD) + 0.5 m FB	RCC	1
		(MSRL TANKS)		
MBBR	MBBR Aeration tank	2.7 m (Dia) X 4.5 m (SWD) + 0.5 m FB	MSRL	1
TST	Tube Settler Tank	1.8 m (L) X 1.8 m (W)X 2.25 m (SWD) + 0.5 m FB + 0.75 m hopper depth	MSRL	1
		(DOSING TANKS)		
DT-01	Hypo Dosing tank	0.475 m (Dia.) X 0.625 m (Ht.)	HDPE	1
DT-02	Hypo Dosing tank	0.475 m (Dia.) X 0.625 m (Ht.)	HDPE	1
DT-03	DWPE Dosing tank	0.91 m (Dia.) X 0.955 m (Ht.)	HDPE	1
OCT	Oil Collection tank	Capacity-25Ltrs	HDPE	1
		(FILTERS)		
DMF	Dual Media Filter	0.8 m Ø X 2.0 m HOS	FRP	1
ACF	Activated Carbon Filter	0.8 m Ø X 2.4 m HOS	FRP	1
		(PUMPS, DOSING PUMPS & BLOWERS)		
GRS01-AP001/AP002	Sewage Transfer pumps	Vertical submersible grinder type (CAP-8.0 m3/hr @5.9 kg/cm2)	CI-SS304	2 (1W+1S)
GRS02-AP001/AP002	Sewage Transfer pumps	Vertical submersible grinder type (CAP-8.0 m3/hr @ 7.5 kg/cm2)	CI-SS304	2 (1W+1S)
GRS03-AP001/AP002	Sewage Transfer pumps	Vertical submersible grinder type (CAP-8.0 m3/hr @ 4.5 kg/cm2)	CI-SS304	2 (1W+1S)
GRS04-AP001/AP002	Sewage Transfer pumps	Vertical submersible grinder type (CAP-8.0 m3/hr @ 4.5 kg/cm2)	CI-SS304	2 (1W+1S)
GRS05-AP001/AP002	Common Collection Sump Pumps	Non-clog pumps ,Submersible grinder type (CAP-4.0 m3/hr @ 1.2 kg/cm2)	CI-SS304	2 (1W+1S)
GRS06-AP001/AP002	MBBR Feed Pumps	Vertical submersible grinder type (CAP-4.0 m3/hr @ 1.2 kg/cm2)	CI-SS304	2 (1W+1S)
GRS08-AP001 / GRS09-AP001	Filter Feed Pumps	Horizontal Centrifugal (CAP-4.0 m3/hr @ 3.5 kg/cm2)	CI-CF8M	2 (1W+1S)
GRS12-AP001 / GRS13-AP001	Treated Water disposal pumps	Horizontal Centrifugal (CAP-4.0 m3/hr @ 2.0 kg/cm2)	CI-CF8M	2 (1W+1S)
GRS15-AP001/AP002	Sludge transfer pumps	Vertical Screw Pumps (CAP-2.0 m3/hr @ 2.9 kg/cm2)	2% Ni-CI -SS316-Nitrile/EPDM	2 (1W+1S)
DP-01	Hypo Dosing pumps for HCC/FFT	(CAP- 0-6 ltr/hr @ 2.0 kg/cm2)	PP	1
DP-02	Hypo Dosing pumps for CF	(CAP- 0-4 ltr/hr @ 4.5 kg/cm2)	PP	1
DP-03	DWPE Dosing pumps for CF	(CAP- 0-25 ltr/hr @ 4.5 kg/cm2)	PP	1
GRC01AN001 / 002	Air Blowers for Common Collection sump, EQT & ST	(CAP-50 m3/hr@ 0.4 kg/cm2)	CI	2 (1W+1S)
GRC02AN001 / 002	Air Blowers for MBBR Aeration tank.	(CAP-40 m3/hr@ 0.5 kg/cm2)	CI	2 (1W+1S)
		(OTHERS)		
CF	Centrifuge	Decanter type (CAP - 2 m3/hr)	MSEP-SS304	1
CS-01	Manual Coarse screen	0.925 m (L) X 0.5 m (W)	MSEP	1
CS-02	Manual Coarse screen	0.925 m (L) X 0.5 m (W)	MSEP	1
CS-03	Manual Coarse screen	0.925 m (L) X 0.5 m (W)	MSEP	1
CS-04	Manual Coarse screen	0.925 m (L) X 0.5 m (W)	MSEP	1
CS-05	Manual Coarse screen	1.160 m (L) X 0.5 m (W)	SS304 fitted with SS304 Frame	1
OS	Oil Skimmer Slotted Pipe type	Suitable for Tank Size	UPVC/CS	1
GRN01AM001	Agitator for hypo dosing tank for HCC/FFT	As per the mfgr data	SS316	1
GRN02AM001	Agitator for hypo dosing tank for CF	As per the mfgr data	SS316	1
GRN03AM001	Agitator for DWPE dosing tank for CF	As per the mfgr data	SS316	1
TROLLEY	TROLLEY	As per the mfgr data	MS	2

ISSUED FOR APPROVAL

PROJECT:		2 X 660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI.
TANGEDCO	OWNER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
DESEIN	OWNER'S CONSULTANT:	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
BHEL	EPC CONTRACTOR:	BHARAT HEAVY ELECTRICALS LIMITED. (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
	SUB CONTRACTOR :	PENNAR ENVIRO Re-engineering & Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad – 500 084

DEPT.	CODE	SCALE	WEIGHT (KG)	VENDOR DRAWING NO.	ITEM
– –	– –	1:50	–	A1–PEL–1037–EL–001	

TITLE: EQUIPMENT LAYOUT FOR SEWAGE TREATMENT PLANT (Inside Area)

	NAME	SIGN	DATE
PREP	ESN		03.05.2018
CHKD	AJP		03.05.2018
CHKD	SSY		03.05.2018
APPD	PAK		03.05.2018

REV	DATE	DESCRIPTION	MECH.	DRAWN	CHK.	ARCH.	ELEC.	C&I
1A	17.09.2018	REVISED AS PER CLIENT COMMETS, REVISED AS MARKED & RE–ISSUED FOR APPROVAL	PAK	ESN	SSY	RV	GSR	KP
1	16.07.2018	REVISED AS PER CLIENT COMMETS & RE–ISSUED FOR APPROVAL	PAK	ESN	SSY	RV	GSR	KP
0	03.05.2018	ISSUED FOR APPROVAL	PAK	ESN	SSY	RV	GSR	KP

DEPT.	CARD CODE	BHEL DRAWING NO.	REV
SIGN	–	PE–V0–412–673–A002	1A
DATE		NO. OF SHEETS – 1	

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV	DATE	ALTERED: 15.11.18	REV	DATE	ALTERED: 04.09.18
R2		CHECKED: 16.11.18	R1		CHECKED: 05.09.18

APPROVED

STATUS : CONTRACT

JOB NO.: 412

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

TAMILNADU GENERATION AND DISTRIBUTION CORP. LTD.(TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT,NOIDA

PENNAR ENVIRO
Re-engineering Water, Environment & Energy
Floor No. 3, DHFLVC Silicon Towers,
Kondapur, Madhapur Road,
Hyderabad - 500 084
www.pennarenviro.com

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

PROCESS DESIGN AND SIZING CALCULATION OF STP

	NAME	SIGN	DATE
PREP	KLNR		18.04.18
CHKD	GSK		18.04.18
APPD	HO		18.04.18

DEPT.							CARD CODE	DRAWING NO.	REV
SIGN			N.A.					PE-V0-412-673-A00-8	R2
DATE							129	NO. OF SHEETS 39 EXCLUDING COVER PAGE	

PENNAR ENVIRO Re-engineering Water, Environment & Energy				
Name of the Client		**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)**		
Name of the Contractor		**BHARAT HEAVY ELECTRICALS LIMITED**		
Name of the Consultant		**DESEIN PVT. LTD.**		
Name of the Vendor		**PENNAR ENVIRO LTD.**		
Name of the Project		**2X660 MW ENNORE SEZ STPP**		
Document Tiltle		**PROCESS DESIGN AND SIZING CALCULATION OF STP**		
BHEL Document No.		**PE-V0-412-673-A008**		
PEL Document No.		**PEL-12171037-PRO-PC-001**	**Date**	**16-11-2018**
PEL Job No		**12171037**	**Vendor Rev**	**R2**
	DESIGN PARAMETERS			**Rev**
	Effluent Characteristics			
	Parameter	**Value**	**Unit**	
		INLET		
	pH	7.0 to 8.0		
	BOD_5	300	MG/L	
	COD	600	MG/L	
	Oil & Grease	<50	MG/L	
	Total Suspended Solids	300	MG/L	
	NH4-N	--	MG/L	R1
	N-total	--	MG/L	R1
	Coliform	10^6-10^7	MPN/1000ml	
	Temperature	Ambient	℃	
		OUTLET		
	pH	6.5 to 8.0		R1
	BOD_5	≤10	MG/L	
	COD	≤100	MG/L	R1
	Oil & Grease	10-20	MG/L	R1
	Total Suspended Solids	≤20	MG/L	
	NH4-N	≤5	MG/L	
	N-total	≤10	MG/L	
	Coliform	<10^3	MPN/1000ml	
	Temperature	Ambient	℃	
	Design Basis			
	Operating Parameters			
	Total Flow, Q	75	M^3/D	
	Operating Hours	22	HR	
	Design flow, Q	3.41	M^3/HR	
	Design flow after recirculation of waste & centrate, Q(avg)	3.67	M^3/HR	
	Design Flow rate considered	4.00	M^3/HR	

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PEL Document No.		**PEL-12171037-PRO-PC-001**	**Date**	**16-11-2018**
PEL Job No		**12171037**	**Vendor Rev**	**R2**
	Peak Factor, PF	3		
	Peak Flow, Q(peak)	12.0	M³/HR	
	Design Calculation			
1	**SEWAGE SUMP (S-01)**			
	Tag. No.	S-01		
	Tank Configuration	Vertical		
	Avg Design Flow	3.00	M³/HR	
	Storage capacity required	37.50	M³	
	Storage capacity provided	100.00	M³	
	Liquid Depth Considered	4.00	M	
	Area	25.00	M²	
	Length	5.00	M	
	Length provided	5.00	M	
	Width required	5.00	M	
	Width provided	5.00	M	
	Dimensions of Tank			
	Length	**5.0**	M	
	Breadth	**5.0**	M	
	Total Depth	**4.5**	M	
2	**SEWAGE TRANSFER PUMPS(P-01)**			
	Tag. No.	GRS-01-AP-001/002		R1
	Pump Configuration	Vertical Submersible grinder type		
	Flow rate required	3.0	M³/HR	
	Flow rate provided	8.0	M³/HR	
	Head required	3.3	KG/CM²	R2
	Margin	10.0	%	
	Selected Head	3.7	KG/CM²	R2
	Head Provided	4.0	KG/CM²	R2
	Quantity	2(1W+1S)	NOS.	
3	**SEWAGE SUMP(S-02)**			

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Name of the Consultant		**DESEIN PVT. LTD.**		
Name of the Vendor		**PENNAR ENVIRO LTD.**		
Name of the Project		**2X660 MW ENNORE SEZ STPP**		
Document Tiltle		**PROCESS DESIGN AND SIZING CALCULATION OF STP**		
BHEL Document No.		**PE-V0-412-673-A008**		
PEL Document No.		**PEL-12171037-PRO-PC-001**	**Date**	**16-11-2018**
PEL Job No		**12171037**	**Vendor Rev**	**R2**
	Tag. No.	S-02		
	Tank Configuration	Vertical		
	Avg Design Flow	3.00	M³/HR	
	Storage capacity required	18.375	M³	
	Storage capacity provided	49.00	M³	
	Liquid Depth Considered	4.00	M	
	Area	12.25	M²	
	Legnth	3.50	M	
	Length provided	3.50	M	
	Width required	3.50	M	
	Width provided	3.50	M	
	Dimensions of Tank			
	Length	**3.5**	M	
	Breadth	**3.5**	M	
	Total Depth	**4.5**	M	
4	**SEWAGE TRANSFER PUMPS(P-02)**			
	Tag. No.	GRS-02-AP-001/002		R1
	Pump Configuration	Vertical Submersible grinder type		
	Flow rate required	3.0	M³/HR	
	Flow rate provided	8.0	M³/HR	
	Head required	4.1	KG/CM²	R2
	Margin	10.0	%	
	Selected Head	4.6	KG/CM²	R2
	Head Provided	4.9	KG/CM²	R2
	Quantity	2(1W+1S)	NOS.	
5	**SEWAGE SUMP (S-03)**			
	Tag. No.	S-03		
	Tank Configuration	Vertical		
	Avg Design Flow	3.00	M³/HR	
	Storage capacity required	40.50	M³	

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Name of the Consultant		**DESEIN PVT. LTD.**		
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Name of the Project		**2X660 MW ENNORE SEZ STPP**		
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BHEL Document No.		**PE-V0-412-673-A008**		
PEL Document No.		**PEL-12171037-PRO-PC-001**	**Date**	**16-11-2018**
PEL Job No		**12171037**	**Vendor Rev**	**R2**
	Storage capacity provided	101.25	M³	
	Liquid Depth Considered	5.00	M	
	Area	20.25	M²	
	Legnth	4.50	M	
	Length provided	4.50	M	
	Width required	4.50	M	
	Width provided	4.50	M	
	Dimensions of Tank			
	Length	**4.5**	M	
	Breadth	**4.5**	M	
	Total Depth	**5.0**	M	
6	**SEWAGE TRANSFER PUMPS (P-03)**			
	Tag. No.	GRS-03-AP-001/002		R1
	Pump Configuration	Vertical Submersible grinder type		
	Flow rate required	3.0	M³/HR	
	Flow rate Provided	8.0	M³/HR	
	Head required	2.6	KG/CM²	R2
	Margin	10.0	%	
	Selected Head	2.9	KG/CM²	R2
	Head Provided	3.3	KG/CM²	R2
	Quantity	2(1W+1S)	NOS.	
7	**SEWAGE SUMP (S-04)**			
	Tag. No.	S-04		
	Tank Configuration	Vertical		
	Storage capacity required	40.50	M³	
	Storage capacity provided	101.25	M³	
	Liquid Depth Considered	5.00	M	
	Area	20.25	M²	
	Legnth	4.50	M	
	Length provided	4.50	M	

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PEL Job No		**12171037**	**Vendor Rev**	**R2**
	Width required	4.50	M	
	Width provided	4.50	M	
	Dimensions of Tank			
	Length	**4.5**	M	
	Breadth	**4.5**	M	
	Total Depth	**5.0**	M	
8	**SEWAGE TRANSFER PUMPS (P-04)**			
	Tag. No.	GRS-04-AP-001/002		R1
	Pump Configuration	Vertical Submersible grinder type		
	Flow rate required	3.0	M^3/HR	
	Flow rate provided	8.0	M^3/HR	
	Head required	2.6	KG/CM^2	R2
	Margin	10.0	%	
	Selected Head	2.9	KG/CM^2	R2
	Head Provided	3.3	KG/CM^2	R2
	Quantity	2(1W+1S)	NOS.	
9	**COMMON COLLECTION SUMP**			
	Tag. No.	CCS		
	Tank Configuration	Vertical		
	Design Flow	3.41	M^3/HR	
	Design Flow rate considered	4.00	M^3/HR	
	Storage capacity required	10.00	M^3	
	Storage capacity provided	15.00	M^3	
	Liquid Depth Considered	1.60	M	
	Area	6.25	M^2	
	Legnth required	2.50	M	
	Length provided	2.50	M	
	Width required	2.50	M	
	Width provided	2.50	M	
	Dimensions of Tank			

PENNAR ENVIRO Re-engineering Water, Environment & Energy				
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Name of the Consultant		**DESEIN PVT. LTD.**		
Name of the Vendor		**PENNAR ENVIRO LTD.**		
Name of the Project		**2X660 MW ENNORE SEZ STPP**		
Document Tiltle		**PROCESS DESIGN AND SIZING CALCULATION OF STP**		
BHEL Document No.		**PE-V0-412-673-A008**		
PEL Document No.		**PEL-12171037-PRO-PC-001**	**Date**	**16-11-2018**
PEL Job No		**12171037**	**Vendor Rev**	**R2**
	Length	**2.5**	M	
	Breadth	**2.5**	M	
	Total Depth	**3.00**	M	
	Air Requirement			
	Air supply rate (0.60-1.0 m3/m3/hr)	0.9	$M^3/M^3/HR$	R1
	Air required (ASR x Volume of tank)	0.2	M^3/MIN	R1
	Air required for CC Sump	13.5	M^3/HR	
	Flow per Diffusers(8-12)	10.0	M^3/HR/ DIFFUSER	
	No of diffisusers	1.35	NOS.	
	No of diffisusers offerd	2.0	NOS.	
10	**COMMON COLLECTION SUMP PUMP**			
	Tag. No.	GRS-05-AP-001/002		R1
	Pump Configuration	Submersible grinder type		
	Flow rate	4.0	M^3/HR	
	Head required	0.7	KG/CM^2	R2
	Margin	10.0	%	R2
	Selected Head	0.8	KG/CM^2	R2
	Head Provided	1.2	KG/CM^2	R2
	Quantity	2(1W+1S)	NOS.	
11	**SCREEN CHAMBER**			
	Tag. No.	SC		
	Screen Chamber Configuration	Vertical		
	No of Units (Manual)	1	NOS.	
	Working at a time	1	NOS.	
	Peak Design Flow	0.0033	M^3/SEC	
	Avg Flow	0.0011	M^3/SEC	
	Minium Self cleansing velocity (0.6-1.0)	0.60	M/SEC	
	C/s area required at average flow	0.0019	M^2	
	C/s area required at Peak flow	0.0056	M^2	

PENNAR ENVIRO Re-engineering Water, Environment & Energy				
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Name of the Consultant		**DESEIN PVT. LTD.**		
Name of the Vendor		**PENNAR ENVIRO LTD.**		
Name of the Project		**2X660 MW ENNORE SEZ STPP**		
Document Tiltle		**PROCESS DESIGN AND SIZING CALCULATION OF STP**		
BHEL Document No.		**PE-V0-412-673-A008**		
PEL Document No.		**PEL-12171037-PRO-PC-001**	**Date**	**16-11-2018**
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	Width of screen (Assumed)	0.3	M	
	Depth of Flow at average Flow	0.0062	M	
	Depth of Flow at Peak Flow	0.0185	M	
	Bar Spacing (10 mm)	0.01	M	
	Thickness of bars	5	MM	
	No of Bars	20.00	NOS.	
		20	NOS.	
	Flowing Section	0.0042	M^2	
	Velocity through Screen	0.7937	M/SEC	
	Angle of Inclination	60	°	
	Inclined height of the screen	0.021	M	
	Liquid Depth provided	0.10	M	
	Area of bars in contact with water	0.00185	M^2	
	CS Area of Channel	0.00741	M^2	
	Channel width required	0.4	M	
	Channel width provided	0.5	M	
	Dimensions of Unit			
	Length	**2.0**	M	
	Width	**0.5**	M	
	Liquid Depth	**0.1**	M	
	Free Board	**0.5**	M	
	Total Depth	**0.60**	M	
12	**OIL & GREASE TRAP**			
	Tag. No.	OGT		
	Tank Configuration	Vertical		
	No of Units	1	NOS.	
	Working at a time	1	NOS.	
	Peak Design Flow	0.0033	M^3/SEC	
	Avg Flow	0.0011	M^3/SEC	

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	Density of particle	0.80	GM/CC	
	Equivalent radius of particle(150 micron)	0.015	CM	
	Density of medium (water)	1.0	GM/CC	
	Viscosity of medium	0.0089	DYNE/CM^3	
	Gravity acceleration	981.00	CM/SEC^2	
	Rising velocity	3.97	M^3/HR-M^2	
	Rising velocity, V	4.00	M^3/HR-M^2	
	Area	3.00	M^2	
	Width (assumed)	1.30	M	
	Baffle Wall thickness	0.20	M	
	Width Provided	1.50	M	
	Calculated length	2.00	M	
	Length provided	2.00	M	
	HRT provided (5-20 Minutes)	20.00	MIN.	
	Volume	4.00	M^3	
	calculated SWD	1.54	M	
	Provided SWD	1.60	M	
	Over All Dimension			
	Length	**2.00**	M	
	Width	**1.50**	M	
	Liquid Depth	**1.60**	M	
	Free Board	**0.60**	M	
	Total Depth	**2.20**	M	
13	**EQUALISATION TANK**			
	Tag. No.	EQT		
	Tank Configuration	Vertical		
	Avg Design Flow	3.67	M^3/HR	
	Design Flow	4.00	M^3/HR	
	HRT at Average flow (8 hrs)	8.00	HR	
	Storage capacity required	32.00	M^3	

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	Liquid Depth (Assumed)	2.50	M	
	Area	12.80	M²	
	Legnth required	3.58	M	
	Length provided	3.60	M	
	Width required	3.58	M	
	Width provided	3.60	M	
	Dimensions of Tank			
	Length	**3.6**	M	
	Breadth	**3.6**	M	
	Liquid Depth	**2.5**	M	
	Free Board	**0.70**	M	
	Total Depth	**3.20**	M	
	Air Requirement			
	Air supply rate (0.60-1.0 m3/m3/hr)	0.9	M³/M³/HR	R1
	Air required (ASR x Volume of tank)	0.5	M³/MIN	R1
	Air required for EQ Tank	29.2	M³/HR	
	Flow per Diffusers(8-12)	10.0	M³/HR/ DIFFUSER	
	No of diffisusers	2.9	NOS.	
	No of diffisusers offerd	4.0	NOS.	
14	**MBBR FEED PUMP**			
	Tag. No.	GRS-06-AP-001/002		R1
	Tank Configuration	Vertical submerisible type		
	Flow rate	4.0	M³/HR	
	Head required	0.6	KG/CM²	R2
	Margin	10.0	%	R2
	Selected Head	0.7	KG/CM²	R2
	Head Provided	1.2	KG/CM²	R2
	Quantity	2(1W+1S)	NOS.	
15	**MBBR TANK**			

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BHEL Document No.		**PE-V0-412-673-A008**		
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PEL Job No		**12171037**	**Vendor Rev**	**R2**
	Tag. No.	MBBR		
	Tank Configuration	Vertical		
	Flowrate per day	80.7	M^3/D	
	Design Flow	88.0	M^3/D	
	No. of Streams	1.0	NOS.	
	Flowrate per day per stream	88.0	M^3/D	
	Total BOD load	26.4	KG/D	
	BOD loading rate on media(10 - 12)	11.0	GM BOD/M^2/D	R1
	Area of media required	2400.0	M^2	
	Bio film area/ Surface area of media	400.0	M^2/M^3	R1
	Volume of media required	6.0	M^3	
	Volume of media provided	6.0	M^3	
	Consider media filling as 25%	25.0	%	
	Therefore volume of aeration tank Required	24.0	M^3	
	Hydraulic retention time provided (Min 4 Hrs.)	7.04	HR	
	Organic/ BOD Loading rate (1-1.4)	1.10	KG BOD/M^3-D	R1
	Volume of aeration tank provided	24.0	M^3	
	No. of tanks to be provided	1.0	No.	
	MBBR tank			
	Volume of each compartment	24.0	M^3	
	Providing SWD as	4.50	M	
	Area Required	5.33	M^2	
	Diameter required	2.61	M	R1
	Diameter provided	2.7	M	R1
	Dimensions of unit			
	Diameter	**2.7**	M	R1
	Liquid Depth	**4.5**	M	
	Free Board	**0.5**	M	
	Total Depth	**5.0**	M	
	Air Requirement			
	Oxygen required per kg of BOD removed	1.20	KG	

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PEL Job No		**12171037**	**Vendor Rev**	**R2**
	Total BOD removed per day	26.40	KG/D	
	Total oxygen req.	31.68	KG/D	
	Standard oxygen transfer efficiency			
	efficiency (SOTE) for 4.5 m depth	27	%	
	Air density	1.2	KG/M³	
	% of oxygen in air	0.23		
	Conc. at saturation Cast	8.24		
	D.O in fresh water Ca	7.58		
	Alpha	0.65		
	Beta	0.95		
	D.O in wastewater Co	2		
	Temperature correction Kt	1.13		
	Blower capacity = (Tot. oxygen required* conc. at saturation)/ (SOTE *air density*Kt*% of oxygen in air *alpha(Ca * Beta - Co))			
	Air required per day is =	928.68	M³/D	
	Air required per hour is =	38.69	M³/HR	
	Flow per Diffusers(8-12)	10	M³/HR/DIFFUSER	
	No of diffisusers	3.9	NOS.	
	No of diffisusers offerd	4.00	NOS.	
	Air required at MBBR tank	38.69	M³/HR	
16	**BLOWER(COMMON FOR COMMON COLLECTION SUMP, EQULISATION TANK & SLUDGE SUMP)**			
	Tag. No.	GRC-01-AN-001/002		R1
	Tank Configuration	Twin lobe		
	Capacity required	48.06	M³/HR	
	Capacity provided	50	M³/HR	
	Head required	0.4	KG/CM²	
	Quantity	2(1W+1S)	NOS.	
17	**BLOWER(MBBR TANK)**			
	Tag. No.	GRC-02-AN-001/002		R1
	Tank Configuration	Twin lobe		

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	Capacity required	38.69	M^3/HR	
	Capacity provided	40	M^3/HR	
	Head required	0.5	KG/CM^2	
	Quantity	2(1W+1S)	NOS.	
17	**SECONDARY SETTLING TANK(TUBE SETTLER TANK)**			
	Tag. No.	TST		
	Tank Configuration	Vertical		
	Design Flow	3.7	M^3/HR	
	Design Flow	4.0	M^3/HR	
	Height of tube settler considered	0.75	M	
	Area Available in TubePac	11	M^2/M^3	
	Angle of Inclination	60.0	o	
	Side Correction for Tube Pack	0.43	M	
	Settling Velocity	0.4	M^3/HR-M^2	
	Factor of safety(0.6-0.8)	0.6		
	Plan Area Available per Cu.m of Tube Pac @ 0.75m depth	16.67	M^2	
	Volume of TubePac required	1.52	M^3	
	Plan Area required for TubePac	2.0	M^2	
	Caluculated Surface Loading rate	1.8	M^3/HR-M^2	
	Design Surface Loading rate	2.00	M^3/HR-M^2	
	Area of Tube settler	1.84	M^2	
	Length required	1.8	M	
	calculated width	1.0	M	
	Correction for angle	0.43	M	
	Inlet baffle	0.30	M	
	Width required	1.75	M	
	width provided	1.80	M	
	Inclined Height	0.87	M	
	Volume of TubePac Required	1.6	M^3	
	Water Depth above tubes	0.50	M	

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	Water below tubes	1.00	M	
	Side water depth	2.25	M	
	Free board	0.50	M	
	Tank depth(excl. hopper)	2.75	M	
	No. of Hoppers per Settling tank	1	NOS.	
	Hopper bottom Slope	43	o	R1
	Hopper depth required	0.75	M	R1
	Dimensions of Tube Settler provided			
	Liquid Depth	**2.25**	M	
	Length	**1.8**	M	
	Breadth	**1.8**	M	
	Free Board	**0.50**	M	
	Total Depth	**2.75**	M	
	Hopper depth	**0.75**	M	R1
	Tube settler Media required	**1.6**	M^3	
18	**HYPO CONTACTTANK / FILTER FEED TANK**			
	Tag. No.	HCT/FFT		
	Tank Configuration	Vertical		
	Avg Design Flow	3.5	M^3/HR	
	Theoretical Detetion time = Operating Volume/Flowrate	60.00	MIN.	
	Contact Time = Theoretical Detetion time x Baffle Factor	18.00	MIN.	
	Storage capacity required	1.06	M^3	
	Storage capacity provided	7.0	M^3	
	Liquid Depth considered	1.50	M	
	Area	4.70	M^2	
	Legnth	2.17	M	
	Length provided	2.20	M	
	Width required	2.17	M	
	Width provided	2.20	M	

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	Dimensions of Tank			
	Length	**2.2**	M	
	Breadth	**2.2**	M	
	Liquid Depth	**1.5**	M	
	Free Board	**0.50**	M	
	Total Depth	**2.00**	M	
19	**HYPOCHLORITE DOSING TANK**			
	Tag. No.	DT-01		
	Tank Configuration	Vertical cylindrical		
	Influent Flow Rate	3.52	M^3/HR	
	Dosage in PPM	2	PPM	
	Hypo Consumption	0.01	KG/HR	
	Hypo Solution Strength	8.0%	W/V	
	Hypo Consumption	0.088	LPH	
	Retention time	24	HR	
	Capacity required	2.115	LTR.	
	Capacity provided	100.0	LTR.	
	Dimensions provided	As per manufacturer std		
	QTY	1	NOS.	
20	**HYPOCHLORITE DOSING PUMP**			
	Tag. No.	DP-01		
	Pump Configuration	Electronic Metering		
	Hypo Consumption	0.09	LPH	
	Hypo Dosing pump Capacity provided	0 - 6	LPH	
	Pump Head	20	MWC	
	QTY	1	NOS.	
21	**FILTER FEED PUMP**			
	Tag. No.	GRS-08/09-AP-001		R1
	Tank Configuration	Horizontal Centrifugal type		

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	Flow rate	4.0	M^3/HR	
	Head required	2.9	KG/CM^2	R2
	Margin	10.0	%	R2
	Selected Head	3.2	KG/CM^2	R2
	Head Provided	3.5	KG/CM^2	R2
	Quantity	2(1W+1S)	NOS.	
22	**DUAL MEDIA FILTER**			
	Tag. No.	DMF		
	Type	Downflow Vertical		
	Avg. Design Flow	3.5	M^3/HR	
	No of Working units	1.0		
	Flow through unit	3.5	M^3/HR	
	Filtration Rate max	10.0	M^3/HR-M^2	
	Area of each unit Required	0.4	M^2	
	Dia of filter required	0.67	M	
	Dia of filter provided	0.80	M	
	Height of media	1.0	M	
	Free Board required (100%)	1.0		
	Height Calculated	2.0	M	
	Height Provided	2.0	M	
	Backwash Design for DMF			R1
	Back Wash Water Rate	22	M^3/HR-M^2	R1
	Back Wash Water Flow Required	7.8	M^3/HR	R1
	Wash Water Duration	10	MIN	R1
	Wash Water Quantity	1.29	M^3	R1
	Rinse water Duration	5	MIN	R1
	Rinse Water Quantity	0.29	M^3	R1
	Total Back wash water per day	1.59	M^3	R1
	Backwash Pump Capacity	8.0	M^3/HR	R1
	Dimensions of DMF			

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	DIA	**0.8**	M	
	HOS	**2.0**	M	
23	**ACTIVATED CARBON FILTER**			
	Tag. No.	ACF		
	Type	Downflow Vertical		
	Avg. Design Flow	3.5	M^3/HR	
	No of Working units	1.0		
	Flow through unit	3.5	M^3/HR	
	Filtration Rate max	12.0	$M^3/HR\text{-}M^2$	
	Area of each unit Required	0.3	M^2	
	Dia of filter required	0.61	M	
	Dia of filter provided	0.80	M	
	Height of media	1.2	M	
	Free Board required (100%)	1.0		
	Height Calculated	2.4	M	
	Height Provided	2.4	M	
	Backwash Design for ACF			R1
	Back Wash Water Rate	9	$M^3/HR\text{-}M^2$	R1
	Back Wash Water Flow Required	3.5	M^3/HR	R1
	Wash Water Duration	10.0	MIN	R1
	Wash Water Quantity	0.58	M^3	R1
	Rinse water Duration	5	MIN	R1
	Rinse Water Quantity	0.29	M^3	R1
	Total Back wash water per day	0.87	M^3	R1
	Dimensions of ACF			
	DIA	**0.8**	M	
	HOS	**2.4**	M	
24	**TREATED WATER TANK**			
	Tag. No.	TWT		
	Tank Configuration	Vertical		

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	Avg Design Flow	3.4	M³/HR	
	Detention time	8.0	HR	
	Storage capacity required	27.2	M³	
	Storage capacity provided	28.0	M³	
	Liquid Depth Considered	2.50	M	
	Area	10.9	M²	
	Legnth	3.30	M	
	Length provided	3.30	M	
	Width required	3.30	M	
	Width provided	3.30	M	
	Dimensions of Tank			
	Length	**3.3**	M	
	Breadth	**3.3**	M	
	Liquid Depth	**2.5**	M	
	Free Board	**0.50**	M	
	Total Depth	**3.00**	M	
25	**TREATED WATER DISPOSAL PUMP**			
	Tag. No.	GRS-12/13-AP-001		R1
	Pump Configuration	Horizontal Centrifugal type		
	Flow rate	4.0	M³/HR	
	Head required	1.6	KG/CM²	R2
	Margin	10.0	%	R2
	Selected Head	1.8	KG/CM²	R2
	Head Provided	2.0	KG/CM²	R2
	Quantity	2(1W+1S)	NOS.	
26	**SLUDGE SUMP**			
	Tag.No.	SS		
	Tank Configuration	Vertical		
	Influent Flow Rate	3.7	M3/HR	
	Inlet TSS	300	PPM	

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	Oulet TSS	20	PPM	
	Inlet BOD	300	PPM	
	Oulet BOD	20.0	PPM	
	Sludge Consistency	1	%	
	Sludge density (Approx)	1020	KG/M3	
	Total Solid per Hr	1.5	KGS/HR	
	Total Solid per day	37	KGS/DAY	
	Total Sludge Flow per Hr	0.15	M3/HR	
	Strorage retention time/ compartment	24.0	hrs	
	Take capcaity requried	3.6	M^3	
	Tank Capacity Considered	4.0	M^3	
	Liquid depth provided	1.5	M	
	Freeboard provided	0.5	M	
	Area required	2.67	M2	
	Lengthrequired	1.63	M	
	Length offered	2.00	M	
	Width required	1.63	M	
	Width offered	2.00	M	
	Dimensions of Tank			
	Length	**2.0**	M	
	Breadth	**2.0**	M	
	Liquid Depth	**1.5**	M	
	Free Board	**0.50**	M	
	Total Depth	**2.00**	M	
	Air Requirement			
	Air mixing rate (60-90% of tank volume)	0.9	PER M^3	
	Air required	0.09	M^3/MIN	
	Air required for Sludge Sump	5.4	M^3/HR	
	Flow per Diffuser(8-12)	10.0	M^3/HR/ DIFFUSER	
	No of diffisusers	0.5	NOS.	

PENNAR ENVIRO Re-engineering Water, Environment & Energy				
Name of the Client		**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)**		
Name of the Contractor		**BHARAT HEAVY ELECTRICALS LIMITED**		
Name of the Consultant		**DESEIN PVT. LTD.**		
Name of the Vendor		**PENNAR ENVIRO LTD.**		
Name of the Project		**2X660 MW ENNORE SEZ STPP**		
Document Tiltle		**PROCESS DESIGN AND SIZING CALCULATION OF STP**		
BHEL Document No.		**PE-V0-412-673-A008**		
PEL Document No.		**PEL-12171037-PRO-PC-001**	**Date**	**16-11-2018**
PEL Job No		**12171037**	**Vendor Rev**	**R2**
	No of diffisusers offerd	2.0	NOS.	
27	**SLUDGE TRANSFER PUMP**			
	Tag. No.	GRS-15-AP-001/002		R1
	Pump Configuration	Vertical Screw type		
	Flow rate	2.0	M³/HR	
	Head required	2.4	KG/CM²	R2
	Margin	10.0	%	R2
	Selected Head	2.7	KG/CM²	R2
	Head Provided	3.0	KG/CM²	R2
	Quantity	2(1W+1S)	NOS.	
28	**HYPOCHLORITE DOSING TANK**			
	Tag. No.	DT-02		
	Tank Configuration	Vertical cylindrical		
	Influent Flow Rate	2.00	M³/HR	
	Dosage in PPM	2	PPM	
	Hypo Consumption	0.004	KG/HR	
	Hypo Solution Strength	8.0%	W/V	
	Hypo Consumption	0.050	LPH	
	Retention time	24	HR	
	Capacity required	1.200	LTR.	
	Capacity provided	100.0	LTR.	
	Dimensions provided	As per manufacturer std		
	QTY	1	NOS.	
29	**HYPOCHLORITE DOSING PUMP**			
	Tag. No.	DP-02		R1
	Pump Configuration	Electronic Metering		
	Hypo Consumption	0.05	LPH	
	Hypo Dosing pump Capacity provided	0 - 4	LPH	
	Pump Head	45	MWC	

PENNAR ENVIRO Re-engineering Water, Environment & Energy				
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Name of the Contractor		**BHARAT HEAVY ELECTRICALS LIMITED**		
Name of the Consultant		**DESEIN PVT. LTD.**		
Name of the Vendor		**PENNAR ENVIRO LTD.**		
Name of the Project		**2X660 MW ENNORE SEZ STPP**		
Document Tiltle		**PROCESS DESIGN AND SIZING CALCULATION OF STP**		
BHEL Document No.		**PE-V0-412-673-A008**		
PEL Document No.		**PEL-12171037-PRO-PC-001**	**Date**	**16-11-2018**
PEL Job No		**12171037**	**Vendor Rev**	**R2**
	QTY	1	NOS.	
30	**DWPE DOSING SYSTEM**			R1
	Tag. No.	DT-03		R1
	Tank Configuration	Vertical cyclindrical		R1
	Total Sludge Flow day	3.63	M3/D	R1
	Sludge Consistency	1	%	R1
	Sludge density (Approx)	1020	KG/M3	R1
	Moisture content in wet cake	20	%	R1
	Wet Cake	185.0	KG/D	R1
	Dosage required	2.0	KG/TON	R1
	DWPE Consumption required	0.4	KG/D	R1
	Polyelectrolyte concentration	0.1	%	R1
	Quantity of polyelectrolyte solution per day	369.95	LTR/D	R1
	Polyelectrolyte Tank Volume on per day basis	370.0	LTR	R1
	Polyelectrolyte Tank Volume provided	500.0	LTR	R1
	Dimensions provided	As per manufacturer std		R1
	QTY	1	NOS.	R1
31	**DWPE DOSING PUMP**			
	Tag. No.	DP-03		R1
	Pump Configuration	Electronic Metering		R1
	Dosing rate required in 16 hours	23.1	LPH	R1
	Polyelectrolyte Flow rate provided	0-25	LPH	R1
	Pump Head	45	MWC	R1
	QTY	1	NOS.	R1
32	**CENTRIFUGE**			
	Tag. No.	CF		R1
	Centrifuge Type	Decanter type		R1
	Capacity required (Considering 16 hours operation/ day)	0.2	M^3/HR	R1
	Capacity Recommended	0.5	M^3/HR	R1

PENNAR ENVIRO Re-engineering Water, Environment & Energy				
Name of the Client		**TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LIMITED (TANGEDCO)**		
Name of the Contractor		**BHARAT HEAVY ELECTRICALS LIMITED**		
Name of the Consultant		**DESEIN PVT. LTD.**		
Name of the Vendor		**PENNAR ENVIRO LTD.**		
Name of the Project		**2X660 MW ENNORE SEZ STPP**		
Document Tiltle		**PROCESS DESIGN AND SIZING CALCULATION OF STP**		
BHEL Document No.		**PE-V0-412-673-A008**		
PEL Document No.		**PEL-12171037-PRO-PC-001**	**Date**	**16-11-2018**
PEL Job No		**12171037**	**Vendor Rev**	**R2**
	Capacity Provided	2.0	M^3/HR	R1
	Quantity	1	NOS.	R1

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018

PRESSURE DROP CALCULATIONS FOR PUMP

GENERAL DATA :

Pump Designation:	Sewage Transfer pump (To Pump sewage from Sewage sump S1 to common collection sump
Tag No:	GRS-01-AP-001/002
Line MOC:	uPVC

CALCULATION:

William-Hazen Formula :-

$$hf = \frac{2.2126 \times 10^7 \times Q^{1.85}}{d^{4.8656}} \times \left(\frac{100}{C}\right)^{1.85}$$

Where,

hf = Frictional pressure drop (mWC) / 100m pipe

Q = Flow rate m³/hr

d = Pipe Inside Dia (mm)

C = Hazen-William roughness Coefficient

Value of C :- 1) For Unlined uPVC Pipe = 140

1) Sewage Transfer Pump GRS-01-AP-001/002 Discharge To Common collection sump - 50 NB uPVC Pipe

Q = Flow rate m³/hr	8
d = Pipe Inside Dia (mm)	51.8
C = Hazen-William roughness Coefficient	140
h_f = Frictional pressure drop (mWC) / 100m pipe	2.54
Staright Pipe Length (m)	840
Equivalent Length Of fittings (m)	51.4
Total Length Considering pipe & Fittings(m).	891.40
Frictional Pressure Loss in mtr.	22.60
Pressure Drop across NRV (m)(1 Nos)	0.200
Total Frictional Pressure Loss in mtr.	22.800

Detail Description of Equivalent Length:

		Equivalent Length/fitting. (m)	Qty. (No.s)
1	90° Elbow	1.5	30
2	45° Elbow	0.85	4
3	Equal Tee	3	1
	Total Equivalent Length of fittings (m)	**51.4**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018
DETAIL REPORT:			
1	Total Frictional Pressure Loss (m)	22.80	
2	Static Head Considered (m)	6.00	
3	Static Head From Pump Discharge to FGL(m)	4.50	
Pump Head Required as Per Calculation(m)		**33.30**	
Margin Provided 10 % (m)		**3.33**	
Final head required for pump considering 10% margin (m)		**36.63**	
Selected Pump Head (m)		**40.0**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018

PRESSURE DROP CALCULATIONS FOR PUMP

GENERAL DATA :

Pump Designation:	Sewage Transfer pump (To Pump sewage from Sewage sump S2 to common collection sump
Tag No:	GRS-02-AP-001/002
Line MOC:	uPVC

CALCULATION:

William-Hazen Formula :-

$$hf = \frac{2.2126 \times 10^7 \times Q^{1.85}}{d^{4.8656}} \times \left(\frac{100}{C}\right)^{1.85}$$

Where,

hf = Frictional pressure drop (mWC) / 100m pipe

Q = Flow rate m³/hr

d = Pipe Inside Dia (mm)

C = Hazen-William roughness Coefficient

Value of C :- 1) For uPVC Pipe = 140

1) Sewage Transfer Pump GRS-02-AP-001/002 Discharge To Common collection sump -50 NB uPVC Pipe

Q = Flow rate m³/hr	8
d = Pipe Inside Dia (mm)	51.8
C = Hazen-William roughness Coefficient	140
h_f = Frictional pressure drop (mWC) / 100m pipe	2.54
Staright Pipe Length (m)	1155
Equivalent Length Of fittings (m)	51.4
Total Length Considering pipe & Fittings(m).	1206.40
Frictional Pressure Loss in mtr.	30.59
Pressure Drop across NRV (m)(1 Nos)	0.200
Total Frictional Pressure Loss in mtr.	30.787

Detail Description of Equivalent Length:

		Equivalent Length/fitting. (m)	Qty. (No.s)
1	90° Elbow	1.5	30
2	45° Elbow	0.85	4
3	Equal Tee	3	1
	Total Equivalent Length of fittings (m)	**51.4**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018
DETAIL REPORT:			
1	Total Frictional Pressure Loss (m)	30.79	
2	Static Head Considered (m)	6.00	
3	Static Head From Pump Discharge Flange to FGL(m)	4.50	
Pump Head Required as Per Calculation(m)		**41.29**	
Margin Provided 10 % (m)		**4.13**	
Final head required for pump considering 10% margin (m)		**45.42**	
Selected Pump Head (m)		**49.0**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018

PRESSURE DROP CALCULATIONS FOR PUMP

GENERAL DATA :

Pump Designation:	Sewage Transfer pump (To Pump sewage from Sewage sump S3 to common collection sump
Tag No:	GRS-03-AP-001/002
Line MOC:	uPVC

CALCULATION:

William-Hazen Formula :-

$$hf = \frac{2.2126 \times 10^7 \times Q^{1.85}}{d^{4.8656}} \times \left(\frac{100}{C}\right)^{1.85}$$

Where,

hf = Frictional pressure drop (mWC) / 100m pipe

Q = Flow rate m³/hr

d = Pipe Inside Dia (mm)

C = Hazen-William roughness Coefficient

Value of C :- 1) For uPVC Pipe = 140

1) Sewage Transfer Pump GRS-03-AP-001/002 Discharge To Common collection sump -50 NB uPVC Pipe

Q = Flow rate m³/hr	8
d = Pipe Inside Dia (mm)	51.8
C = Hazen-William roughness Coefficient	140
h_f = Frictional pressure drop (mWC) / 100m pipe	2.54
Staright Pipe Length (m)	577.5
Equivalent Length Of fittings (m)	43.9
Total Length Considering pipe & Fittings(m).	621.40
Frictional Pressure Loss in mtr.	15.75
Pressure Drop across NRV (m)(1 Nos)	0.200
Total Frictional Pressure Loss in mtr.	15.955

Detail Description of Equivalent Length:

		Equivalent Length/fitting. (m)	Qty. (No.s)
1	90° Elbow	1.5	25
2	45° Elbow	0.85	4
3	Equal Tee	3	1
	Total Equivalent Length of fittings (m)	**43.9**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018
DETAIL REPORT:			
1	Total Frictional Pressure Loss (m)	15.95	
2	Static Head Considered (m)	6.00	
3	Static Head From Pump Discharge Flange to FGL(m)	4.50	
Pump Head Required as Per Calculation(m)		**26.45**	
Margin Provided 10 % (m)		**2.65**	
Final head required for pump considering 10% margin (m)		**29.10**	
Selected Pump Head (m)		**33.0**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018

PRESSURE DROP CALCULATIONS FOR PUMP

GENERAL DATA :

Pump Designation:	Sewage Transfer pump (To Pump sewage from Sewage sump S4 to common collection sump
Tag No:	GRS-04-AP-001/002
Line MOC:	uPVC

CALCULATION:

William-Hazen Formula :-

$$hf = \frac{2.2126 \times 10^7 \times Q^{1.85}}{d^{4.8656}} \times \left(\frac{100}{C}\right)^{1.85}$$

Where,

hf = Frictional pressure drop (mWC) / 100m pipe

Q = Flow rate m³/hr

d = Pipe Inside Dia (mm)

C = Hazen-William roughness Coefficient

Value of C :- 1) For uPVC Pipe = 140

1) Sewage Transfer Pump GRS-04-AP-001/002 Discharge To Common collection sump -50 NB uPVC Pipe

Q = Flow rate m³/hr	8
d = Pipe Inside Dia (mm)	51.8
C = Hazen-William roughness Coefficient	140
h_f = Frictional pressure drop (mWC) / 100m pipe	2.54
Staright Pipe Length (m)	577.5
Equivalent Length Of fittings (m)	48.4
Total Length Considering pipe & Fittings(m).	625.90
Frictional Pressure Loss in mtr.	15.87
Pressure Drop across NRV (m)(1 Nos)	0.200
Total Frictional Pressure Loss in mtr.	16.069

Detail Description of Equivalent Length:

		Equivalent Length/fitting. (m)	Qty. (No.s)
1	90° Elbow	1.5	28
2	45° Elbow	0.85	4
3	Equal Tee	3	1
	Total Equivalent Length of fittings (m)	**48.4**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018
DETAIL REPORT:			
1	Total Frictional Pressure Loss (m)	16.07	
2	Static Head Considered (m)	6.00	
3	Static Head From Pump Discharge Flange to FGL(m)	4.50	
Pump Head Required as Per Calculation(m)		**26.57**	
Margin Provided 10 % (m)		**2.66**	
Final head required for pump considering 10% margin (m)		**29.23**	
Selected Pump Head (m)		**33.0**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018

PRESSURE DROP CALCULATIONS FOR PUMP

GENERAL DATA :

Pump Designation:	Common collection sump pump (To Pump Sewage from common collection tank to Screen Chamber)
Tag No:	GRS-05-AP-001/002
Line MOC:	uPVC

CALCULATION:

William-Hazen Formula :-

$$hf = \frac{2.2126 \times 10^7 \times Q^{1.85}}{d^{4.8656}} \times \left(\frac{100}{C}\right)^{1.85}$$

Where,

hf = Frictional pressure drop (mWC) / 100m pipe

Q = Flow rate m^3/hr

d = Pipe Inside Dia (mm)

C = Hazen-William roughness Coefficient

Value of C :- 1) For uPVC Pipe = 140

1) Common collection sump Pump GRS-05-AP-001/002 Discharge To to Screen Chamber - 50NB uPVC Pipe

Q = Flow rate m^3/hr	4
d = Pipe Inside Dia (mm)	51.8
C = Hazen-William roughness Coefficient	140
h_f = Frictional pressure drop (mWC) / 100m pipe	0.70
Staright Pipe Length (m)	15
Equivalent Length Of fittings (m)	12
Total Length Considering pipe & Fittings(m).	27.00
Frictional Pressure Loss in mtr.	0.19
Pressure Drop across NRV (m)(1 Nos)	0.200
Total Frictional Pressure Loss in mtr.	0.390

Detail Description of Equivalent Length:

		Equivalent Length/fitting. (m)	Qty. (No.s)
1	90° Elbow	1.5	6
2	45° Elbow	0.85	0
3	Equal Tee	3	1
	Total Equivalent Length of fittings (m)	**12**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018
DETAIL REPORT:			
1	Total Frictional Pressure Loss (m)	0.39	
2	Static Head Considered (m)	6.50	
Pump Head Required as Per Calculation(m)		**6.89**	
Margin Provided 10 % (m)		**0.69**	
Final head required for pump considering 10% margin (m)		**7.58**	
Selected Pump Head (m)		**12.0**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

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Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018

PRESSURE DROP CALCULATIONS FOR PUMP

GENERAL DATA :

Pump Designation:	MBBR Feed pump (To Pump Equalized Sewage from Equalization tank to MBBR Aeration tank)
Tag No:	GRS-06-AP-001/002
Line MOC:	uPVC

CALCULATION:

William-Hazen Formula :-

$$hf = \frac{2.2126 \times 10^7 \times Q^{1.85}}{d^{4.8656}} \times \left(\frac{100}{C}\right)^{1.85}$$

Where,

hf = Frictional pressure drop (mWC) / 100m pipe

Q = Flow rate m^3/hr

d = Pipe Inside Dia (mm)

C = Hazen-William roughness Coefficient

Value of C :- 1) For uPVC Pipe = 140

1) MBBR Feed pump GRS-06-AP-001/002 Discharge To to MBBR Aeration Tank - 50 NB uPVC pipe

Q = Flow rate m^3/hr	4
d = Pipe Inside Dia (mm)	51.8
C = Hazen-William roughness Coefficient	140
h_f = Frictional pressure drop (mWC) / 100m pipe	0.70
Staright Pipe Length (m)	15
Equivalent Length Of fittings (m)	12
Total Length Considering pipe & Fittings(m).	27.00
Frictional Pressure Loss in mtr.	0.19
Pressure Drop across NRV (m)(1 Nos)	0.200
Total Frictional Pressure Loss in mtr.	0.390

Detail Description of Equivalent Length:

		Equivalent Length/fitting. (m)	Qty. (No.s)
1	90° Elbow	1.5	6
2	45° Elbow	0.85	0
3	Equal Tee	3	1
	Total Equivalent Length of fittings (m)	**12**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018
DETAIL REPORT:			
1	Total Frictional Pressure Loss (m)	0.39	
2	Static Head Considered (m)	5.50	
Pump Head Required as Per Calculation(m)		**5.89**	
Margin Provided 10 % (m)		**0.59**	
Final head required for pump considering 10% margin (m)		**6.48**	
Selected Pump Head (m)		**12.0**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018

PRESSURE DROP CALCULATIONS FOR PUMP

GENERAL DATA :

Pump Designation:	Filter Feed pump (To Pump chlorine contact water from Chlorine contact tank to Treated water tank through filters)
Tag No:	GRS-08/09-AP-001
Line MOC:	uPVC

CALCULATION:

William-Hazen Formula :-

$$hf = \frac{2.2126 \times 10^7 \times Q^{1.85}}{d^{4.8656}} \times \left(\frac{100}{C}\right)^{1.85}$$

Where,

hf = Frictional pressure drop (mWC) / 100m pipe

Q = Flow rate m³/hr

d = Pipe Inside Dia (mm)

C = Hazen-William roughness Coefficient

Value of C :- 1) For uPVC Pipe = 140

1) Filter Feed pump GRS-08/09-AP-001 Discharge To to Treated water Tank - 50 NB uPVC Pipe

Q = Flow rate m³/hr	4
d = Pipe Inside Dia (mm)	45.8
C = Hazen-William roughness Coefficient	140
h_f = Frictional pressure drop (mWC) / 100m pipe	1.28
Staright Pipe Length (m)	30
Equivalent Length Of fittings (m)	54
Total Length Considering pipe & Fittings(m).	84.00
Frictional Pressure Loss in mtr.	1.08
Pressure Drop across NRV (m)(1 Nos)	0.200
Pressure Drop across Diaphragm valve (m)(6 Nos)	1.320
Total Frictional Pressure Loss in mtr.	2.595

Detail Description of Equivalent Length:

		Equivalent Length/fitting. (m)	Qty. (No.s)
1	90° Elbow	1.5	20
2	45° Elbow	0.85	0
3	Equal Tee	3	8
	Total Equivalent Length of fittings (m)	**54**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018

DETAIL REPORT:

1	Total Frictional Pressure Loss (m)	2.60
2	Static Head Considered (m)	4.50
3	Pressure drop across DMF	8.00
4	Pressure drop across ACF	8.00
5	Pressure drop across Flow element (2 Nos)	4.00
6	Pressure drop across Media trap & carbon trap (1 No each)	2.00
Pump Head Required as Per Calculation(m)		**29.10**
Margin Provided 10 % (m)		**2.91**
Final head required for pump considering 10% margin (m)		**32.00**
Selected Pump Head (m)		**35.0**

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018

PRESSURE DROP CALCULATIONS FOR PUMP

GENERAL DATA :

Pump Designation:	Treated water disposal pump (To Pump treated water from Treated water tank to Gardening Area/Horticulture area which is approx 500 mtr away from STP)
Tag No:	GRS-12/13-AP-001
Line MOC:	uPVC

CALCULATION:

William-Hazen Formula :-

$$hf = \frac{2.2126 \times 10^7 \times Q^{1.85}}{d^{4.8656}} \times \left(\frac{100}{C}\right)^{1.85}$$

Where,

hf = Frictional pressure drop (mWC) / 100m pipe

Q = Flow rate m^3/hr

d = Pipe Inside Dia (mm)

C = Hazen-William roughness Coefficient

Value of C :- 1) For uPVC Pipe = 140

1) Treated water disposal Pump GRS-12/13-AP-001 Discharge To Gardening Area/Horticulture area - 50NB uPVC Pipe

Q = Flow rate m^3/hr	4
d = Pipe Inside Dia (mm)	45.8
C = Hazen-William roughness Coefficient	140
h_f = Frictional pressure drop (mWC) / 100m pipe	1.28
Staright Pipe Length (m)	525
Equivalent Length Of fittings (m)	51.4
Total Length Considering pipe & Fittings(m).	576.40
Frictional Pressure Loss in mtr.	7.38
Pressure Drop across NRV (m)(1 Nos)	0.200
Total Frictional Pressure Loss in mtr.	7.579

Detail Description of Equivalent Length:

		Equivalent Length/fitting. (m)	Qty. (No.s)
1	90° Elbow	1.5	30
2	45° Elbow	0.85	4
3	Equal Tee	3	1
	Total Equivalent Length of fittings (m)	**51.4**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018
DETAIL REPORT:			
1	Total Frictional Pressure Loss (m)	7.58	
2	Static Head Considered (m)	6.00	
3	Pressure drop across Flow element	2.00	
Pump Head Required as Per Calculation(m)		**15.58**	
Margin Provided 10 % (m)		**1.56**	
Final head required for pump considering 10% margin (m)		**17.14**	
Selected Pump Head (m)		**20.0**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018

PRESSURE DROP CALCULATIONS FOR PUMP

GENERAL DATA :

Pump Designation:	Sludge transfer pump(To Pump Sludge from Sludge holding tank to centrifuge)
Tag No:	GRS-15-AP-001/002
Line MOC:	uPVC

CALCULATION:

William-Hazen Formula :-

$$hf = \frac{2.2126 \times 10^7 \times Q^{1.85}}{d^{4.8656}} \times \left(\frac{100}{C}\right)^{1.85}$$

Where,

hf = Frictional pressure drop (mWC) / 100m pipe

Q = Flow rate m^3/hr

d = Pipe Inside Dia (mm)

C = Hazen-William roughness Coefficient

Value of C :- 1) For uPVC Pipe = 140

1) Sludge transfer pump P-09 A/B Discharge To to centrifuge - 25NB uPVC Pipe

Q = Flow rate m^3/hr	2
d = Pipe Inside Dia (mm)	26.6
C = Hazen-William roughness Coefficient	140
h_f = Frictional pressure drop (mWC) / 100m pipe	5.00
Staright Pipe Length (m)	20
Equivalent Length Of fittings (m)	19.8
Total Length Considering pipe & Fittings(m).	39.80
Frictional Pressure Loss in mtr.	1.99
Pressure Drop across NRV (m)(1 Nos)	0.200
Total Frictional Pressure Loss in mtr.	2.188

Detail Description of Equivalent Length:

		Equivalent Length/fitting. (m)	Qty. (No.s)
1	90° Elbow	1.37	10
2	45° Elbow	0.7	0
3	Equal Tee	3.05	2
	Total Equivalent Length of fittings (m)	**19.8**	

PENNAR ENVIRO
Re-engineering Water, Environment & Energy

Project:	2 x 660 MW ENNORE SEZ SUPER CRITICAL TTP		
Customer:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.		
Consultant:	DESEIN PVT.LTD , New Delhi		
EPC Contractor:	BHARAT HEAVY ELECTRICALS LTD		
Document no:	PE-V0-412-673-A008	Date:	16/11/2018
DETAIL REPORT:			
1	Total Frictional Pressure Loss (m)	2.19	
2	Static Head Considered (m)	7.00	
3	Head required at the centrifuge inlet (m)	15.00	
Pump Head Required as Per Calculation(m)		**24.19**	
Margin Provided 10 % (m)		**2.42**	
Final head required for pump considering 10% margin (m)		**26.61**	
Selected Pump Head (m)		**29.0**	

APPROVED

COMPLIANCE SHEET					
PROJECT: 1X800 MW SUPERCRITICAL THERMAL POWER PROJECT					
BHEL DOC NO: PE-V0-412-673-A020					
PEL DOC NO: PEL-12171037-PRO-CP-001					
DOC NAME: OPERATIONAL & CONTROL PHILOSPHY FOR STP					
[illegible]N[illegible]	**[illegible]AN[illegible]ENDCO[illegible]DE[illegible]E[illegible]N[illegible] C[illegible] D[illegible]16[illegible]11[illegible]01[illegible]**	**[illegible]EL[illegible]PEL[illegible]**	**[illegible]AN[illegible]ENDCO C[illegible] D[illegible]13[illegible]03[illegible]01[illegible]**	**[illegible]EL[illegible]PEL[illegible]**	**[illegible]AN[illegible]ENDCO C[illegible]**
1	Control Philosophy shall be updated as per comments on P&I Diagram for Sewage Treatment Plant, # PE-V0-412-673-A001, R01.	Noted & Incorporated	Noted.	Point Closed	
2	STP's different drives are accommodated in the different DDCMIS as per control scheme, Please note that document shall also be updated accordingly pertaining to respective DDCMIS	Noted. However please note that the control scope of different drives is clearly indicated in scheme as well as in IO cum drive list of STP. The same shall be taken care accordingly during DDCMIS implementation by EDN.	Please comply the comment.	Incorporated	
3	"Control System for Mechanical Auxiliary Packages, # PE-DM-412-145 I900" shall be included as a reference document in the design philosophy.	Noted & Incorporated	Noted.	Point Closed	
4	"Drive Control Philosophy, # PE-DM-412-145-I002" shall be included as a reference document in the design philosophy.	Noted & Incorporated	Noted.	Point Closed	
5	Please note that i. opening & closing of discharge MOV/SOV shall be interlocked with pump status (start or stop) and as well as with pump individual discharge pressure as per approved P&IDs. ii. Auto start of standby pump or blower shall also be interlocked with discharge pressure low in addition to tripping of main pump. iii. Standby Pump shall not start if the running pump trips because of low-low level. iv. Discharge pressure low shall also be included for Tripping of pump.	i. Please note that there is no MOV/SOV / Auto Valves envisaged at the discharge of pumps and all the valves are manual valves, so the same is not applicable. ii. Noted and same is already indicated in document. iii. Noted and same is already indicated in document. iv. Noted and same is already indicated in document.	i. Noted. Ii to iv. Comments are not incorporated in totality. Please mark the changes in the document.	Noted & Incorporated	
6			Control Philopshy shall be updated as per comments on "Control Scheme for Sewage Treatment plant, # PE-V0-412-673-A049, Rev 01".	Noted & Incorporated	

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV	DATE		REV	DATE		
R2		ALTERED: 23.08.19 CHECKED: 23.08.19	R1		ALTERED: 11.12.18 CHECKED: 11.12.18	

STATUS : CONTRACT

JOB NO.: 412

SEWAGE TREATMENT PLANT

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

TAMILNADU GENERATION AND DISTRIBUTION CORP. LTD.(TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT,NOIDA

PENNAR ENVIRO
Re-engineering Water, Environment & Energy
Floor No. 3, DHFLVC Silicon Towers,
Kondapur, Madhapur Road,
Hyderabad – 500 084
www.pennarenviro.com

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

OPERATION & CONTROL PHILOSOPHY -STP

	NAME	SIGN	DATE
PREP	GSK		16.04.18
CHKD	GSK		16.04.18
APPD	HO		16.04.18

DEPT.	CARD CODE	DRAWING NO.	REV
SIGN	–	PE-V0-412-673-A020	R2
DATE		NO. OF SHEETS 38 EXCLUDING COVER PAGE	

N.A.

OPERATIONAL & CONTROL PHILOSPHY

PROCESS DESCRIPTION

TREATMENT SCHEME

The treatment scheme of the Treatment plant shall be as below:

S. No	DESCRIPTION
1.	SEWAGE COLLECTION SYSTEM
2.	SCREEN CHAMBER
3.	OIL & GREASE TRAP
4.	EQUALIZATION TANK
5.	MBBR TANK
6.	TUBE SETTLER TANK(SECONDARY SETTLING)
7.	HYPO CONTACT TANK/FILTER FEED TANK
8.	DUAL MEDIA FILTER
9.	ACTIVATED CARBON FILTER
10.	TREATED WATER TANK
11.	SLUDGE HOLDING TANK
12.	CENTRIFUGE

A. Sewage Collection system.

The treatment units are Sewage sumps -01, 02, 03 & 04 and common collection sump at STP area.

B. Primary Treatment

The treatment units are bar screen, oil & grease trap and equalization tank.

C. Secondary Treatment

The treatment units are MBBR aeration tank and tube settler tank

D. Tertiary Treatment

The treatment units are Dual Media Filter and Activated carbon filter

E. Dewatering system

The treatment unit is centrifuge.

REFERNCE DOCUMENTS FOR OPERATIONAL & CONTROL PHILOSOPHY

F. Control System for Mechanical Auxiliary Packages

Doc. No.: PE-DM-412-145-I900

G. Drive Control Philosophy

Doc. No.: PE-DM-412-145-I002

A. Collection System

Sewage from various locations are collected in their area sewage sumps (S-01, 02, 03 & 04) and the collected sewage from sewage sumps is pumped using sewage transfer pumps(GRS01/02/03/04-AP001/002) to common collection sump (CCS) located at STP area.

There shall be 1 No. screen– coarse screen (CS-01, 02, 03 & 04) at the inlet of sewage sumps. Function of screen is to prevent entry of Solid particles into sewage sumps.

Sewage from common collection sump will be fed to Screen chamber using Common collection sump pumps (GRS05-AP001/002) provided at the common collection sump, pumps shall be as one working and one standby, hence if running pump gets tripped due to any damage, a standby pump can be started immediately and process does not get disturbed.

B. Primary Treatment

1. SCREEN CHAMBER (SC)

The first unit operation shall be Screen Chamber. The influent from common collection sump shall flow through screen chamber. There shall be 1 No. screen– coarse screen (CS-05) (10 mm opening). Function of screen is to prevent entry of Solid particles above certain size such as plastic cups, paper dishes, polyethylene bags, sanitary napkins etc. into STP. If these items are allowed to enter the STP they clog and damage the pumps and cause stoppage of plant. The screens shall be manually operated; hence screens will need to be cleaned periodically to prevent chocking of screen bar.

2. OIL & GREASE TRAP (OGT)

Following screen chamber the sewage shall be flowing to Oil & grease trap system. Here free floating oil and grease will be removed periodically by slotted pipe arrangement and waste oil & grease collected is disposed off.

3. EQUALIZATION TANK (EQT)

The wastewater from the bar screens, oil & grease trap comes to equalization tank; its main function is to act as buffer. To collect the incoming waste water that comes at widely fluctuating rates and pass it on to downstream units at steady (average) flow rate.

Effluent will be pumped at high flow rate for short period of time. The equalization tank stores this effluent and lets it out when there is no/ little incoming effluent. Due to constant flow rate, it is easier to design downstream units. In the equalization tank air shall be bubbled through a grid provided at the base of the tank for following.

a) To avoid development of anaerobic condition

b) To mix the contents of the tank and for homogenization.

c) To avoid solids from settling.

Sewage from Equalization tank will be fed to MBBR aeration tank using MBBR feed pumps (GRS06-AP001/002) provided at the Equalization tank, pumps shall be as one working and one standby, hence if running pump gets tripped due to any damage, a standby pump can be can be started immediately (manually or automatically, as per selected manual/auto mode) and process does not get disturbed.

C. Secondary Treatment

4. MOVING BED BIO REACTOR (MBBR)

Sewage from the Equalization tank (EQT) is subjected to MBBR tank for biological treatment. MBBR process uses aeration and mixing in waste water with small biofilm carrier elements to grow bacteria and treat waste water flows. Air is mechanically compressed and distributed to the aerobic reactor tank. Oxygen in the air diffuses into the thin biofilm that naturally grows on the biofilm carrier elements. The biofilm carrier moves at random throughout the aerobic reactor tank. As air passes through the water and past the media, the waste in the water acts as food for microbes growing on the moving media. The system reduces BOD, and COD.

The MBBR system has the following advantages over other biological systems:

a) Smaller foot print area

b) Ease in operation and maintenance

c) Operator skills required are minimal

d) System less susceptible to upset conditions (shock loading, power failure etc.)

e) Lower energy requirements

f) No clogging or chocking of the media.

5. TUBE SETTLER TANK (TST)

Following bio-chemical oxidation, the wastewater from the MBBR tank is taken to a tube-deck settling tank for solid-liquid separation. Effluent from MBBR tank will have settleable solids, which can be settled given the enough area for settling, Tubes are placed in to sedimentation tank at the upper portion, inclined vertically at 60 degree, and hence as the water enters in to the settling tank, and tubes will provide higher surface area for solids to settle faster than

conventional sedimentation tank. Sludge collected in the hopper bottom of the settling tank is withdrawn into a sludge holding tank.

6. HYPO CONTACT TANK/FILTER FEED TANK (HCT/FFT)

Overflow from the tube deck settling tank is subjected to tertiary treatment. Clarified water from tube settler will be collected in to Hypo contact tank/Filter feed tank (HCT/FFT). Where hypo chlorite will be dosed to kill the microbial organisms.

The treated water is disinfected to destroy and render harmless disease-causing organisms, such as bacteria and viruses, etc. hypo chlorite is provided to disinfect the water before filtration. Hypo available commercially 6-12% can be used for the purpose. Dedicated dosing system is provided with Hypo dosing tank, Dosing pumps and level switch for safety of dosing pumps etc.

The dosing rate is set as per the desired chlorine dosing rate typically 3-5 PPM. Hypo solution will be dosed in the Treated water tank.

7. HYPO DOSING SYSTEM (GRN-01)

Hypo dosing tank (DT-01) is provided for preparing / storing the Hypo solution. The prepared solution shall be dosed in treated water tank with the help of Hypo dosing pump (DP-01). The dosing tanks are provided with level transmitters for tripping the pump at low level in the dosing tanks.

D. Tertiary Treatment

8. DUAL MEDIA FILTER (DMF)

Clarified water from Treated water tank will be pumped to Dual media filter (DMF). Filter feed pumps (GRS08/09-AP001) provided with one as working and one as standby. Therefore, standby pump can be started any time if need be arise. Both the pumps will remain in working condition at time of backwashing of filter.

The waste water is pumped to a Dual media filter (DMF) for removal of particulate matter. It is used to trap the trace amount of solids which escaped from the tube settler (TST) and can handle suspended solids in economical manner. Dual media filter comprises of anthracite and sand media of different sizes, which works as media for TSS to get attached while in filtration process. This is a pressurized filter so that higher surface velocity can be used and area required for the filtration has been reduced. Dual media filter is FRP cylindrical vessel with frontal piping & valves and inlet distributer and lateral header is provided inside for proper filtration process. The filter will be backwashed at regular intervals or when DP goes beyond preset value in spite of regular operation. The accumulated suspended solids are backwashed and the backwash water is recycled back to the Common collection sump.

9. ACTIVATED CARBON FILTER (ACF)

Following DMF, the wastewater is passed through an activated carbon column for removal of trace organics and pollutants. It receives water that is already filtered by dual media filter and improves multiple quality parameters of the water: Color, odor and trace organics etc. ACF comprises of carbon media for adsorption of organic and other odors material, from inside it comprises of water distribution arrangement at top and lateral and header collection from bottom of the filter. ACF is also FRP vessel with frontal piping & valves. The filter will be

backwashed at regular intervals or when DP goes beyond preset value in spite of regular operation. The accumulated waste are backwashed and the backwash water is recycled back to the Common collection sump.

Activated carbon filter has finite capacity to absorb and hold the pollutant, after which the carbon is said to be exhausted. The exhausted material is removed from filter and disposed off: fresh activated carbon will need to be charged in the filter.

10. TREATED WATER TANK (TWT)

Filtered water from Activated carbon filter will be collected in to treated water tank.

Treated water pumps (GRS12/13-AP001) provided with one as working and one as standby to pump the treated water for gardening/horticulture purpose at regular intervals.

E. Dewatering Treatment

Biological treatment of wastewater produces excess biological solids due to the growth and multiplication of bacteria and other microorganisms in the system. The excess biomass thus produced needs to be bleed out of the system, and disposed off efficiently.

Sludge is removed from the Tube settler tank sludge outlet.

11. SLUDGE HOLDING TANK (SHT)

A sludge holding tank is provided to store biological sludge The sludge holding tank is kept under aeration (to prevent the living organisms from putrefying).

Sludge from sludge holding tank will be fed to centrifuge using sludge transfer pumps (GRS12/13-AP001) provided at the sludge holding tank, pumps shall be as one working and

one standby, hence if running pump gets tripped due to any damage, a standby pump can be started immediately and process does not get disturbed.

12. CENTRIFUGE(CF)

The mechanical dewatering units shall be centrifuge designed to recover solids of surplus or excess activated sludge to be wasted from biological treatment units. The filtrate is recycled back to the common collection sump for further treatment. The Dewatered sludge should be collected and disposed off by the client.

13. HYPO DOSING SYSTEM (GRN-02)

Hypo dosing tank (DT-02) is provided for preparing / storing the Hypo solution. The prepared solution shall be dosed at the sludge transfer pumps discharge header with the help of Hypo dosing pump (DP-02). The dosing tank is provided with level transmitters for tripping the dosing pump at low level in the dosing tanks.

14. DWPE DOSING SYSTEM (GRN-03)

Hypo dosing tank (DT-02) is provided for preparing / storing the De watering poly electrolyte solution. The prepared solution shall be dosed at the sludge transfer pumps discharge header with the help of DWPE dosing pump (DP-03). The dosing tank is provided with level switch for tripping the dosing pump at low level in the dosing tanks.

OPERATION AND CONTROL

The mode of operation & control of the STP is DDCMIS based semi-automatic.

COLLECTION SYSTEM

SEWAGE SUMP (S - 01/02/03/04)

The Sewage sumps are provided with the level transmitters (LT-GRS 01/02/03/04-CL 001/002), which will give alarm at low level. Level transmitter will trip the Sewage transfer pump (GRS 01/02/03/04-AP 001/002) in case of low level.

SEWAGE TRANSFER PUMP (GRS 01/02/03/04-AP 001/002)

Two nos. of the Sewage transfer pumps (1W+1S) for each sump, have been provided to transfer the raw sewage water from sewage sump to common collection sump.

Permissive of starting of pump:

- Sewage Sumps (S-01/02/03/04) level should be adequate.
- Electrical Disturbance f/b not available.
- Common Collection sump level should be not high.
- Manual valves V-102/04 & 106, V-108/10 & 112, V-114/116 & 118 and V-120/122 & 124 remain open.

Process trip indication will be generated at following condition:

- Electrical Disturbance f/b available.
- Emergency stop f/b available from LPBS
- Low level in low Level transmitter(LT-GRS 01/02/03/04-CL 001/002) (Interlock I1, I2, I3 & I4)
- Discharge pressure low in Sewage Transfer Pumps(GRS 01/02/03/04-AP 001/002) discharge header Pressure transmitter (PT-GRS 01/02/03/04 – CP 001/002)

The pumps will be provided with following selections

Auto / Manual

In manual mode of operation the pumps can be started from operator workstations.

In auto mode of operation pump selected will start when the permissive of pump is satisfied. Standby pump will start automatically if any one of the main pump trips due to pressure is detected low by the low pressure at the discharge or any electrical disturbance feedback.

Standby pump will not start automatically if any one of the running pump trips due to low level in the tank.

COMMON COLLECTION SUMP (CCS)

The Common collection sump is provided with air diffusers, where air is purged with the help of Air blower (GRC 01- AN 001/002). Common collection sump is provided with level transmitters (LT-GRS 05-CL 001/002), which will give alarm at low level. Level transmitter will trip the Sewage transfer pump (GRS 05-AP 001/002) in case of low level.

COMMON COLLECTION SUMP PUMPS (GRS 05-AP 001/002)

Two nos. of the Common collection sump pumps (1W+1S), have been provided to transfer the raw sewage water from common collection sump to Screen Chamber.

Permissive of starting of pump:

- Common collection sump (CCS) level should be adequate.
- Electrical Disturbance f/b not available.
- Manual valves V-126/28 & 130 remain open.

Process trip indication will be generated at following condition:

- Electrical Disturbance f/b available.

- Emergency stop f/b available from LPBS
- Low level in low Level transmitter(LT-GRS 05-CL 001/002) (Interlock I5)
- Discharge pressure low in Sewage transfer pumps(GRS 05-AP 001/002) discharge header Pressure transmitter (PT- GRS 05 –CP 001/002)

The pumps will be provided with following selections

Auto / Manual

In manual mode of operation the pumps can be started from operator workstations.

In auto mode of operation pump selected will start when the permissive of pump is satisfied.

Standby pump will start automatically if any one of the main pump trips due to pressure is detected low by the low pressure at the discharge or any electrical disturbance feedback.

Standby pump will not start automatically if any one of the running pump trips due to low level in the tank.

Note:
1. Control of Sewage transfer pump- GRS 01-AP 001/002 shall be implemented in CHP DDCMIS.
2. Control of Sewage transfer pump- GRS 02-AP 001/002 shall be implemented in CWPH DDCMIS.
3. Control of Sewage transfer pump- GRS 03-AP 001/002 shall be implemented in RODM DDCMIS.
4. Control of Sewage transfer pump- GRS 04-AP 001/002 shall be implemented in Main plant DDCMIS.

Further the control of complete STP (except the system indicated above in point 1 to 4) shall be implemented in DDCMIS panels placed in STP control room

PRIMARY TREATMENT

EQUALIZATION TANK (EQT):

The Equalization Tank is provided with air diffusers, where air is purged with the help of Air blower (GRC 01-AN 001/002). Equalization tank is provided with the level transmitters (LT-GRS 06-CL 001/002), which will give alarm low level at the DDCMIS. Level transmitters (LT- GRS 06-CL 001/002) will trip the MBBR feed pump (GRS 06 – AP 001/002) in case of low level.

AIR BLOWERS FOR CCS, EQT & SLUDGE SUMP (GRC 01-AN 001/002):

Two numbers of Air Blower (1W+1S) will be provided common for Common collection sump, Equalization Tank & Sludge Sump.

Permissive of starting of Blower:

- Common collection sump (GRS-05) level should be not low.
- Equalization tank (GRS-06) level should be not low.
- Sludge holding tank (GRS-15) level should be not low.
- Electrical Disturbance f/b not available.
- Manual valves V-139/142, V-143, V-145, V-146 and V-147 remain open.

Process trip indication will be generated at following condition:

- Electrical Disturbance f/b available.
- Emergency stop f/b available from LPBS
- Air Blower(GRC 01 –AN 001/002) outlet pressure low (PT –GRC 01-CP 001/002)
- Discharge pressure low in Air Blower (GRC 01 –AN 001/002) discharge header Pressure transmitter (PT –GRC 01-CP 001/002)

The Blowers will be provided with following selections

Auto / Manual

In manual mode of operation the Blowers can be started from operator workstations.

In auto mode of operation blowers selected will start when the permissive of blower is satisfied. Standby blower will start automatically if any one of the main blower trips due to pressure is detected low by the low pressure at the discharge or any electrical disturbance feedback.

MBBR FEED PUMP (GRS 06-AP 001/002):

Two nos. of the MBBR feed pumps (1W+1S), have been provided to transfer the sewage water from Equalization tank to MBBR aeration tank.

Permissive of starting of pump:

- Equalization tank (EQT) level should be adequate.
- Electrical Disturbance f/b not available.
- Hypo contact tank/Filter feed tank (GRS-07) level should be not high.
- Manual valves V-132/34 & V-136 remain open.

Process trip indication will be generated at following condition:

- Electrical Disturbance f/b available.
- Emergency stop f/b available from LPBS
- Low level in low Level transmitter (LT- GRS 06-CL 001/002) (Interlock I 6)
- Discharge pressure low in MBBR feed Pumps (GRS 06-AP 001/002) discharge header Pressure transmitter (PT- GRS 06-CP 001/002)

The pumps will be provided with following selections

Auto / Manual

In manual mode of operation the pumps can be started from operator workstations.

In auto mode of operation pump selected will start when the permissive of pump is satisfied. Standby pump will start automatically if any one of the main pump trips due to pressure is detected low by the low pressure at the discharge or any electrical disturbance feedback.

Standby pump will not start automatically if any one of the running pump trips due to low level in the tank.

SECONDARY TREATEMNT

AIR BLOWERS FOR MBBR AERATION TANK (GRC 02-AN 001/002)

Two numbers of Air Blower (1W+1S) will be provided for supply of air to MBBR Aeration Tank.

Permissive of starting of Blower:

- MBBR Aeration tank (MBBR) level should be not low.
- Electrical Disturbance f/b not available.
- Manual valves V-150,V153 & V-154 remain open

Process trip indication will be generated at following condition:

- Electrical Disturbance f/b available.
- Emergency stop f/b available from LPBS
- Discharge pressure low in Air Blower (GRC 02 –AN 001/002) discharge header Pressure transmitter (PT –GRC 02-CP 001/002)

The Blowers will be provided with following selections

Auto / Manual

In manual mode of operation the Blowers can be started from operator workstations.

In auto mode of operation blowers selected will start when the permissive of blower is satisfied. Standby blower will start automatically if any one of the main blower trips due to pressure is detected low by the low pressure at the discharge or any electrical disturbance feedback.

HYPO CONTACT TANK/ FILTER FEED TANK (HCT/FFT):

Hypo contact tank/ Filter feed tank will be provided with level transmitter (LT- GRS 07-CL001/002), which will give alarm low level at the DDCMIS and trip Filter feed pumps (GRS 08/09 – AP 001) in case of low level.

HYPO DOSING TANK (DT-01)

The preparation of the chemical is totally manual. Hypo dosing tank will be provided with level transmitters (LT-GRN 01-CL 001/002), which will give alarm of low level at the DDCMIS. Level transmitter (LT-GRN 01-CL 001/002) will trip Hypo dosing pump (DP-01) in case of low level.

HYPO DOSING PUMP (DP-01)

The pumps shall start automatically or with operator intervention and will be in continuous operation.

Permissive of starting of pump:

- Hypo dosing tank (DT-01) level should be not low.
- Hypo contact tank/Filter Feed Tank level should be not low.
- Electrical Disturbance f/b not available.

Process trip indication will be generated at following condition:

- Electrical Disturbance f/b available.
- Emergency stop f/b available from LPBS
- Low level in Level transmitter (LT - LT-GRN 01-CL 001/002)
- Discharge pressure low in Hypo Dosing pump(DP-01) discharge header Pressure transmitter (PT-GRN 01-CP 001/002)

The pumps will be provided with following selections

Auto / Manual

In manual mode of operation the Dosing pumps can be started from operator workstations.

In auto mode of operation dosing pump selected will start when the permissive of pump is satisfied. Standby dosing pump will start automatically if any one of the main pump trips due to pressure is detected low by the low pressure at the discharge or any electrical disturbance feedback.

Standby pump will not start automatically if any one of the running dosing pump trips due to low level in the dosing tank.

TERTIARY TREATEMNT

FILTER FEED PUMPS (GRS 08/09-AP 001):

Two nos. of the filter feed pumps (1W+1S), have been provided to transfer the clarified water from Hypo contact tank/ Filter feed tank to Dual Media filter.

Permissive of starting of pump:

- Hypo contact tank/ Filter feed tank (GRS 07) level should be adequate.
- Electrical Disturbance f/b not available.
- Treated water tank level should be not high.
- Manual valves V-157/59 & V-162/164 remain open.
- Pneumatic valve GRS10AA201, GRB01AA201, GRB01AA205, GRS10AA202, GRB02AA201 & GRB02AA205 remain open during service
- Pneumatic valve GRB01AA202, GRB01AA203, GRB02AA202 & GRB02AA203 remain open during back wash of DMF & ACF
- Pneumatic valve GRS10AA201, GRB01AA201, GRB01AA204, GRS10AA202, GRB02AA201 & GRB02AA204 remain open during rinse of DMF & ACF.

Process trip indication will be generated at following condition:

- Electrical Disturbance f/b available.
- Emergency stop f/b available from LPBS
- Low level in low Level transmitter (LT- GRS 07-CL 001/002) (Interlock I 7)
- Discharge pressure low in Filter feed pumps (GRS 08/09-AP 001/002) discharge header Pressure transmitter (PT- GRS 10-CP 001/002)
- High level in level transmitter (LT-GRS 11-CL 001/002) (Interlock I 18)

The pumps will be provided with following selections

Auto / Manual

In manual mode of operation the pumps can be started from operator workstations.

In auto mode of operation pump selected will start when the respective filters are put in service. Standby pump will start automatically if any one of the main pump trips due to pressure is detected low by the low pressure at the discharge or any electrical disturbance feedback.

Standby pump will not start automatically if any one of the running pump trips due to low level in the filter feed tank.

DUAL MEDIA FILTER (DMF):

Filter service run precondition:

- Respective valves GRS10AA201, GRB01AA201 and GRB01AA205 will remain open during service mode.
- Filter feed pump running (GRS 08/09 AP 001).

Filter service:

Open common inlet valve GRS10AA201, inlet valve GRB01AA201 and vent valve GRB01AA206 for 2-5 minutes to remove complete air from vessel. Then close vent valve GRB01AA206 and open rinse valves GRB01AA204 for 5 minutes to rinse the filter bed. After removal of air from vessel & rinsing the service inlet valve GRB01AA201 & GRB01AA205 will remain open during the service cycle with 3.5 m3/hour flow by flow transmitter (FT- GRS 10-CF 001) and flow indicator (FI- GRS 10-CF 501). In case of any stoppage of service run, timer shall not be reset.

Filter service termination:

Semiautomatic, initiation of backwashing at preset pressure drop (0.8 kg/cm^2) across the filter shown by differential pressure transmitter (DPT-GRB 01-CP 001/002) on the DDCMIS or once in 22 hours.

Filter backwashing:

Automatic operation of on/off pneumatic valves based on preset timing for each back wash steps for selected filter. Each filter to be backwashed once in 22 hours as per following details:

Filter backwashing precondition:

- Hypo contact tank/Filter feed tank level not low.
- Filter Feed Pump manual valves V-157, V-159, V-162 & V-164 remain open.
- Filter Feed pumps GRS 08 AP 001 & GRS 09 AP 001 should start during back wash
- DMF Inlet Valve GRS10AA201 remain open.
- DMF vent valve GRB01AA206 shall remain open during backwash step.

Air release & Water drain

By opening vent valve GRB01AA206 and backwash outlet valve GRB01AA203 for 2 – 5 minutes max. to bring down water level just above the media and to depressurize the vessel.

DMF vent valve GRB01AA206 shall remain open during backwash step.

Backwashing

By opening backwash outlet valve GRB01AA203 and backwash inlet valve GRB01AA202 at preset flow rate of 7.0 m3/hour for 10-20 minutes.

Water refill

By opening auto valves GRB01AA201 on inlet and vent valve GRB01AA206 for 5 - 10 minutes to remove the air from unit and filling it completely with water. Exact time to be set during commissioning.

Water rinse

By opening auto valve GRB01AA201 and GRB01AA204 for 5 minutes at a flow of 3.5 m3/hour.

The filter can be put back in service by following service sequence.

ACTIVATED CARBON FILTER (ACF)

Filter service run precondition:

- Respective valve GRS10AA202, GRB02AA201 and GRB02AA205 will remain open during service mode.
- Respective DMF valves GRS10AA201, GRB01AA201 and GRB01AA205 will remain open during service of ACF
- Filter feed pump running (GRS 08/09 AP 001).

Filter service:

Open common inlet valve GRS10AA202, inlet valve GRB02AA201 and vent valve GRB02AA206 for 2-5 minutes to remove complete air from vessel. Then close vent valve GRB02AA206 and open rinse valve GRB02AA204 for 5-10 minutes to rinse the filter bed. After removal of air from vessel & rinsing the service inlet valve GRB02AA201 & GRB02AA205 will remain open during the service cycle to give flow of 3.5 m3/hour measured by flow transmitter (FT- GRS 10-CF 002) and flow indicator (FI- GRS 10-CF 502). In case of any stoppage of service run, timer shall not be reset.

Filter service termination:

Remote initiation of backwashing at preset pressure drop (0.8 kg/cm^2) across the ACF through differential pressure transmitter (DPT-GRB 02-CP 001/002) on the DDCMIS or once in 22 hours.

Filter backwashing:

Automatic operation of on/off pneumatic valves based on preset timing for each back wash steps for selected filter. Each filter to be backwashed once in 22 hours as per following details:

Filter backwashing precondition:

- Hypo contact tank/Filter feed tank level not low.
- Filter Feed Pump manual valves V-157, V-159, V-162, V-164 remain open.
- Filter Feed pumps GRS 08 AP 001 & GRS 09 AP 001 should start during back wash
- ACF Inlet Valve GRS10AA202 remain open.
- ACF vent valve GRB02AA206 shall remain open during backwash step.
- DMF valves GRS10AA201, GRB01AA201 and GRB01AA205 will remain open during back wash of ACF.
- DMF Shall be back washed prior to ACF back wash operation.

Air release & Water drain:

By opening vent valve GRB02AA206 and backwash outlet valve GRB01AA206 for 2 – 5 minutes max. to bring down water level just above the media and to depressurize the vessel.

Backwashing

By opening backwash inlet valve GRB02AA202 and outlet valve GRB02AA203 to give flow of 3.0 m3/hour for 10-20 minutes.

ACF vent valve GRB02AA206 shall remain open during backwash step.

Water Fill

By opening auto valves GRB02AA201 on inlet and vent valve GRB02AA206 for 5 - 10 minutes to remove the air from unit and filling it completely with water. Exact time to be set during commissioning.

Water Rinse

By opening service inlet valve GRB02AA201 and drain valve GRB02AA204 at service flow rate for 5 minutes.

The filter can be put back in service by following service sequence.

TREATED WATER TANK (TWT)

Treated Water tank is provided with level transmitter (LT-GRS 11-CL 001/002), which will give alarm of high and low level at the DDCMIS. Level transmitter (LT-GRS 11-CL 001/002) will trip treated water transfer pump (GRS 12/13-AP 001) in case of low level and Filter feed pump (GRS 08/09-AP 001) will be tripped in case of high level.

TREATED WATER DISPOSAL PUMP (GRS 12/13-AP 001)

Two nos. of the treated water disposal pumps (1W+1S), have been provided to transfer the filtered water from treated water tank to gardening/horticulture.

Permissive of starting of pump:

- Treated water tank (TWT) level should be not low.
- Electrical Disturbance f/b not available.
- Manual valve V-203/205, V-208/210 & V-211 remain open

Process trip indication will be generated at following condition:

- Electrical Disturbance f/b available.
- Emergency stop f/b available from LPBS
- Low level in transmitter (LT-GRS 11-CL 001/002) (Interlock I 8)
- Discharge pressure low in Treated water disposal pumps (GRS 12/13-AP 001) discharge header Pressure transmitter (PT- GRS 14-CP 001/002)

The pumps will be provided with following selections

Auto / Manual

In manual mode of operation the pumps can be started from operator workstations.

In auto mode of operation pump selected will start when the start permissive is satisfied. Standby pump will start automatically if any one of the main pump trips due to pressure is detected low by the low pressure at the discharge or any electrical disturbance feedback.

Standby pump will not start automatically if any one of the running pump trips due to low level in the tank.

DEWATERING SYSTEM

SLUDGE HOLDING TANK (SHT)

Sludge holding tank is provided with level transmitter (LT-GRS 15-CL 001/002), which give alarm of high and low will level at the DDCMIS. Level transmitter (LT-GRS 15-CL 001/002) will trip Sludge transfer pump (GRS 15-AP 001/002) in case of low level.

SLUDGE TRANSFER PUMP (GRS 15-AP 001/002)

Two nos. of the Sludge transfer pumps (1W+1S), have been provided to transfer the sludge from sludge holding tank to Centrifuge and to MBBR aeration tank.

Permissive of starting of pump:

- Sludge holding tank level should be not low.
- Electrical Disturbance f/b not available.
- Manual valve V-188/190 & V-192 remain open

Process trip indication will be generated at following condition:

- Electrical Disturbance f/b available.
- Emergency stop f/b available from LPBS
- Low level in transmitter (LT-GRS 15-CL 001/002) (Interlock I 9)
- Sludge transfer pump outlet pressure low (PT-GRS 15-CP 001/002)
- Discharge pressure low in Sludge transfer pumps (GRS 15-AP 001/002) discharge header Pressure transmitter (PT- GRS 15-CP 001/002)

The pumps will be provided with following selections

Auto / Manual

In manual mode of operation the pumps can be started from operator workstations.

In auto mode of operation pump selected will start when the start permissive is satisfied. Standby pump will start automatically if any one of the main pump trips due to pressure is detected low by the low pressure at the discharge or any electrical disturbance feedback.

Standby pump will not start automatically if any one of the running pump trips due to low level in the tank.

CENTRIFUGE (CF)

Centrifuge service run precondition:

- Sludge transfer pump running (GRS 15 AP 001/002).
- Respective valve V-188, V-190 and V-192 will remain open during service mode.
- Hypo Dosing pump running(DP-02)
- DWPE dosing pump(DP-03)

Centrifuge service starting:

Start the centrifuge motor from the operator work station or from the DDCMIS and the centrifuge shall be flushed for 5 minutes by opening flush water valve (V-234) after 3 min of centrifuge starting.

Start the Hypo dosing pump(DP-02) & DWPE dosing pump(DP-03) after 1 min of closing flush water valve(V-234) and start Sludge transfer pump (GRS 15-AP 001/002) after ½ min of starting Hypo dosing pump.

Centrifuge service stopping:

Stop the Sludge transfer pump (GRS 15 AP001/002) and stop the DWPE dosing pump (DP-03) and Hypo dosing pump (DP-02) 1 min after the stopping of Sludge transfer pump (GRS 15 AP001/002).

Open the flush water valve (V-234) 1 min after the stopping of DWPE dosing pump (DP-03) and Hypo dosing pump (DP-02), close the flushing valve (V-234) after 10 min and stop the centrifuge motor after 8 min of closing the flushing valve (V-234).

Process trip indication will be generated at following condition:

- Electrical Disturbance f/b available.
- Emergency stop f/b available from LPBS
- Sludge Overload in centrifuge.

In case the centrifuge trips due to sludge overload, hooter will give alarm and trips the Sludge transfer pump and stop the Hypo dosing pump(DP-02) & DWPE dosing pump(DP-03) and open the flushing line valve(V-234) for 5 minutes and close the flushing valve(V-234) after 5 minutes.

The operator has to reset the Hooter and restart the centrifuge as per centrifuge starting sequence.

HYPO DOSING TANK (DT-02)

The preparation of the chemical is totally manual. Hypo dosing tank will be provided with level transmitters (LT-GRN 02-CL 001/002), which will give alarm of low level at the DDCMIS. Level transmitter (LT-GRN 02-CL 001/002) will trip Hypo dosing pump (DP-02) in case of low level.

HYPO DOSING PUMP (DP-02)

The pumps shall start automatically or with operator intervention and will be in continuous operation.

Permissive of starting of pump:

- Hypo dosing tank (DT-02) level should be not low.
- Centrifuge shall be in Service/operation.
- Electrical Disturbance f/b not available.

Process trip indication will be generated at following condition:

- Electrical Disturbance f/b available.
- Emergency stop f/b available from LPBS
- Low level in Level transmitter (LT - LT-GRN 02-CL 001/002)

- Discharge pressure low in Hypo Dosing pump(DP-02) discharge header Pressure transmitter (PT-GRN 02-CP 001/002)

The pumps will be provided with following selections

Auto / Manual

In manual mode of operation the Dosing pumps can be started from operator workstations.

In auto mode of operation dosing pump selected will start when the permissive of pump is satisfied. Standby dosing pump will start automatically if any one of the main pump trips due to pressure is detected low by the low pressure at the discharge or any electrical disturbance feedback.

Standby pump will not start automatically if any one of the running dosing pump trips due to low level in the dosing tank.

DWPE DOSING TANK (DT-03)

The preparation of the chemical is totally manual. DWPE dosing tank will be provided with level Switch (LS-GRN 03-CL 001), which will give alarm of low level at the DDCMIS. Level Switch (LS-GRN 03-CL 001) will trip DWPE dosing pump (DP-03) in case of low level.

DWPE DOSING PUMP (DP-03)

The pumps shall start automatically or with operator intervention and will be in continuous operation.

Permissive of starting of pump:

- DWPE dosing tank (DT-03) level should be not low.
- Centrifuge shall be in Service/operation.

- Electrical Disturbance f/b not available.

Process trip indication will be generated at following condition:

- Electrical Disturbance f/b available.
- Emergency stop f/b available from LPBS
- Low level in Level Switch (LS-GRN 03-CL 001)

INTERLOCK LIST & ALARM LIST

Following is the list of interlocks provided as per the Pretreatment plant. The below table shall be referred along with the P&ID

TABLE: INTERLOCK LIST

Interlock Number	Description	Interlock
I1	Low level in the Sewage Sump (GRS -01)	Trip the running Sewage transfer pumps (GRS 01-AP 001/002).
I10	Low pressure at the Sewage transfer pump (GRS 01-AP 001/002) common discharge header.	Trip the running Sewage transfer pumps (GRS 01-AP 001/002) and start the stand by pump (GRS 01-AP 001/002).
I2	Low level in the Sewage Sump (GRS -02)	Trip the running Sewage transfer pumps (GRS 02-AP 001/002).
I11	Low pressure at the Sewage transfer pump (GRS 02-AP 001/002) common discharge header.	Trip the running Sewage transfer pumps (GRS 02-AP 001/002) and start the stand by pump (GRS 02-AP 001/002).
I3	Low level in the Sewage Sump (GRS -03)	Trip the running Sewage transfer pumps (GRS 03-AP 001/002).
I2	Low pressure at the Sewage transfer pump (GRS 03-AP 001/002) common discharge header.	Trip the running Sewage transfer pumps (GRS 03-AP 001/002) and start the stand by pump (GRS 03-AP 001/002).
I4	Low level in the Sewage Sump (GRS -04)	Trip the running Sewage transfer pumps (GRS 04-AP 001/002).
I13	Low pressure at the Sewage transfer pump (GRS 04-AP 001/002) common discharge header.	Trip the running Sewage transfer pumps (GRS 04-AP 001/002) and start the stand by pump (GRS 04-AP 001/002).

Interlock Number	Description	Interlock
I5	Low level in the Common Collection Sump (GRS -05)	Trip the running Common collection sump pumps (GRS 05-AP 001/002).
I14	Low pressure at the Common collection sump pumps (GRS 05-AP 001/002) common discharge header.	Trip the running Common collection sump pumps (GRS 05-AP 001/002) and start the stand by pump (GRS 05-AP 001/002).
I6	Low level in Equalization tank (GRS -06)	Trip the running MBBR feed pumps (GRS 06-AP 001/002).
I15	Low pressure at the MBBR feed (GRS 06-AP 001/002) common discharge header.	Trip the running MBBR feed pumps (GRS 06-AP 001/002) and start the stand by pump (GRS 06-AP 001/002).
I7	Low level in Hypo contact tank/Filter Feed tank (GRS -07)	Trip the running Filter feed pumps (GRS 08/09-AP 001).
I16	Low pressure at the Filter feed pumps (GRS 08/09-AP 001) common discharge header.	Trip the running Filter feed pumps (GRS 08/09-AP 001) and start the stand by pump (GRS 08/09-AP 001).
I17	Low level in the Hypo dosing tank (GRN-01)	Trip the running Hypo dosing pump (DP – 01)
I8	Low level in the Treated Water Tank (GRS-11)	Trip the running Treated water disposal pumps (GRS 12/13-AP 001).
I18	High level in the Treated Water Tank (GRS-11)	Trip the running Filter feed pumps (GRS 08/09-AP 001).
I19	Low pressure at the Treated water disposal pump (GRS 12/13-AP 001) common discharge header.	Trip the running Treated water disposal pump (GRS 12/13-AP 001) and start the stand by pump (GRS 12/13-AP 001).

Interlock Number	Description	Interlock
I9	Low level in the Sludge Holding Tank (GRS-15)	Trip the running Sludge transfer pumps (GRS 15-AP 001/002).
I20	Low pressure at the Sludge transfer pump (GRS 15-AP 001/002) common discharge header.	Trip the running Sludge transfer pump (GRS 15-AP 001/002) and start the stand by pump (GRS 15-AP 001/002).
I21	Low level in the Hypo dosing tank (DT-02)	Trip the running Hypo dosing pump (DP – 02)
I22	Low level in the DWPE dosing tank (DT-03)	Trip the running DWPE dosing pump (DP – 03)

TABLE: ALARM LIST

Alarm Number	Description	Alarm
LAL 101/102	Low level in the Sewage sump (GRS-01) sensed in LT (GRS 01 CL 001/002)	Low alarm in the DDCMIS
PAL 101/102	Low pressure in the Sewage transfer(GRS 01 AP 001/002) pumps sensed in PT(GRS 01 CP 001/002)	Low alarm in the DDCMIS
PAH 101/102	High pressure in the Sewage transfer(GRS 01 AP 001/002) pumps sensed in PT(GRS 01 CP 001/002)	High alarm in the DDCMIS
LAL 103/104	Low level in the Sewage sump (GRS-02) sensed in LT (GRS 02 CL 001/002)	Low alarm in the DDCMIS

PAL 103/104	Low pressure in the Sewage transfer(GRS 02 AP 001/002) pumps sensed in PT(GRS 02 CP 001/002)	Low alarm in the DDCMIS
PAH 103/104	High pressure in the Sewage transfer(GRS 02 AP 001/002) pumps sensed in PT(GRS 02 CP 001/002)	High alarm in the DDCMIS
LAL 105/106	Low level in the Sewage sump (GRS-03) sensed in LT (GRS 03 CL 001/002)	Low alarm in the DDCMIS
PAL 105/106	Low pressure in the Sewage transfer(GRS 03 AP 001/002) pumps sensed in PT(GRS 03 CP 001/002)	Low alarm in the DDCMIS
PAH 105/106	High pressure in the Sewage transfer(GRS 03 AP 001/002) pumps sensed in PT(GRS 03 CP 001/002)	High alarm in the DDCMIS
LAL 107/108	Low level in the Sewage sump (GRS-04) sensed in LT (GRS 04 CL 001/002)	Low alarm in the DDCMIS
PAL 107/108	Low pressure in the Sewage transfer(GRS 04 AP 001/002) pumps sensed in PT(GRS 04 CP 001/002)	Low alarm in the DDCMIS
PAH 107/108	High pressure in the Sewage transfer(GRS 04 AP 001/002) pumps sensed in PT(GRS 04 CP 001/002)	High alarm in the DDCMIS
LAL 109/110	Low level in the Common collection sump (GRS-05) sensed in LT (GRS 05 CL 001/002)	Low alarm in the DDCMIS
PAL 109/110	Low pressure in the Common collection sump pump(GRS 05 AP 001/002) pumps sensed in PT(GRS 05 CP 001/002)	Low alarm in the DDCMIS

PAH 109/110	High pressure in the Common collection sump pump (GRS 05 AP 001/002) pumps sensed in PT(GRS 05 CP 001/002)	High alarm in the DDCMIS
LAL 111/112	Low level in the Equalization tank (GRS-06) sensed in LT (GRS 06 CL 001/002)	Low alarm in the DDCMIS
PAL 111/112	Low pressure in the MBBR feed pump(GRS 06 AP 001/002) pumps sensed in PT(GRS 06 CP 001/002)	Low alarm in the DDCMIS
PAH 111/112	High pressure in the MBBR feed pump (GRS 06 AP 001/002) pumps sensed in PT(GRS 06 CP 001/002)	High alarm in the DDCMIS
PAL 115/116	Low pressure in the Air Blower for CCS, EQT & SHT (GRC 01 AN 001/002) blowers sensed in PT(GRC 01 CP 001/002)	Low alarm in the DDCMIS
PAH 115/116	High pressure in the Air Blower for CCS, EQT & SHT (GRC 01 AN 001/002) blowers sensed in PT(GRC 01 CP 001/002)	High alarm in the DDCMIS
PAL 117/118	Low pressure in the Common air blower for CCS, EQT & SHT (GRC 02 AN 001/002) sensed in PT(GRC 02 CP 001/002)	Low alarm in the DDCMIS
PAH 117/118	High pressure in the Common air blower for CCS, EQT & SHT (GRC 02 AN 001/002) sensed in PT(GRC 02 CP 001/002)	High alarm in the DDCMIS

LAL 113/114	Low level in the Hypo contact tank/Filter feed tank (GRS-07) sensed in LT (GRS 07 CL 001/002)	Low alarm in the DDCMIS
PAL 113/114	Low pressure in the Filter Feed pump (GRS 08/09 AP 001) pumps sensed in PT(GRS 10 CP 001/002)	Low alarm in the DDCMIS
PAH 113/114	High pressure in the Filter Feed pump (GRS 08/09 AP 001) pumps sensed in PT(GRS 10 CP 001/002)	High alarm in the DDCMIS
FAL 101	Low flow in the Filter inlet header (GRB 01) sensed in FT(GRS 10 CF 001)	Low alarm in the DDCMIS
FAH 101	High flow in the Filter inlet header (GRB 01) sensed in FT(GRS 10 CF 001)	High alarm in the DDCMIS
FAL 102	Low flow in the Filter inlet header (GRB 02) sensed in FT(GRS 10 CF 002)	Low alarm in the DDCMIS
FAH 102	High flow in the Filter inlet header (GRB 02) sensed in FT(GRS 10 CF 002)	High alarm in the DDCMIS
LAL 117/118	Low level in the Sludge holding tank (GRS-15) sensed in LT (GRS 15 CL 001/002)	Low alarm in the DDCMIS
PAL 119/120	Low pressure in the Sludge transfer pump (GRS 15 AP 001/002) pumps sensed in PT(GRS 15 CP 001/002)	Low alarm in the DDCMIS
PAH 119/120	High pressure in the Sludge transfer pump (GRS 15 AP 001/002) pumps sensed in PT(GRS 15 CP 001/002)	High alarm in the DDCMIS

LAL 115/116	Low level in the Sludge holding tank (GRS-11) sensed in LT (GRS 11 CL 001/002)	Low alarm in the DDCMIS
PAL 121/122	Low pressure in the Sludge transfer pump (GRS 12/13 AP 001) pumps sensed in PT(GRS 14 CP 001/002)	Low alarm in the DDCMIS
PAH 121/122	High pressure in the Sludge transfer pump (GRS 12/13 AP 001) pumps sensed in PT(GRS 14 CP 001/002)	High alarm in the DDCMIS

All pumps status (run and process trip) will be displayed in DDCMIS work station. The selection of working and standby pump shall be done from the DDCMIS by the operator and the selected pump is started through the DDCMIS as well as from field when the start permissive is satisfied.

If the running pump trips due to damage/failure/process trip/fault. The stand by pump can be started either automatically from DDCMIS or manually from field as per AUTO/MANUAL mode.

Entire Treatment plant shall be Semi-Automatic with automation provided according to the process requirement with Manual intervention where ever required or at the event of failure of DDCMIS.

Entire process is properly instrumented for normal and stable operation of the plant. Plant is controlled & Monitored through DDCMIS.

All the drives status (running/tripped/stop) will be displayed in DDCMIS work station.

Proposed plant will be operated in Auto/Manual modes which can be selected from DDCMIS or Selector switches provided on the panel locally.

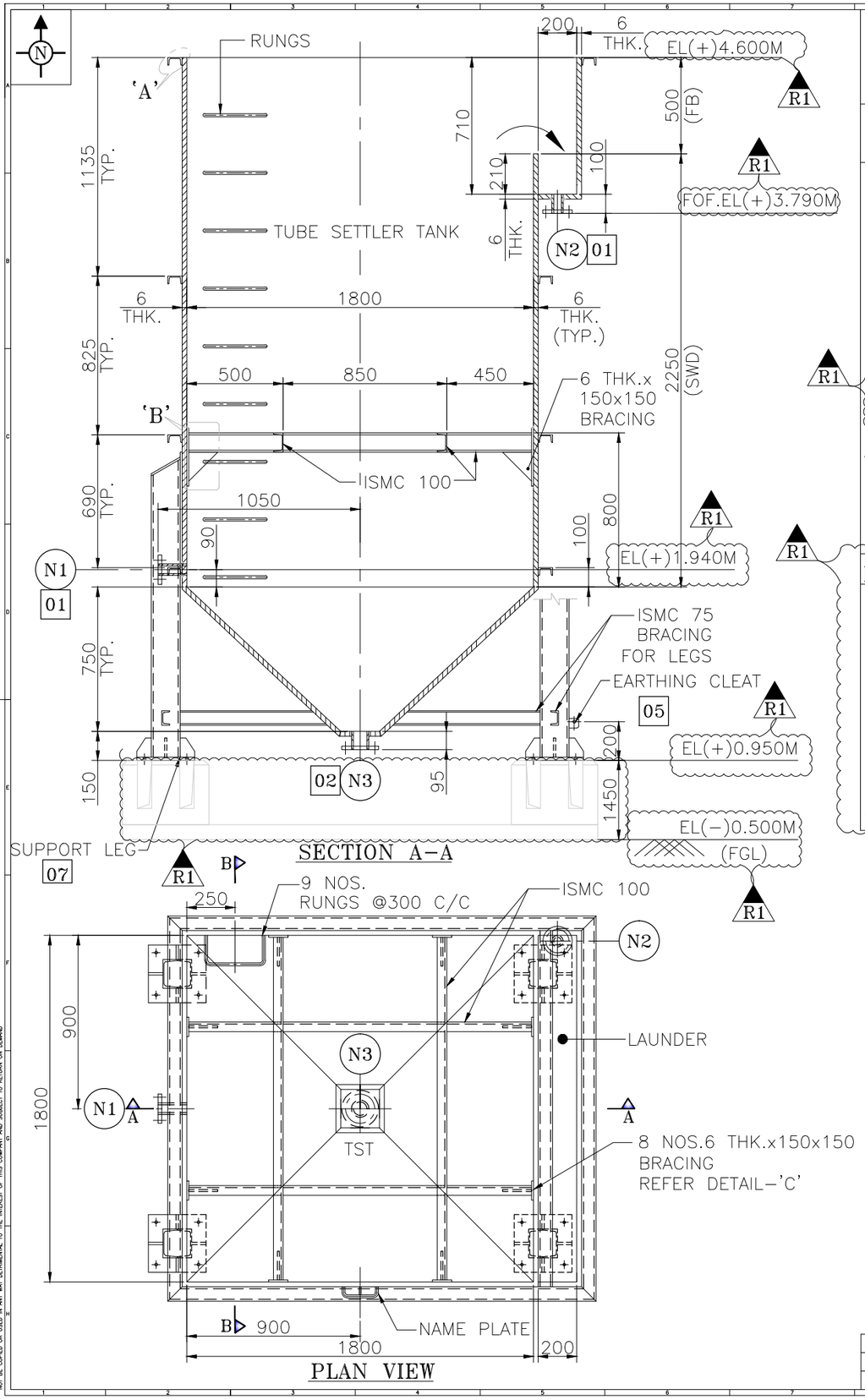
APPROVED

COMMENTS RESOLUTION SHEET [CRS]

PROJECT NAME	2 X 660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI.		
DOCUMENT NUMBER	PE-V0-412-673-A034	**DATE**	13-12-2018
DOCUMENT TITLE	MECH.GA. OF LAMELLA TUBE SETTLER TANK FOR SEWAGE TREATMENT PLANT	**REVISION**	**R-1**

No.	CLIENT COMMENT	PEL RESPONSE
1.	Indicate FGL on the drawing	Noted & Incorporated.
2.	Indicate all elevations on the drawing	Noted & Incorporated.
3.	Indicate following note on the drawing "EL 0.00 M corresponds to RL 10.00 M which is FFL of TG Building"	Noted & Incorporated.
4.	Revise painting details in line with comments on painting schedule	Noted & Incorporated.

PEL/D&D-F003



INTERNAL LINING	: 4.5 THK. NATURAL RUBBER IN 3 LAYERS,HARDNESS 65°±5° SHORE 'A' AS PER IS:4682 PART−I
INTERNAL SURFACE PREPARATION	: ABRASIVE BLASTING AS PER SA 2 1/2.

GENERAL NOTE :−

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. NUMBER GIVEN IN THE Sq.BOX REPRESENTING THE CORRESPONDING WELDING DETAIL NUMBER.
3. PLEASE DO NOT SCALE THE DRAWING REFER DIMENSIONS ONLY.
4. FOR EQUIPMENT LOCATION & ORIENTATION REFER EQUIPMENT LAYOUT.
5. EL(+)0.00M CORRESPONDS TO RL 10.00M WHICH IS FFL OF TG BUILDING

REFERENCE DRAWINGS :−

1. EQUIPMENT LAYOUT : A1−PEL−1037−EL−001
2. GENERAL NOTES FOR FABRICATION AND R/L : A3−PEL−1037−NOTE−FAB & R/L

EXTERNAL PAINTING:

SURFACE PREPARATION	: ABRASIVE BLASTING AS PER SIS05−5900, GRADE SA 2 1/2,
PRIMER	: 2 COATS OF ZINK SILICATE EPOXY PRIMER DFT= 50 MICRONS/COAT
FINISH	:2 COATS OF HIGH BUILD EPOXY@90 MICRONS DFT/COAT
TOTAL DFT COAT	: 260 MICRONS.
COLOR SHADE	: LIGHT GRAY IS−5 631

SERVICE	:	TUBE SETTLER TANK
TAG NO.	:	TST
MOC.	:	MSRL
QTY.	:	1NO.
UNIT SIZE	:	1.8Mx1.8Mx2.25M(SWD)+0.5M FB +0.75M HOPPER DEPTH

ISSUED FOR APPROVAL

LIST OF NOZZLE CONNECTIONS

MK.NO.	DESCRIPTION	SIZE (NB)	SCH. /THK.	QTY. NOS	COMP.PAD DIA.	COMP.PAD THK.	REMARKS
N1	INLET	50	HEAVY	1	−−	−	
N2	OUTLET	50	HEAVY	1	−−	−	
N3	SLUDGE OUTLET	80	HEAVY	1	−−	−	

DESIGN DATA

DESIGN PRESSURE	: ATM
DESIGN TEMPERATURE	: 50 °C (Atmospheric)
HYDROTEST PRESSURE	: FULL OF WATER
FLANGES EXTERNAL	: ANSI B16.5 150# SOFF. OFF CRS.
CORROSION ALLOWANCE	: NIL
RADIOGRAPHY	: NIL
JOINT EFFICENCY	: 0.7
EMPTY WEIGHT	: 1818.5 kgs.
OPERATING WEIGHT	: 11000 kgs.
EXTERNAL PAINTING AREA	: 45.04 Sq.M
INTERNAL R/L AREA	: 27.62 Sq.M
INSPECTION	: AS PER APPROVED QAP.
CAPACITY	: 7.3 m3

MATERIAL OF CONSTRUCTION

SHELL/BOTTOM CONE	: IS 2062 Gr. B
COMPENSATING PAD	: IS 2062 Gr. B
FLANGES EXTERNAL	: IS 2062 Gr. B
NOZZLE NECKS	: IS 1239 PART−1 HVY. DUTY ERW
INT. & EXT. ATTACHMENTS	: IS 2062 Gr. B
SUPPORT LEGS	: IS 2062 Gr. B
BOLTS & NUTS EXTERNAL	: IS 1367 CLASS 4.6/4,GALV.
GASKETS	: 3 mm THK. NATURAL RUBBER

PROJECT:		2 X 660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI.
TANGEDCO	OWNER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
DESEIN	OWNER'S CONSULTANT:	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
BHEL	EPC CONTRACTOR:	BHARAT HEAVY ELECTRICALS LIMITED. (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
PENNAR ENVIRO	SUB CONTRACTOR :	Re-engineering Water, Environment & Energy. Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad − 500 084

DEPT.	CODE	SCALE	WEIGHT (KG)	VENDOR DRAWING NO.	ITEM
−−	−−	1:25	−	A3−PEL−1037−FGA−002	

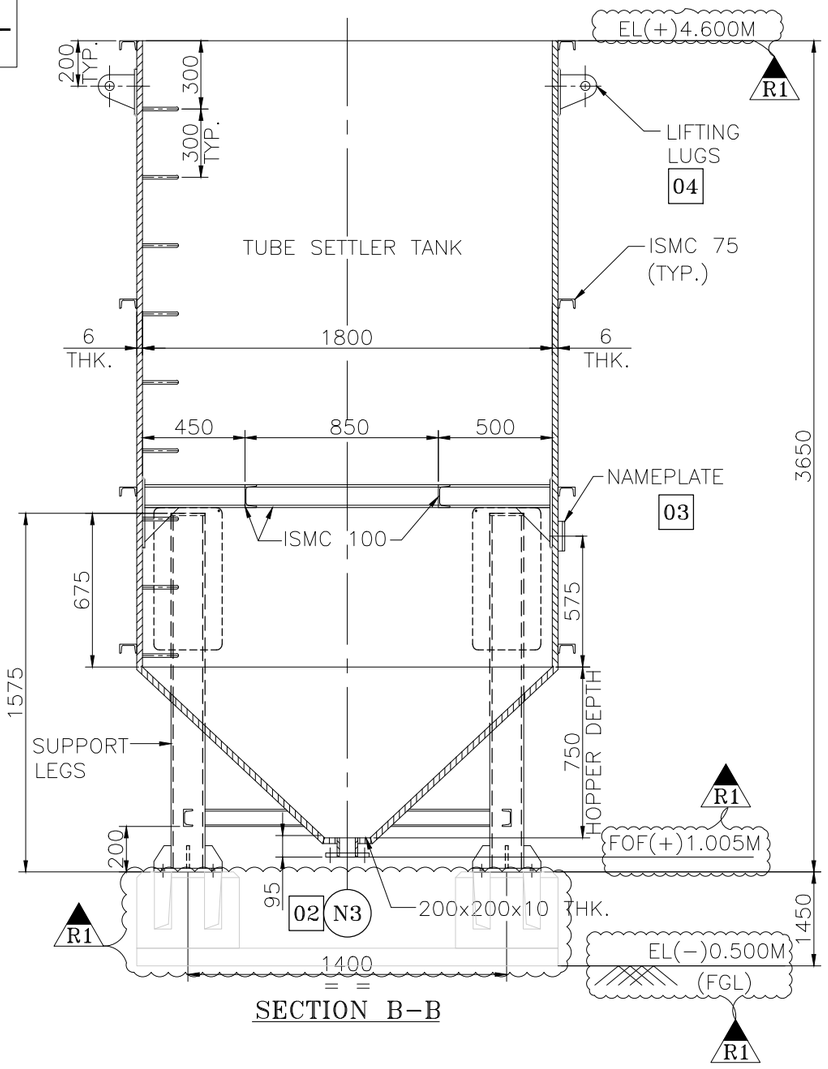
TITLE: MECH. GA. OF LAMELLA TUBE SETTLER TANK FOR SEWAGE TREATMENT PLANT

	NAME	SIGN	DATE
PREP	AP		01.09.2018
CHKD	PAK		01.09.2018
CHKD	PAK		01.09.2018
APPD	PAK		01.09.2018

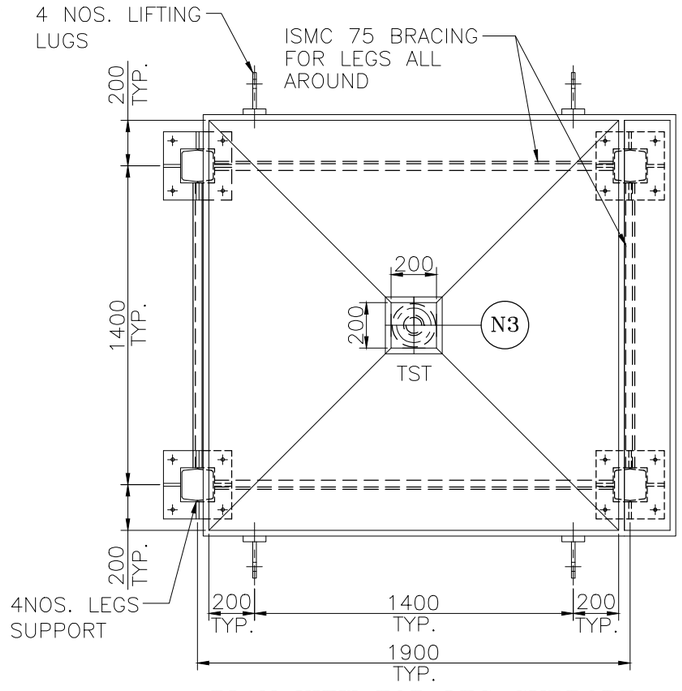
DEPT.	CARD CODE	BHEL DRAWING NO.	REV
SIGN	−	PE−V0−412−673−A034	1
DATE		NO. OF SHEETS − 1 OF 3	

REV	DATE	DESCRIPTION	MECH.	DRAWN	CHK.
1	13.12.2018	REVISED AS PER FOR TANGEDCO COMMENTS	PAK	PSR	SSY
0	01.09.2018	ISSUED FOR APPROVAL	PAK	AP	SSY

PEL/D&D-F003



SECTION B–B



PLAN VIEW FOR LEG SUPPORT AND LIFTING HOOK

1	13.12.2018	REVISED AS PER FOR TANGEDCO COMMENTS	PAK	PSR	SSY
0	01.09.2018	ISSUED FOR APPROVAL	PAK	AP	SSY
REV	DATE	DESCRIPTION	MECH.	DRAWN	CHK.

PROJECT:	2 X 660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI.
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EPC CONTRACTOR:	BHARAT HEAVY ELECTRICALS LIMITED. (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
SUB CONTRACTOR :	PENNAR ENVIRO Re-engineering Water, Environment & Energy Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad – 500 084

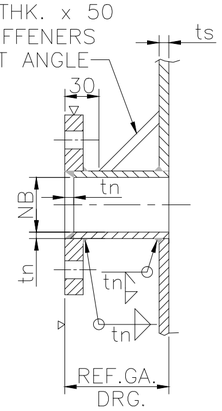
DEPT.	CODE		SCALE	WEIGHT (KG)	VENDOR DRAWING NO.	ITEM
--	--		1:25	–	A3-PEL-1037-FGA-002	

TITLE: MECH. GA. OF LAMELLA TUBE SETTLER TANK FOR SEWAGE TREATMENT PLANT

	NAME	SIGN	DATE
PREP	AP		01.09.2018
CHKD	PAK		01.09.2018
CHKD	PAK		01.09.2018
APPD	PAK		01.09.2018

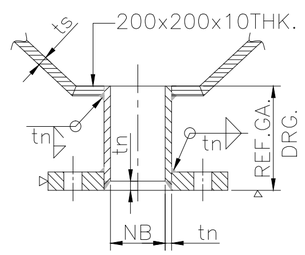
DEPT.	CARD CODE	BHEL DRAWING NO.	REV
SIGN	–	PE-V0-412-673-A034	1
DATE		NO. OF SHEETS – 2 OF 3	

PEL/D&D-F003



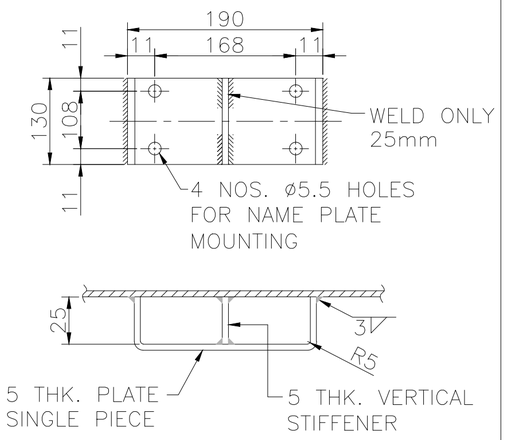
NOZZLE DETAIL (WITHOUT COMPENSATING PAD) (UP TO 50 NB)

1



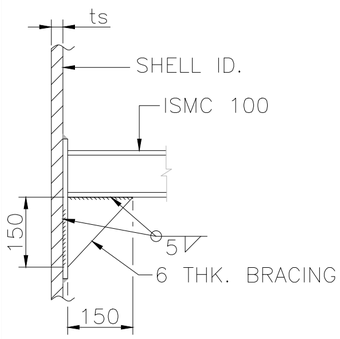
NOZZLE DETAIL (WITHOUT COMPENSATING PAD) (80 NB)

2



NAME PLATE BRACKET

3



DETAIL–'C'

GENERAL NOTE :–

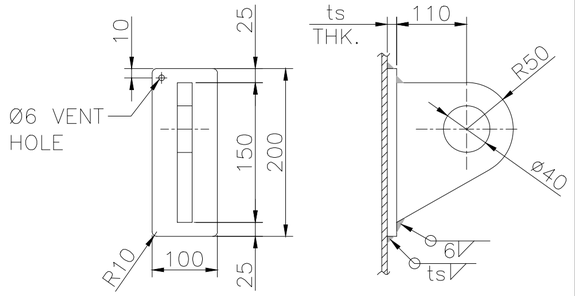
1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. PLEASE DO NOT SCALE THE DRAWING REFER DIMENSIONS ONLY.

REFERENCE DRAWINGS :–

1. GA. DRAWING FOR TUBE SETTLER TANK : A3–PEL–1037–FGA–002

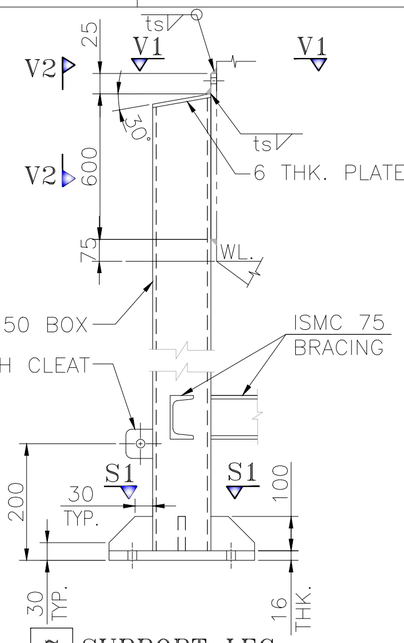
LEGEND:–

NB : NOMINAL BORE
TN : THICKNESS OF NECK
TS : THICKNESS OF SHELL

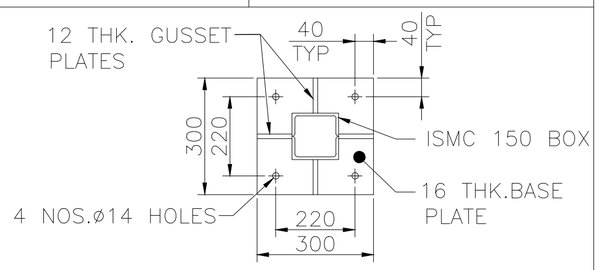


ELEVATION

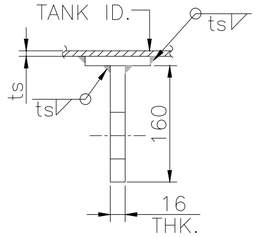
SIDE VIEW



SECTION '1–1'



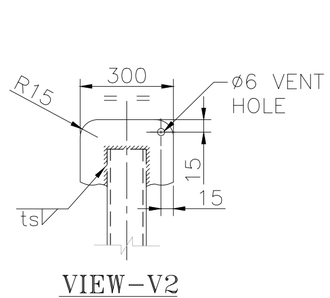
DETAIL OF LEG SUPPORT



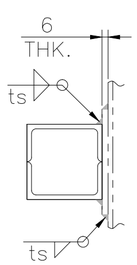
PLAN

DETAIL OF LIFTING LUG

4



VIEW–V2



VIEW–V1

ISSUED FOR APPROVAL

PROJECT:	2 X 660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI.
OWNER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT:	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
EPC CONTRACTOR:	BHARAT HEAVY ELECTRICALS LIMITED. (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
SUB CONTRACTOR :	PENNAR ENVIRO Re-engineering Water, Environment & Energy Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad – 500 084

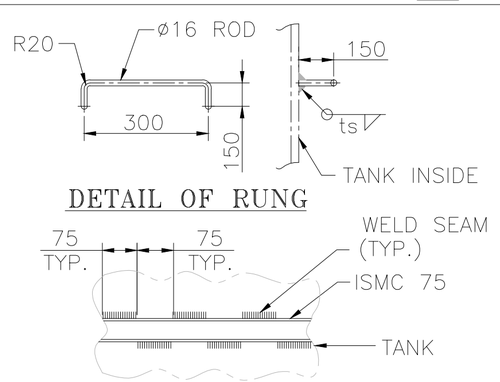
DEPT.	CODE		SCALE	WEIGHT (KG)	VENDOR DRAWING NO.	ITEM
--	--		1:25	–	A3–PEL–1037–FGA–002	

TITLE

MECH. GA. OF LAMELLA TUBE SETTLER TANK FOR SEWAGE TREATMENT PLANT

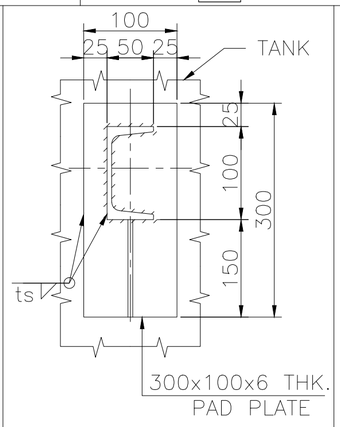
	NAME	SIGN	DATE
PREP	AP		01.09.2018
CHKD	PAK		01.09.2018
CHKD	PAK		01.09.2018
APPD	PAK		01.09.2018

DEPT.	CARD CODE	BHEL DRAWING NO.	REV
SIGN	–	PE–V0–412–673–A034	1
DATE		NO. OF SHEETS – 3 OF 3	

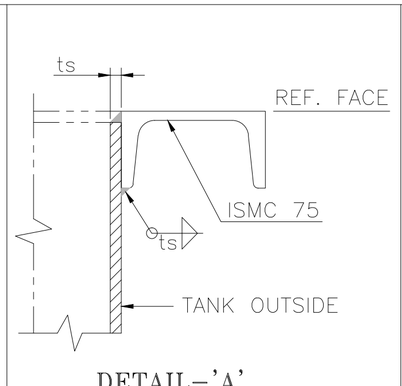


DETAIL OF RUNG

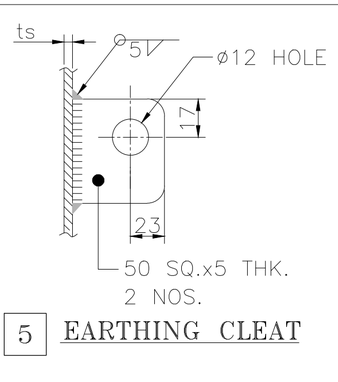
TYP.WELDING DETAILS FOR STIFFENERS (STITCH & STAGGERED TYP.)



DETAIL–'B'



DETAIL–'A'



EARTHING CLEAT

5

REV	DATE	DESCRIPTION	MECH.	DRAWN	CHK.
1	13.12.2018	REVISED AS PER TANGEDCO COMMENTS (NO CHANGES IN THIS SHEET)	SSY	PSR	PAK
0	01.09.2018	ISSUED FOR APPROVAL	SSY	AP	PAK

REV	DATE	ALTERED: RSJ	REV	DATE	ALTERED
0	05.09.18	CHECKED: GSR			CHECKED

APPROVED

STATUS : CONTRACT

JOB NO.: 412

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

TAMILNADU GENERATION AND DISTRIBUTION CORP. LTD.(TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT,NOIDA

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

TECHNICAL DATASHEET OF MOTOR FOR SEWAGE TREATMENT PLANT

	NAME	SIGN	DATE
PREP	RSJ		05.09.18
CHKD	GSR		05.09.18
APPD	KP		05.09.18

DEPT.							CARD CODE	DRAWING NO.	REV
SIGN			N.A.				-	PE-V0-412-673-A036	0
DATE									

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NO. OF SHEETS 10 EXCLUDING COVER PAGE

ANNEXURE

SR.N0	DESCRIPTION	kW RATING	QUANTITY
1	Sewage tranfer pump for S-1 sump	3.00	2
2	Sewage tranfer pump for S-2 sump	3.00	2
3	Sewage tranfer pump for S-3 sump	3.00	2
4	Sewage tranfer pump for S-4 sump	3.00	2
5	Common collection sump pump	1.50	2
6	MBBR feed pump	1.50	2
7	Filter feed pump	1.50	2
8	Treated water disposal pump	3.00	2
9	Sludge transfer pump	0.55	2
10	Hypo dosing pump	0.37	1
11	DWPE dosing pump	0.37	1
12	Agitator for hypo dosing tank	0.37	1
13	Agitator DWPE dosing tank	0.37	1
14	Air blower for common sump, equalization tank & sludge sump	2.20	2
15	Air blower for MBBR aeration tank	3.00	2
16	Centrifuge	5.50	1
17	Misc	0.55	2

A.C. AND D.C. MOTORS

A.	**A.C. MOTOR**		
1.0	**GENERAL**		
1.1	Application		: Pump
1.2	Quantity		: As per requirement
1.3	Make		: As per approved vendor list
1.4	Frame Size		: As per motor kW rating
1.5	Applicable Standard		: IS : 325, IS : 12615 : 2011
2.0	**TYPE AND RATING**		
2.1	Type of Motor		: Squirrel Cage Induction Motor, IE3
2.2	Service		: As per Pump Application
2.3	Duty Cycle/Designation		: S1 Continuous
2.4	Rated Continuous Output		
	At 40 Deg.C ambient	KW	: As per motor rating
	At 20 Deg.C ambient	KW	: As per motor rating
2.5	Rated Speed	r.p.m.	: As per pump requirement
2.6	Rated Voltage & % variation		: 415 +/- 10%
2.7	Rated Frequency & % variation		: 50 Hz +/- 3%
2.8	Combined voltage and frequency variation % (absolute sum)		: +/- 10%
2.9	Full load current	Amps	: As per motor kW rating
2.10	No load current	Amps	: As per motor kW rating
2.11	Rated Power Factor		: Depends upon motor kW rating
2.12	Efficiency at rated voltage and frequency:		
	a) Full load	%	: Depends upon motor kW rating

	b) 3/4 load	%	:	Depends upon motor kW rating
	c) 1/2 load	%	:	Depends upon motor kW rating

3.0 PERFORMANCE

3.1	Method of Starting		:	DOL Starter
3.2	Starting current at 110% voltage % full load current		:	As per motor kW rating
3.3	Starting Current at rated voltage	% f.l.c.	:	As per motor kW rating
3.4	Starting Torque at rated voltage	kg.m	:	
	a) Pull out torque	kg.m	:	As per motor kW rating
	b) Full load torque	kg.m	:	As per motor kW rating

				80% Voltage	100% Voltage	110% Voltage
3.5	Starting time at					
	a) With load	sec.	:	As per motor kW rating		
	b) Without load (driven equipment coupled)	sec	:	As per motor kW rating		
3.6	Safe stall time at			80% Voltage	100% Voltage	110% Voltage
	a) Hot condition	sec.	:	As per motor kW rating		
	b) Cold condition	sec.	:	As per motor kW rating		
3.7	a) Heating time constant	min	:	NA		
	b) Cooling time constant	min	:	NA		

4.0 CONSTRUCTION

4.1	Degree of Protection of Enclosure	:	IP 55
4.2	Method of Cooling	:	TEFC, IC 411
4.3	Insulation Class	:	Class 'F' temp. rise limited to Class 'B'
4.4	Temperature Rise Over 20 Deg.C ambient (by resistance)	:	70 Deg.C
4.5	Tropicalised	Yes/No :	Yes

4.6	Winding Connection	: Delta		
4.7	Bearings		**D.E.**	**N.D.E.**
	a) Make	: FAG/SKF		
	b) Type	: BALL BEARING		
	c) Recommended lubricant	: Anti-friction Bearings		
4.8	Motor Terminal Box			
	a) Type	: Stud Type		
	b) Fault withstand Current kA	: 50 kA		
	c) Fault Current Withstand Time Sec.	: 0.25 Sec		
	d) Cable lugs & Glands furnished Yes/No	: Yes		
	e) Position	: As per GA Drawing		
	f) Position	: As per GA Drawing		

5.0 ACCESSORIES

5.1	Space Heaters	: 30kW & above
	a) No. x Watt	:
	b) Volt, phase, frequency	:
5.2	Winding temperature detector	: NA
	a) Type	:
	b) Nos. furnished	:
5.3	Bearing temperature detector	:NA
	a) Type	:
	b) Nos. furnished	:
5.4	Temperature Indicators	: NA
	a) Type	:
	b) Nos. provided	:
	c) Locations	:

5.5	Temperature Alarm Contact	: NA
	a) Nos. provided	:
	b) Locations	:
	c) Contact rating	:
5.6	Flow Switch	: NA
	a) Type	:
	b) Nos. provided	:
	c) Locations	:
	d) Contact Rating	:
5.7	Current Transformer for differential protection	: NA
	a) Nos. provided	:
	b) Current Ratio	:
	c) Class	:
	d) Knee point voltage	:
	e) Excitation current at VK/2	:
5.8	Accessory Terminal Box	:
	a) No. provided	01
	b) Cable glands furnished	Yes/No: Yes
5.9	Speed Switch	: NA
	a) Type	:
	b) Nos. provided	:
	c) Locations	:
	d) Contact Rating	:
6.0	Paint Shade & Painting detail	: RAL 7032
6.1	**GROUNDING**	
6.2	No. of grounding pads provided	
	a) On motor body	: 02 Nos.

	b) On terminal box		: 01 No
7.0	**MISCELLANEOUS**		
7.1	Type of mounting		: As per pump requirement
7.2	Overall dimension (LxBxH) mm x mm x mm		: As per GA Drawing
7.3	Approximate Weight Kg		: As per motor kW rating
7.4	Moment of Inertia (Sq.GD)		
	a) Stator	Kg.Sq.m	: ---
	b) Rotor	Kg.Sq.m	: As per motor kW rating
	c) Total	Kg.Sq.m	: As per motor kW rating
7.5	Weight		
	a) Stator	Kg	: As per motor kW rating
	b) Rotor	Kg	: As per motor kW rating
	c) Total	Kg	: As per motor kW rating
7.6	Noise level		: 85 dB @ 1.5 m (As per IS 12065)
7.7	Vibration level		: 1.8 mm (As per IS 12075)
7.8	Motor is designed to withstand momentary overload		: 160 % for 15 secs as per IS
7.9	No of starts /stop		: 2H / 3C / 3 equally spread
7.10	Guaranteed bearing life in hours		: 40,000 Hours
7.11	Resistance per phase of winding @30deg.C		: As per motor kW rating
7.12	Resistance per terminal @ 30 deg C		: As per motor kW rating
7.13	Full load capability at 75 % rated voltage at motor terminals without injurious heating		: 5 minutes
7.14	Withstanding capability of 120 % of rated speed without any mechanical damage		: 2 minutes
7.15	Motor capable of withstanding the stresses imposed at starting		: 110 % rated voltage
7.16	The starting torque developed by motor at minimum permissible voltage at start i. e. 80 % of rated voltage shall be more than the starting torque requirement of driven		: Yes, Provided

	equipment by margin of at least 10 % throughout the range of starting in order to account for higher starting torque required during service due to wear and tear	
7.17	Motor subject to reverse rotation shall be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125 % rated speed in reverse direction	: Yes, Provided
7.18	The locked motor withstand time under hot condition at 110 % rated voltage shall be more than motor starting time by at least	: Yes, Available
7.19	3.0 sec for motors up to 20 sec starting time Motor shall start with rated load and accelerate to full speed with 80% rated voltage at motor terminals and suitable for the operation for 10 minutes during running condition	:Yes, Provided
7.20	Motor shall not stall at 70% of nominal voltage for one (1.0) minute	: Yes, Considered.
7.21	Motor suitable for sudden application of 150% voltage during bus transfer withstand up to 1 sec	: Yes, Provided.
7.22	Momentary overload capacity without any damage	: 60%of full load torque for 12sec
7.23	Permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment	:Yes, Provided
7.24	Hot thermal withstand curve shall have a margin or at least 10 % over the full load current of the motor to permit relay setting utilising motor rated capacity	: Yes, Provided
7.25	The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment	: Yes, Provided
7.26	The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non- driving end of the motor	: Yes, Provided

7.27	Vendor to confirm terminal box shall be split type with removable cover with access to connections and shall have the same degree of protection as motor.	: Yes, Provided
7.28	BHEL as EPC contractor it is BHEL responsibility to ensure that motor shall match with specific requirements. Motor terminal box shall match with the cabling arrangement indicated in the cabling layout prepared by BHEL and cable size	: Yes, Provided
7.29	Rating plate detail shall be provided as per tender clause 6.09.00 of V.II-F1/S-II.	: Yes, Provided
7.30	Main terminal box shall indicte	
	(a). Type	: Detachable type
	(b). Power Cable details (Conductor, size, armour/unarmour)	: As per motor & current rating
	(c). Cable gland & lugs details (Size, type & material)	: As per motor & current rating
	(d). Possible Fault level (kA & Duration in sec)	: 50kA for 0.25 sec
7.31	(a). Terminal box material	: Sheet metal
	(b). Terminal box is rotatable by 360 degree in the step of 90 degree	: Yes, provided
	(c). Body material	: Cast Iron
	(d). Motor would get supplied with cable entry from non-driving-end. The same can be rotated downwards for entry of cable from bottom at application site	: Yes, considered.

AC & DC MOTORS

B. D.C MOTOR : NOT APPLICABLE

1.0 GENERAL

1.1	Application		:
1.2	Make		:
1.3	Frame size		:
1.4	Reference standard		:

2.0 TYPE & RATING

2.1	Type		:
2.2	Service		:
2.3	Duty cycle		:
2.4	Rated continuous output		
	a) At 40 Deg. C ambient kW		:
	b) At 20 Deg. C ambient kW		:
2.5	Rated voltage	Volt	:
2.6	Voltage range over which satisfactory operation is guaranteed		:
2.7	Rated current		
	a) Starting	Amp.	:
	b) Running	Amp.	:
2.8	Rated speed	r.p.m.	:

3.0 CONSTRUCTION

3.1	Enclosure		
	a) Type		:
	b) Degree of protection		:
3.2	Method of cooling		:
3.3	Insulation class		:
3.4	Tropicalized?		:

AC & DC MOTORS

3.5	Commutator material		:
4.0	**ACCESSORIES**		
4.1	Motor starter		
	a) Type		:
	b) Make		:
	c) Resistance	ohm	:
4.2	Space heater		
	a) No. x kW		:
	b) Volts / Phase / Frequency		:
4.3	Motor terminal box		
	a) Type		:
	b) Cable lug / gland furnished		:
5.0	**MISCELLANEOUS**		
5.1	Overall dimension (LxBxH) mm		:
5.2	Approx. weight	kg	:

r I/O LIST (Analog & Binary) cum Drive list FOR STP, Dwg No. PE-V0-412-673-A038

N	C d d 11 1	EL d 7 1 1	C	EL	C	EL	C	EL
1	I/O LIST (Analog & Binary) cum Drive list shall be updated as per comments on P&I Diagram for Sewage Treatment Plant PE-V0-412-673-A001, R01.	I/O LIST (Analog & Binary) cum Drive list is revised as per the latest PID.	I/O LIST (Analog & Binary) cum Drive list shall be updated as per final approved P&I Diagram for Sewage Treatment Plant PE-V0-412-673-A001, R03.	I/O LIST (Analog & Binary) cum Drive list is revised as per the final approved PID for Sewage Treatment Plant PEV0-412-673-A001, R03.	Noted.	Point closed	--	--
	STP's different drives are accommodated in the different DDCMIS, please note that I/O list and Drive list pertaining to respective DDCMIS shall also be updated accordingly.	Noted. The same shall be taken care during implementation in DDCMIS as per the IO & drive list of STP.	List of DDCMIS are not as per contract. i. Separate CHP DDCMIS is not provided by BHEL EDN, as the same system is in BHEL ISG scope. Please check. ii. Separate CWPH DDCMIS is not provided by BHEL (EDN), same is part of respective unit DDCMIS. Please check. iii. Respective Unit DDCMIS is provided by BHEL (EDN), which unit DDCMIS shall be used for implementation of STP logics. Please note that above requirements is also not included in the controller functional grouping and I/O / drive list for respective DDCMIS. Please clarify.	Only Sewage transfer pumps installed in sewage lifting sumps (S1, S2, S3 & S4) other than STP area are controlled from respective DDCMIS. 1. IOs for Sewage transfer pump-1A/1B shall be implemented in CHP DDCMIS panels placed in control room near CHP MCC-1 near crusher house as indicated in electrical equipment layout of CHP MCC-1 2. IOs for Sewage transfer pump-2A/2B shall be implemented in CWPH DDCMIS panels placed in CW P/H control room as indicated electrical equipment layout of CW PH area 3. IOs for Sewage transfer pump-3A/3B shall be implemented in RODM DDCMIS panels as indicated in electrical equipment layout of RODM plant 4. IOs for Sewage transfer pump-4A/4B shall be implemented in Main plant DDCMIS Further the control of complete STP (except the system indicated above in point 1 to 4) shall be implemented in DDCMIS panels placed in STP control room as indicated in equipment layout of STP (Dwg No. PE-V0-412-673-A002) EDN will consider the IOs in the respective DDCMIS panels. The same is also indicated in remarks column of IO cum drive list.	Noted.	Point closed	--	--

APPROVED

□N□□	C□□ □ □□□□d□d □□11□1□	□□EL □□□□d□d 7□1□1□	C□□ □ □□□□	□□EL □□□□	C□□ □ □□□□	□□EL □□□□	C□□ □ □□□□	□□EL □□□□
3□	BHEL to note that each & every signal shall be included in line with approved Drive control philosophy and Technical specification. BHEL to check & reconcile the details.	Noted. Further during implementation in DDCMIS, all the signals shall be considered by BHEL-EDN as per Drive control philosophy only. The same is already indicated in notes.	Noted.	Point closed	--	Point closed	--	--
4□	BHEL to note that first unit's tag nos. shall have prefix 10 and second unit's tag nos. shall have prefix 20 and common system, tag nos. shall have prefix 90. BHEL to follow the prefix philosophy as per NIT, Vol. V, Cl. No. 2.01.25.	A note regarding tag no. is indicated under note heading in revised document. Further please note that STP is a common system hence all the tags are prefixed with '90'.	Refer Sr. no. 2 above.	Please refer reply against point no 2	Noted.	Point closed	--	--
□□	IO count shall be included considering spare philosophy in line with technical specifications.	Noted.	Noted.	Point closed		Point closed	--	--
6□	Details for Back up Control desk and Local Control Panel as per Vol. III and Vol. V, chapter 6. IO List shall be updated accordingly considering control/operation from BUCD and LCP.	IO List has been revised considering signal exchange with Back Up Panel.	Not as per specification, I/Os for indicators, Annunciation windows, mimic shall be included.	IOs related to Backup control desk is deleted in revised IO list as per the MOM between M/s TANGEDCO & BHEL EDN dtd 24/25-01-19 at TANGEDCO Chennai	Noted.	Point closed	--	--
7□	"Drive Control Philosophy, # PE-DM-412-145-I002" shall be included as a reference document in the design philosophy. IO List shall be updated accordingly considering IO interfacing as per approved "Drive Control Philosophy, # PE-DM-412-145-I002".	Reference for Drive Control Philosophy, PE-DM-412-145-I002 is indicated under Note heading.	Noted.	Point closed	--	Point closed	--	--
□□	BHEL to include following UPS signals inline with vol. V, Cl. No. 7.06.12. a) The Bidder shall furnish 4-20 mA signals to DDCMIS/PLC for the following: i) Inverter A & B output voltages	The mentioned signals have been added in the revised I/O List.	Noted.	Point closed	--	Point closed	--	--

□N□□	C□□ □ □□□□d□d □□11□1□	□□EL □□□□□d□d 7□1□1□	C□□ □ □□□□	□□EL □□□□□	C□□ □ □□□□	□□EL □□□□□	C□□ □ □□□□	□□EL □□□□□
	ii) Inverter A & B output currents iii) Inverter A&B output frequency b) List of alarms (min.) through potential free contacts shall be as follows: - i. Rectifier – 1 Trip. ii. Inverter – 1 Trip. iii. UPS battery low. iv. Rectifier – 2 Trip. v. Inverter – 2 Trip. vi. Load on static Bypass. vii. Static Bypass failure viii. ACDB – 1 Incomer Tripped. ix. ACDB – 2 Incomer Tripped. x. UPS – 1 Fan Tripped. xi. UPS – 2 Fan Tripped.							
□□	BHEL to note that IO signals from DDCMIS/PLC sub-vendor drawing/documents like Hard Wired Signals like Cooling Fan fail alarm, 230 V AC/24 V DC convertor ail alarm, 24 V DC under voltage alarm, 24 V DC over voltage alarm, loss of UPS power supply feeder alarm &	Please note that Controls for STP are not PLC based. DDCMIS based controls have been envisaged. The signals related to DDCMIS panels shall be taken care by EDN in line with Main Plant DDCMIS.	Follow the contract specification irrespective of change of type of control system.	Please find the replies below: 1) Cooling Fan fail alarm – The signal is not applicable, in line with main plant DCS. 2) 230 V AC/24 V DC convertor fail alarm – PSS, PSF FAIL Signal is considered in DCS. 3) 24 V DC under voltage alarm – The output of PSS and PSF are 24V regulated, any	Follow the contract specification irrespective of change of type of control system.	The said IOs are indicated in revised list.	Noted.	--

□N□□	C□□ □ □□□□ d□d □□11□1□	□□EL □□□□□ d□d 7□1□1□	C□□ □ □□□□	□□EL □□□□□	C□□ □ □□□□	□□EL □□□□□	C□□ □ □□□□	□□EL □□□□□
	Flame & Smoke detector alarm etc. shall also be included by BHEL in the I/O list.			discrepancy will trigger PSS/PSF fail alarm. 4) 24 V DC over voltage alarm - The output of PSS and PSF are 24V regulated, any discrepancy will trigger PSS/PSF fail alarm. 5) Loss of UPS power supply feeder alarm - Loss of feeder supply - FDR1 not available, FDR2 not available are considered in DCS. 6) Flame & Smoke detector alarm - No smoke detector is envisaged in the panel. Hence, no IO is considered. This IO list is for process signals. All the above mentioned applicable signals shall be considered by EDN in DDCMIS.				
10□	BHEL to include a note that the spare capacity/requirements shall be in line with technical specification, vol. V, cl. No. 4.03.11	Note has been added in the revised I/O List.	Noted.	Point closed	--	Point closed	--	--
11□	BHEL have not considered signals for PCC, BUS coupler, Incomer, breakers etc. in the I/O list. BHEL to note that Control & monitoring of electrical	Please note that no electrical signal exchange is envisaged between STP Switchboard #OWC and DCS. This is as per Analog I/O List for electrical System (Doc no.PE-DC-412-510-E151) & Binary I/O List for electrical System (Doc no.PE-DC-412-510-E152).	Please clarify, where the required HW signal exchange for control and operation of electrical system shall be implemented.	STP Switchboard #OWC is a non-breaker board. Hence remote operation from DCS and electrical signal exchange between STP Switchboard #OWC and DCS are not envisaged. This is as per Analog I/O	Electrical I/O list are not approved yet. Complete signals shall be included as per comment.	As per MOM held at PEM between BHEL, TANGEDCO, DESEIN, dated 25/04/17-26/04/17 - Annexure 3 point no. 13 - No remote control & feedback is	Noted.	--

□N□□	C□□ □ □□□□d□d □□11□1□	□□EL □□□□□d□d 7□1□1□	C□□ □ □□□□	□□EL □□□□□	C□□ □ □□□□	□□EL □□□□□	C□□ □ □□□□	□□EL □□□□□
	distribution system, namely PCC, Bus coupler, Incomer, breakers etc. for this plant shall be controlled from its PLC operating station as well as from respective switchgear unit. Hence AI for monitoring of voltage, current, Kwh, power factor shall be provided in PLC.			List for electrical System (Doc no.PE-DC-412-510-E151) & Binary I/O List for electrical System (Doc no.PE-DC-412-510-E152).		envisaged for MCCB. Hence remote operation from DCS and electrical signal exchange between STP Switchboard #OWC and DCS are not indicated in IO list.		
1□□	Ammeter current signal for all motors above and equal to 30 KW rating and important drive below 30 KW rating shall be included in the IO list in line with Vol. V, Cl. No. 3.03.48.	Please note that there are no drives above or equal to 30KW. Further there are no critical drives applicable for STP Package. In view of the same no current feedback is envisaged.	Comment is applicable for each type of Feed pump and sludge transfer pumps.	Please note that the Feed pump and sludge transfer pumps are of less than 30 KW rating. Hence the ammeter current signals are not included.	Ammeter current signal for important drive below 30 KW rating shall be included in the IO list in line with Vol. V, Cl. No. 3.03.48.	In sewage treatment plant, there is no critical/important drive below 30 KW from process point of view. Accordingly no current feedback signal is indicated in IO list.	Comment is applicable for each type of Feed pump and sludge transfer pumps being critical/important drive below 30 KW from process point of view.	Current feedback signal is indicated for filter feed pumps, MBBR feed pumps and treated water disposal pumps in revised document.
13□	Voltmeter for Incomer shall be included. Hence, IO list shall be revised accordingly.	Refer reply for Sl no.11	Please clarify, where the required HW signal exchange for control and operation of electrical system shall be implemented.	STP Switchboard #OWC is a non-breaker board. Hence remote operation from DCS and electrical signal exchange between STP Switchboard #OWC and DCS are not envisaged. This is as per Analog I/O List for electrical System (Doc no.PE-DC-412-510-E151) & Binary I/O List for electrical System (Doc no.PE-DC-412-510-E152).	Electrical I/O list are not approved yet. Complete signals shall be included as per comment.	Please refer reply against point no. 11	Noted.	--
14□	I/O redundancy shall be considered as per specification, Vol. V, Chapter 4.	Noted.	Please include the suitable note as per comment. Moreover redundancy of signals shall be identified in the list.	Note regarding same is included in document under	Note # 3 is not as per comment.	Note is modified as per the comment in	Noted.	--

□N□□	C□□ □ □□□□d□d □□11□1□	□□EL □□□□□d□d 7□1□1□	C□□ □ □□□□	□□EL □□□□□	C□□ □ □□□□	□□EL □□□□□	C□□ □ □□□□	□□EL □□□□□
				heading 'Note' at point no. 3		revised IO list.		
1□□	BHEL to ensure that complete Electrical Signals and Interfacing signals shall be included in the I/O List in line with final approved sub-Vendor drgs/documents.	For electrical signals refer reply against serial no 11. Other interfacing signals have been taken care in the I/O List.	Please clarify, where the required HW signal exchange for control and operation of electrical system shall be implemented.	STP Switchboard #OWC is a non-breaker board. Hence remote operation from DCS and electrical signal exchange between STP Switchboard #OWC and DCS are not envisaged. This is as per Analog I/O List for electrical System (Doc no.PE-DC-412-510-E151) & Binary I/O List for electrical System (Doc no.PE-DC-412-510-E152).	Electrical I/O list are not approved yet. Complete signals shall be included as per comment.	Please refer reply against point no. 11	Noted.	--
Add□□□□□□□□□□□□								
16□	--	Type of instrument for FLOW AT DMF INLET & FLOW AT ACF INLET updated in line with comment /confirmation on P&ID.	Noted.	Point closed	--	Point closed	--	--
17□	--	Range of instrument corrected to 0-625mm from 0-6000mm as per system/tank dimensions (tank ht 625mm) for NaOCL DOSING TANK DT-01 LEVEL & NaOCL DOSING TANK DT-02 LEVEL	Noted.	Point closed	--	Point closed	--	--

FIRST ANGLE PROJECTION (ALL DIMENSIONS ARE IN MM)

REV	DATE	ALTERED: SK	REV	DATE	ALTERED
0–A	14.05.18	CHECKED: KBP			CHECKED

STATUS : CONTRACT

JOB NO.: 412

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

TAMILNADU GENERATION AND DISTRIBUTION CORP. LTD.(TANGEDCO)

CONSULTANT: DESEIN PVT LTD, NEW DELHI.

BHARAT HEAVY ELECTRICALS LIMITED
PROJECTS ENGINEERING MANAGEMENT,NOIDA

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

I/O LIST (ANALOG & BINARY) CUM DRIVE LIST FOR STP

	NAME	SIGN	DATE
PREP	SK		19.06.19
CHKD	KBP		
APPD	PK		

DEPT.							CARD CODE	DRAWING NO.	REV
SIGN			N.A.				230	PE–V0–412–673–A038	04
DATE								NO. OF SHEETS EXCLUDING COVER PAGE	

TITLE	**I/O LIST (ANALOG & BINARY) CUM DRIVE LIST FOR STP**
PROJECT NAME	**2X660 MW ENNORE SEZ STPP**
CLIENT	**TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.**
CONSULTANT	**DESEIN PVT. LTD, NEW DELHI**
EPC CONTRACTOR	**BHEL (BHARAT HEAVY ELECTRICALS LTD.)**
DOCUMENT NO	**PE-V0-412-673-A038 Rev 04**

NOTES:

1	IO LIST CONTAINS I/Os OF FIELD CONTACTS/SIGNALS TO BE CONNECTED TO DDCMIS. IN ADDITION TO THIS FOLLOWING I/O's SHALL ALSO BE PROVIDED :- ALL SIGNALS i.e. COMMANDS/FEEDBACKS BETWEEN DCS AND MCC/ SOLENOID OPTD DRIVES/ELECTRICAL ACTUATOR/DRIVE/RELAY PANEL AS SHOWN IN **DRIVE CONTROL PHILOSOPHY, DRG NO. PE-DM-412-145-I002** FOR ALL THE DRIVES INDICATED IN DRIVE LIST OF STP PLANT.
2	FIRST UNIT KKS TAGS TO BE READ WITH PREFIX '10' AND SECOND UNIT TAG NOS. TO BE READ WITH PREFIX '20'. KKS TAG FOR SYSTEMS COMMON TO BOTH UNITS TO BE READ WITH PREFIX '90'.
3	I/O REDUNDANCY SHALL BE CONSIDERED AS PER SPECIFICATION, VOL. V, CHAPTER 4.

LEGEND:

1	STP	SEWAGE TREATMENT PLANT
2	CHP	COAL HANDLING PLANT
3	CWPH	COOLING WATER PUMP HOUSE
4	BUP	BACKUP CONTROL DESK
5	LT	LEVEL TRANSMITTER
6	PT	PRESSURE TRANSMITTER
7	FT	FLOW TRANSMITTER
8	TT	TEMPERATURE TRANSMITTER
9	DPT	DP TRANSMITTER
10	AT	ANALYSER TRANSMITTER
11	pHT	pH ANALYSER TRANSMITTER
12	TurbT	TURBIDITY ANALYSER TRANSMITTER
13	LTUD	LOW TENSION UNIDIRECTIONAL DRIVE
14	SOL-S	SOLENOID DRIVE-SINGLE COIL

TITLE	**I/O LIST (ANALOG & BINARY) CUM DRIVE LIST FOR STP**
PROJECT NAME	**2X660 MW ENNORE SEZ STPP**
CLIENT	**TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.**
CONSULTANT	**DESEIN PVT. LTD, NEW DELHI**
EPC CONTRACTOR	**BHEL (BHARAT HEAVY ELECTRICALS LTD.)**
DOCUMENT NO	**PE-V0-412-673-A038**

DRIVE LIST

□N□□	□□EL D□ □ NO□	D□ □□NAME	□□□ NO	□A□ NO□	DE□C□P□□ON	D□□E □□PE	A□EA	CON□□OL □COPE	□EMA□□□
1	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS10AA201	V-165	FILTER FEED PUMP P-07A/B OUTLET VLV	SOL-S	STP PLANT	STP DDCMIS	COIL VOLTAGE 24VDC
2	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB01AA201	V-166	DMF FEED INLET VLV	SOL-S	STP PLANT	STP DDCMIS	COIL VOLTAGE 24VDC
3	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB01AA202	V-167	DMF BACKWASH INLET VALVE	SOL-S	STP PLANT	STP DDCMIS	COIL VOLTAGE 24VDC
4	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB01AA203	V-168	DMF BACKWASH OUTLET VALVE	SOL-S	STP PLANT	STP DDCMIS	COIL VOLTAGE 24VDC
5	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB01AA204	V-169	DMF DRAIN / RINSE OUTLET VLV	SOL-S	STP PLANT	STP DDCMIS	COIL VOLTAGE 24VDC
6	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB01AA205	V-170	DMF FEED OUTLET VLV	SOL-S	STP PLANT	STP DDCMIS	COIL VOLTAGE 24VDC
7	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB01AA206	V-171	DMF VENT VLV	SOL-S	STP PLANT	STP DDCMIS	COIL VOLTAGE 24VDC
8	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS10AA202	V-176	DMF OUTLET VLV	SOL-S	STP PLANT	STP DDCMIS	COIL VOLTAGE 24VDC
9	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB02AA201	V-177	ACF FEED INLET VLV	SOL-S	STP PLANT	STP DDCMIS	COIL VOLTAGE 24VDC
10	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB02AA202	V-178	ACF BACKWASH INLET VALVE	SOL-S	STP PLANT	STP DDCMIS	COIL VOLTAGE 24VDC
11	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB02AA203	V-179	ACF BACKWASH OUTLET VALVE	SOL-S	STP PLANT	STP DDCMIS	COIL VOLTAGE 24VDC
12	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB02AA204	V-180	ACF DRAIN / RINSE OUTLET VLV	SOL-S	STP PLANT	STP DDCMIS	COIL VOLTAGE 24VDC
13	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB02AA205	V-181	ACF FEED OUTLET VLV	SOL-S	STP PLANT	STP DDCMIS	COIL VOLTAGE 24VDC
14	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB02AA206	V-182	ACF VENT VLV	SOL-S	STP PLANT	STP DDCMIS	COIL VOLTAGE 24VDC
15	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRN01AM001	AG-01	NaOCL DOSING TANK DT-01 AGITATOR	LTUD	STP PLANT	STP DDCMIS	
16	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRN01AM001	AG-02	NaOCL DOSING TANK DT-02 AGITATOR	LTUD	STP PLANT	STP DDCMIS	
17	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRC01AN001	B-01A	AIR BLWR-1A FOR CCS ,EQT & SHT	LTUD	STP PLANT	STP DDCMIS	
18	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRC01AN002	B-01B	AIR BLWR-1B FOR CCS ,EQT & SHT	LTUD	STP PLANT	STP DDCMIS	
19	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRC02AN001	B-02A	AIR BLWR-2A FOR MBBR	LTUD	STP PLANT	STP DDCMIS	
20	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRC02AN002	B-02B	AIR BLWR-2B FOR MBBR	LTUD	STP PLANT	STP DDCMIS	
21	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS08AP001	P-07A	FILTER FEED PUMP-A	LTUD	STP PLANT	STP DDCMIS	
22	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS09AP001	P-07A	FILTER FEED PUMP-B	LTUD	STP PLANT	STP DDCMIS	
23	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS12AP001	P-08A	TREATED WATER DISPOSAL PUMP-A	LTUD	STP PLANT	STP DDCMIS	
24	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS13AP001	P-08B	TREATED WATER DISPOSAL PUMP-B	LTUD	STP PLANT	STP DDCMIS	

TITLE	**I/O LIST (ANALOG & BINARY) CUM DRIVE LIST FOR STP**
PROJECT NAME	**2X660 MW ENNORE SEZ STPP**
CLIENT	**TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.**
CONSULTANT	**DESEIN PVT. LTD, NEW DELHI**
EPC CONTRACTOR	**BHEL (BHARAT HEAVY ELECTRICALS LTD.)**
DOCUMENT NO	**PE-V0-412-673-A038**

DRIVE LIST

□N□□	□□EL D□ □ NO□	D□ □□NAME	□□□ NO	□A□ NO□	DE□C□P□□ON	D□□E □□PE	A□EA	CON□□OL □COPE	□EMA□□□
25	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS01AP001	P-01A	SEWAGE TRANSFER PUMP-1A	LTUD	CHP PLANT	CHP DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN CHP CONTROL ROOM NEAR CRUSHER HOUSE
26	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS01AP002	P-01B	SEWAGE TRANSFER PUMP-1B	LTUD	CHP PLANT	CHP DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN CHP CONTROL ROOM NEAR CRUSHER HOUSE
27	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS02AP001	P-02A	SEWAGE TRANSFER PUMP-2A	LTUD	NEAR CWPH	CWPH DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN CWPH CONTROL ROOM
28	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS02AP002	P-02B	SEWAGE TRANSFER PUMP-2B	LTUD	NEAR CWPH	CWPH DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN CWPH CONTROL ROOM
29	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS03AP001	P-03A	SEWAGE TRANSFER PUMP-3A	LTUD	NEAR RODM PLANT	RODM DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN RODM CONTROL ROOM
30	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS03AP002	P-03B	SEWAGE TRANSFER PUMP-3B	LTUD	NEAR RODM PLANT	RODM DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN RODM CONTROL ROOM
31	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS04AP001	P-04A	SEWAGE TRANSFER PUMP-4A	LTUD	TG BUILDING	MAIN PLANT DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN MAIN PLANT CONTROL ROOM
32	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS04AP002	P-04B	SEWAGE TRANSFER PUMP-4B	LTUD	TG BUILDING	MAIN PLANT DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN MAIN PLANT CONTROL ROOM
33	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS05AP001	P-05A	COMMON COLLECTION SUMP PUMP-A	LTUD	STP PLANT	STP DDCMIS	
34	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS05AP002	P-05B	COMMON COLLECTION SUMP PUMP-B	LTUD	STP PLANT	STP DDCMIS	
35	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS06AP001	P-06A	MBBR FEED PUMP-A	LTUD	STP PLANT	STP DDCMIS	
36	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS06AP002	P-06B	MBBR FEED PUMP-B	LTUD	STP PLANT	STP DDCMIS	
37	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS15AP001	P-09A	SLUDGE TRANSFER PUMP-A	LTUD	STP PLANT	STP DDCMIS	
38	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS15AP002	P-09B	SLUDGE TRANSFER PUMP-B	LTUD	STP PLANT	STP DDCMIS	
39	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRN01AP001	DP-01	NaOCL DOSING PUMP-1	LTUD	STP PLANT	STP DDCMIS	
40	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRN02AP001	DP-02	NaOCL DOSING PUMP-2	LTUD	STP PLANT	STP DDCMIS	
41	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS16AP001		CENTRIFUGE MOTOR	LTUD	STP PLANT	STP DDCMIS	
42	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRN03AP001	DP-03	POLYELECTROLYTE DOSING PUMP	LTUD	STP PLANT	STP DDCMIS	
43	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRN03AM001	AG-03	POLYELECTROLYTE DOSING TANK AGITATOR	LTUD	STP PLANT	STP DDCMIS	
45	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS15AA202	V-234	FLUSHING VALVE	SOL-S	STP PLANT	STP DDCMIS	COIL VOLTAGE 24VDC

TITLE	**I/O LIST (ANALOG & BINARY) CUM DRIVE LIST FOR STP**
PROJECT NAME	**2X660 MW ENNORE SEZ STPP**
CLIENT	**TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.**
CONSULTANT	**DESEIN PVT. LTD, NEW DELHI**
EPC CONTRACTOR	**BHEL (BHARAT HEAVY ELECTRICALS LTD.)**
DOCUMENT NO	**PE-V0-412-673-A038**

BINARY IO LIST

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1	PE-V0-412-673-A040	CONTROL SCHEME FOR STP	90GRN03CL001	POLYELECTROLYTE DOSING TANK LEVEL	LS	LOW	NC	FIELD	STP DDCMIS	
2	--	UPS SYSTEM FOR STP	90BRV41EH201	UPS -1 RECTIFIER-1	--	TRIPPED	NO	UPS PNL	STP DDCMIS	
3	--	UPS SYSTEM FOR STP	90BRV41EH202	UPS -1 RECTIFIER-2	--	TRIPPED	NO	UPS PNL	STP DDCMIS	
4	--	UPS SYSTEM FOR STP	90BRV41EH203	UPS -1 INVERTER-1	--	TRIPPED	NO	UPS PNL	STP DDCMIS	
5	--	UPS SYSTEM FOR STP	90BRV41EH204	UPS -1 INVERTER-2	--	TRIPPED	NO	UPS PNL	STP DDCMIS	
6	--	UPS SYSTEM FOR STP	90BRV41EH205	UPS -1 BATTERY-1 LOW	--	TRUE	NO	UPS PNL	STP DDCMIS	
7	--	UPS SYSTEM FOR STP	90BRV41EH206	UPS -1 BATTERY-2 LOW	--	TRUE	NO	UPS PNL	STP DDCMIS	
8	--	UPS SYSTEM FOR STP	90BRV41EH207	UPS -1 LOAD ON STATIC BYPASS	--	TRUE	NO	UPS PNL	STP DDCMIS	
9	--	UPS SYSTEM FOR STP	90BRV41EH208	UPS -1 STATIC BYPASS FAILED	--	TRUE	NO	UPS PNL	STP DDCMIS	
10	--	UPS SYSTEM FOR STP	90BRV41EH209	UPS -1 INVERTER OFF OR FAILED	--	TRUE	NO	UPS PNL	STP DDCMIS	
11	--	UPS SYSTEM FOR STP	90BRV41EH210	UPS -1 FAN TRIPPED	--	TRUE	NO	UPS PNL	STP DDCMIS	
12	--	UPS SYSTEM FOR STP	90BRV41EH211	UPS ACDB-1 INCOMER TRIPPED	--	TRUE	NO	UPS PNL	STP DDCMIS	
13	--	UPS SYSTEM FOR STP	90BRV42EH211	UPS ACDB-2 INCOMER TRIPPED	--	TRUE	NO	UPS PNL	STP DDCMIS	
14	--	UPS SYSTEM FOR STP	90BRV42EH201	UPS -2 RECTIFIER-1	--	TRIPPED	NO	UPS PNL	STP DDCMIS	
15	--	UPS SYSTEM FOR STP	90BRV42EH202	UPS -2 RECTIFIER-2	--	TRIPPED	NO	UPS PNL	STP DDCMIS	
16	--	UPS SYSTEM FOR STP	90BRV42EH203	UPS -2 INVERTER-1	--	TRIPPED	NO	UPS PNL	STP DDCMIS	
17	--	UPS SYSTEM FOR STP	90BRV42EH204	UPS -2 INVERTER-2	--	TRIPPED	NO	UPS PNL	STP DDCMIS	
18	--	UPS SYSTEM FOR STP	90BRV42EH205	UPS -2 BATTERY-1 LOW	--	TRUE	NO	UPS PNL	STP DDCMIS	
19	--	UPS SYSTEM FOR STP	90BRV42EH206	UPS -2 BATTERY-2 LOW	--	TRUE	NO	UPS PNL	STP DDCMIS	
20	--	UPS SYSTEM FOR STP	90BRV42EH207	UPS -2 LOAD ON STATIC BYPASS	--	TRUE	NO	UPS PNL	STP DDCMIS	
21	--	UPS SYSTEM FOR STP	90BRV42EH208	UPS -2 STATIC BYPASS FAILED	--	TRUE	NO	UPS PNL	STP DDCMIS	
22	--	UPS SYSTEM FOR STP	90BRV42EH209	UPS -2 INVERTER OFF OR FAILED	--	TRUE	NO	UPS PNL	STP DDCMIS	
23	--	UPS SYSTEM FOR STP	90BRV42EH210	UPS -2 FAN TRIPPED	--	TRUE	NO	UPS PNL	STP DDCMIS	
24	--	UPS SYSTEM FOR STP	90BRV40EH201	COOLING FAN FAIL		TRUE	NO	UPS PNL	STP DDCMIS	

TITLE	**I/O LIST (ANALOG & BINARY) CUM DRIVE LIST FOR STP**
PROJECT NAME	**2X660 MW ENNORE SEZ STPP**
CLIENT	**TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.**
CONSULTANT	**DESEIN PVT. LTD, NEW DELHI**
EPC CONTRACTOR	**BHEL (BHARAT HEAVY ELECTRICALS LTD.)**
DOCUMENT NO	**PE-V0-412-673-A038**

BINARY IO LIST

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25	--	UPS SYSTEM FOR STP	90BRV40EH202	230 V AC/24 V DC CONVERTOR FAIL		TRUE	NO		STP DDCMIS	
26	--	UPS SYSTEM FOR STP	90BRV40EH203	24 V DC UNDER VOLTAGE		TRUE	NO		STP DDCMIS	
27	--	UPS SYSTEM FOR STP	90BRV40EH204	24 V DC OVER VOLTAGE		TRUE	NO		STP DDCMIS	
28	--	UPS SYSTEM FOR STP	90BRV40EH205	LOSS OF UPS POWER SUPPLY FEEDER		TRUE	NO	UPS PNL	STP DDCMIS	
29	--	UPS SYSTEM FOR STP	90BRV40EH206	FLAME & SMOKE DETECTOR		TRUE	NO		STP DDCMIS	

TITLE	**I/O LIST (ANALOG & BINARY) CUM DRIVE LIST FOR STP**
PROJECT NAME	**2X660 MW ENNORE SEZ STPP**
CLIENT	**TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.**
CONSULTANT	**DESEIN PVT. LTD, NEW DELHI**
EPC CONTRACTOR	**BHEL (BHARAT HEAVY ELECTRICALS LTD.)**
DOCUMENT NO	**PE-V0-412-673-A038**

ANALOG IO LIST

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1	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS01CL001	SEWAGE SUMP S-01 LEVEL	LT	ULTRASONIC	0-5000	mm	4-20 mA	FIELD	CHP DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN CHP CONTROL ROOM NEAR CRUSHER HOUSE
2	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS01CL002	SEWAGE SUMP S-01 LEVEL	LT	ULTRASONIC	0-5000	mm	4-20 mA	FIELD	CHP DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN CHP CONTROL ROOM NEAR CRUSHER HOUSE
3	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS02CL001	SEWAGE SUMP S-02 LEVEL	LT	ULTRASONIC	0-5000	mm	4-20 mA	FIELD	CWPH DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN CWPH CONTROL ROOM
4	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS02CL002	SEWAGE SUMP S-02 LEVEL	LT	ULTRASONIC	0-5000	mm	4-20 mA	FIELD	CWPH DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN CWPH CONTROL ROOM
5	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS03CL001	SEWAGE SUMP S-03 LEVEL	LT	ULTRASONIC	0-5000	mm	4-20 mA	FIELD	RODM DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN RODM CONTROL ROOM
6	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS03CL002	SEWAGE SUMP S-03 LEVEL	LT	ULTRASONIC	0-5000	mm	4-20 mA	FIELD	RODM DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN RODM CONTROL ROOM
7	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS04CL001	SEWAGE SUMP S-04 LEVEL	LT	ULTRASONIC	0-5000	mm	4-20 mA	FIELD	MAIN PLANT DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN MAIN PLANT CONTROL ROOM
8	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS04CL002	SEWAGE SUMP S-04 LEVEL	LT	ULTRASONIC	0-5000	mm	4-20 mA	FIELD	MAIN PLANT DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN MAIN PLANT CONTROL ROOM
9	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS01CP001	SEWAGE TRANSFER PUMP P-01A/B DISCH HDR PR	PT	DIAPHRAGM	0-10	kg/cm2	4-20 mA	FIELD	CHP DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN CHP CONTROL ROOM NEAR CRUSHER HOUSE
10	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS01CP002	SEWAGE TRANSFER PUMP P-01A/B DISCH HDR PR	PT	DIAPHRAGM	0-10	kg/cm2	4-20 mA	FIELD	CHP DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN CHP CONTROL ROOM NEAR CRUSHER HOUSE
11	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS02CP001	SEWAGE TRANSFER PUMP P-02A/B DISCH HDR PR	PT	DIAPHRAGM	0-10	kg/cm2	4-20 mA	FIELD	CWPH DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN CWPH CONTROL ROOM
12	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS02CP002	SEWAGE TRANSFER PUMP P-02A/B DISCH HDR PR	PT	DIAPHRAGM	0-10	kg/cm2	4-20 mA	FIELD	CWPH DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN CWPH CONTROL ROOM
13	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS03CP001	SEWAGE TRANSFER PUMP P-03A/B DISCH HDR PR	PT	DIAPHRAGM	0-10	kg/cm2	4-20 mA	FIELD	RODM DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN RODM CONTROL ROOM
14	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS03CP002	SEWAGE TRANSFER PUMP P-03A/B DISCH HDR PR	PT	DIAPHRAGM	0-10	kg/cm2	4-20 mA	FIELD	RODM DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN RODM CONTROL ROOM
15	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS04CP001	SEWAGE TRANSFER PUMP P-04A/B DISCH HDR PR	PT	DIAPHRAGM	0-10	kg/cm2	4-20 mA	FIELD	MAIN PLANT DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN MAIN PLANT CONTROL ROOM
16	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS04CP002	SEWAGE TRANSFER PUMP P-04A/B DISCH HDR PR	PT	DIAPHRAGM	0-10	kg/cm2	4-20 mA	FIELD	MAIN PLANT DDCMIS	TO BE ACQUIRED IN DDCMIS PANEL IN MAIN PLANT CONTROL ROOM
17	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS05CL001	COMMON COLLECTION SUMP LEVEL	LT	ULTRASONIC	0-3000	mm	4-20 mA	FIELD	STP DDCMIS	
18	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS05CL002	COMMON COLLECTION SUMP LEVEL	LT	ULTRASONIC	0-3000	mm	4-20 mA	FIELD	STP DDCMIS	
19	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS05CP001	COMMON COLLECTION SUMP PUMP P-05A/B DISCH HDR PR	PT	DIAPHRAGM	0-4	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
20	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS05CP002	COMMON COLLECTION SUMP PUMP P-05A/B DISCH HDR PR	PT	DIAPHRAGM	0-4	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
21	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS06CL001	EQUALIZATION TANK LEVEL	LT	ULTRASONIC	0-3200	mm	4-20 mA	FIELD	STP DDCMIS	
22	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS06CL002	EQUALIZATION TANK LEVEL	LT	ULTRASONIC	0-3200	mm	4-20 mA	FIELD	STP DDCMIS	
23	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS06CP001	MBBR FEED PUMP P-06A/B DISCH HDR PR	PT	DIAPHRAGM	0-4	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
24	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS06CP002	MBBR FEED PUMP P-06A/B DISCH HDR PR	PT	DIAPHRAGM	0-4	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
25	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS07CL001	HYPO CONTACT(HC)/FILTER FEED TANK(FFT) LEVEL	LT	ULTRASONIC	0-2000	mm	4-20 mA	FIELD	STP DDCMIS	
26	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS07CL002	HYPO CONTACT(HC)/FILTER FEED TANK(FFT) LEVEL	LT	ULTRASONIC	0-2000	mm	4-20 mA	FIELD	STP DDCMIS	
27	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS10CP001	FILTER FEED PUMP P-07A/B DISCH HDR PR	PT	DIAPHRAGM	0-6	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
28	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS10CP002	FILTER FEED PUMP P-07A/B DISCH HDR PR	PT	DIAPHRAGM	0-6	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
29	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS10CF001	FLOW AT DMF INLET	FT	Magnetic	0-6	m3/hr	4-20 mA	FIELD	STP DDCMIS	
30	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB01CP001	DP ACROSS DMF	DPT	TRANSMITTER	0-4	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
31	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB01CP002	DP ACROSS DMF	DPT	TRANSMITTER	0-4	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
32	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS10CF002	FLOW AT ACF INLET	FT	Magnetic	0-6	m3/hr	4-20 mA	FIELD	STP DDCMIS	
33	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB02CP001	DP ACROSS ACF	DPT	TRANSMITTER	0-4	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
34	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRB02CP002	DP ACROSS ACF	DPT	TRANSMITTER	0-4	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
35	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS11CL001	TREATED WATER TANK LEVEL	LT	ULTRASONIC	0-3000	mm	4-20 mA	FIELD	STP DDCMIS	
36	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS11CL002	TREATED WATER TANK LEVEL	LT	ULTRASONIC	0-3000	mm	4-20 mA	FIELD	STP DDCMIS	
37	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS14CP001	TREATED WATER DISPOSAL PUMP P-08A/B DISCH HDR PR	PT	DIAPHRAGM	0-4	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
38	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS14CP002	TREATED WATER DISPOSAL PUMP P-08A/B DISCH HDR PR	PT	DIAPHRAGM	0-4	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
39	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS14CF001	TREATED WATER DISPOSAL PUMP P-08A/B DISCH HDR FLOW	FT	Orifice-DP Type	0-6	m3/hr	4-20 mA	FIELD	STP DDCMIS	
40	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS14CQ001	pH AT TREATED WATER DISPOSAL PMP DISCH HDR	pH	pHT	0-14		4-20 mA	FIELD	STP DDCMIS	
41	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS14CQ002	TURBIDITY AT TREATED WATER DISPOSAL PMP DISCH HDR	TURBIDITY	TurbT	0-50	NTU	4-20 mA	FIELD	STP DDCMIS	

TITLE	**I/O LIST (ANALOG & BINARY) CUM DRIVE LIST FOR STP**
PROJECT NAME	**2X660 MW ENNORE SEZ STPP**
CLIENT	**TAMILNADU GENERATION & DISTRIBUTION CORPORATION LTD.**
CONSULTANT	**DESEIN PVT. LTD, NEW DELHI**
EPC CONTRACTOR	**BHEL (BHARAT HEAVY ELECTRICALS LTD.)**
DOCUMENT NO	**PE-V0-412-673-A038**

ANALOG IO LIST

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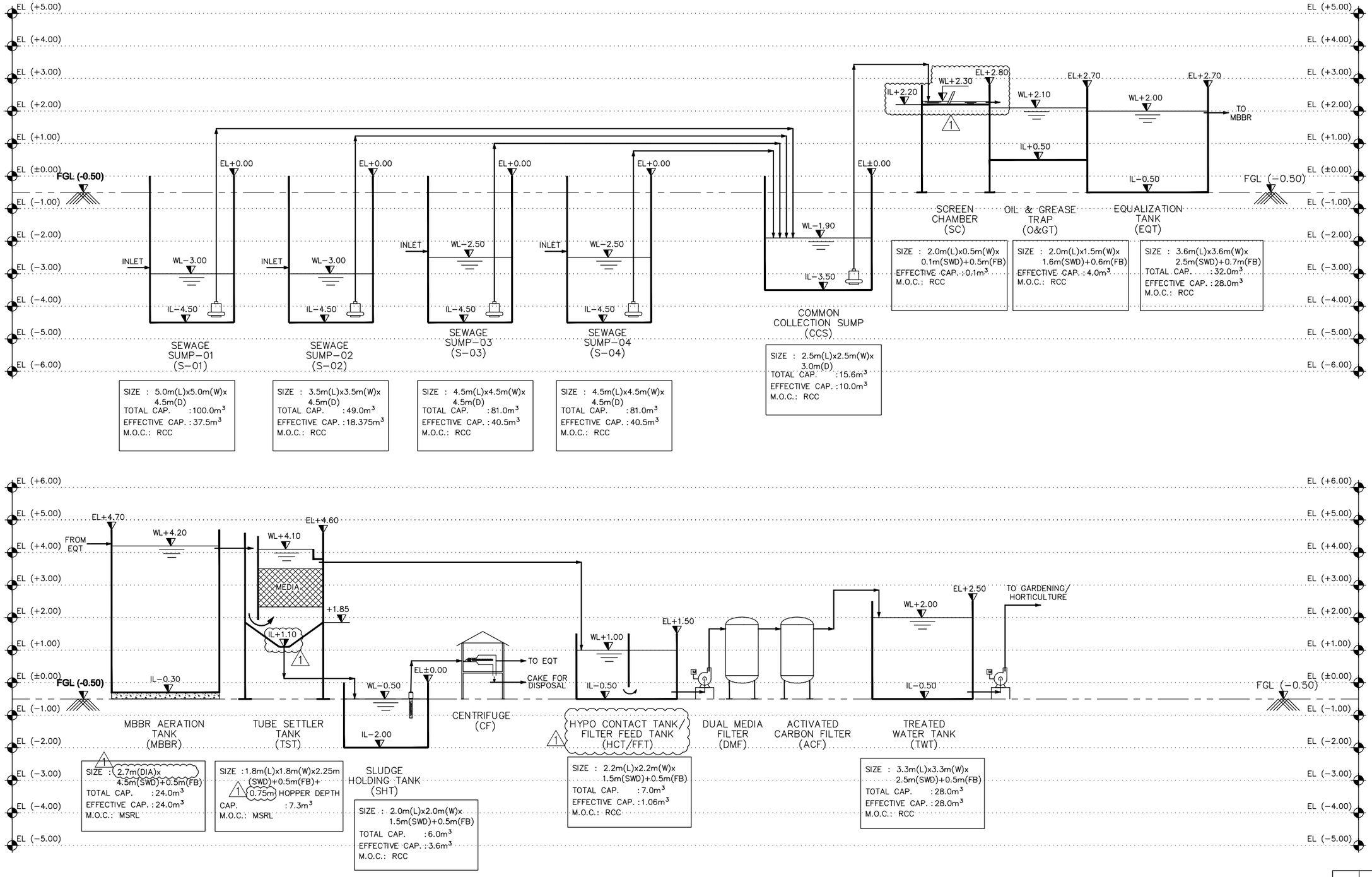
42	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS14CT201	TREATED WATER DISPOSAL PMP DISCH HDR TEMP	TT	TRANSMITTER	0-50	^{O}C	4-20 mA	FIELD	STP DDCMIS	
43	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS15CL001	SLUDGE HOLDING TANK LEVEL	LT	ULTRASONIC	0-2000	mm	4-20 mA	FIELD	STP DDCMIS	
44	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS15CL002	SLUDGE HOLDING TANK LEVEL	LT	ULTRASONIC	0-2000	mm	4-20 mA	FIELD	STP DDCMIS	
45	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS15CP001	SLUDGE TRANSFER PUMP P-09A/B DISCH HDR PR	PT	DIAPHRAGM	0-4	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
46	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS15CP002	SLUDGE TRANSFER PUMP P-09A/B DISCH HDR PR	PT	DIAPHRAGM	0-4	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
47	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRN01CL001	NaOCL DOSING TANK DT-01 LEVEL	LT	ULTRASONIC	0-625	mm	4-20 mA	FIELD	STP DDCMIS	
48	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRN01CL002	NaOCL DOSING TANK DT-01 LEVEL	LT	ULTRASONIC	0-625	mm	4-20 mA	FIELD	STP DDCMIS	
49	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRN01CP001	NaOCL DOSING PUMP DP-01 DISCH PR	PT	DIAPHRAGM	0-4	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
50	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRN01CP002	NaOCL DOSING PUMP DP-01 DISCH PR	PT	DIAPHRAGM	0-4	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
51	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRN02CL001	NaOCL DOSING TANK DT-02 LEVEL	LT	ULTRASONIC	0-625	mm	4-20 mA	FIELD	STP DDCMIS	
52	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRN02CL002	NaOCL DOSING TANK DT-02 LEVEL	LT	ULTRASONIC	0-625	mm	4-20 mA	FIELD	STP DDCMIS	
53	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRN02CP001	NaOCL DOSING PUMP DP-02 DISCH PR	PT	DIAPHRAGM	0-6	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
54	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRN02CP002	NaOCL DOSING PUMP DP-02 DISCH PR	PT	DIAPHRAGM	0-6	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
55	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRC01CP001	AIR BLOWER B-01A/B DISCH HDR PR	PT	DIAPHRAGM	0-1	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
56	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRC01CP002	AIR BLOWER B-01A/B DISCH HDR PR	PT	DIAPHRAGM	0-1	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
57	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRC01CF001	AIR BLOWER B-01A/B DISCH HDR FLOW	FT	Orifice-DP Type	0-60	m3/hr	4-20 mA	FIELD	STP DDCMIS	
58	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRC02CP001	AIR BLOWER B-02A/B DISCH HDR PR	PT	DIAPHRAGM	0-1	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
59	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRC02CP002	AIR BLOWER B-02A/B DISCH HDR PR	PT	DIAPHRAGM	0-1	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
60	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRC02CF001	AIR BLOWER B-02A/B DISCH HDR FLOW	FT	Orifice-DP Type	0-50	m3/hr	4-20 mA	FIELD	STP DDCMIS	
61	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90QFB60CF001	INSTRUMENT AIR TO STP LINE FLOW	FT	Orifice-DP Type	0-25	m3/hr	4-20 mA	FIELD	STP DDCMIS	
62	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90QFB60CP001	INSTRUMENT AIR TO STP LINE PR	PT	DIAPHRAGM	0-10	kg/cm2	4-20 mA	FIELD	STP DDCMIS	
63	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS08CE001	FILTER FEED PUMP-A CURRENT			0-100	%	4-20 mA	MCC	STP DDCMIS	
64	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS09CE001	FILTER FEED PUMP-B CURRENT			0-100	%	4-20 mA	MCC	STP DDCMIS	
65	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS12CE001	TREATED WATER DISPOSAL PUMP-A CURRENT			0-100	%	4-20 mA	MCC	STP DDCMIS	
66	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS13CE001	TREATED WATER DISPOSAL PUMP-B CURRENT			0-100	%	4-20 mA	MCC	STP DDCMIS	
67	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS06CE001	MBBR FEED PUMP-A CURRENT			0-100	%	4-20 mA	MCC	STP DDCMIS	
68	PE-V0-412-673-A001	P & ID FOR SEWAGE TREATMENT PLANT	90GRS06CE002	MBBR FEED PUMP-B CURRENT			0-100	%	4-20 mA	MCC	STP DDCMIS	
69	--	UPS SYSTEM FOR STP	90BRV41EH001	UPS-1 OUTPUT CURRENT			0- 1500	AMP	4-20 mA	UPS PNL	STP DDCMIS	
70	--	UPS SYSTEM FOR STP	90BRV41EH002	UPS-1 OUTPUT VOLTAGE			0-300	VOLT	4-20 mA	UPS PNL	STP DDCMIS	
71	--	UPS SYSTEM FOR STP	90BRV41EH003	UPS-1 OUTPUT FREQ			45-55	Hz	4-20 mA	UPS PNL	STP DDCMIS	
72	--	UPS SYSTEM FOR STP	90BRV42EH001	UPS-2 OUTPUT CURRENT			0- 1500	AMP	4-20 mA	UPS PNL	STP DDCMIS	
73	--	UPS SYSTEM FOR STP	90BRV42EH002	UPS-2 OUTPUT VOLTAGE			0-300	VOLT	4-20 mA	UPS PNL	STP DDCMIS	
74	--	UPS SYSTEM FOR STP	90BRV42EH003	UPS-2 OUTPUT FREQ			45-55	Hz	4-20 mA	UPS PNL	STP DDCMIS	

Document Title: HFD for 75 KLD SEWAGE TREATMENT PLANT

Document No.: PE-V0-412-673-A007

APPROVED

Sr. No.	Customer comments D.669/18 dt.25.09.2018 on Rev-0	Comments	
1	BHEL shall check & justify the sewage collection sump & pump capacities	Kindly refer document PE-DC-412-673-A001 (DESIGN MEMO OF SEWAGE TREATMENT PLANT), where in capacities of sumps and pumps are already discussed and finalised. Details indicated in the P&ID are incorporated accordingly. Kindly accept and clear the document.	
2	BHEL shall guarantee that the sewage tank would not turn into septic and solid deposition would not happen	System in line with Design memorandum based on specification requirement has been provided. Provided system will operate on continuous basis. With proper operation of the system development of septic condition or solid deposition will not occour.	
3	Please check IL of Screen Chamber	Noted & incorporated/ revised.	
4	Please submit sizing calculation of Bio digester & reed bed.	Same shall be furnished in document no PE-V0-412-673-A008 titled PROCESS DESIGN AND SIZING CALCULATION INCLUDING PRESSURE DROP CALCULATIONS (STP)	
5	MOC of Screen chamber to be provided as per Spec. Vol. III P.808, Cl.1.02.	Noted and confirmed compliance to Spec. Vol. III P.808, Cl.1.02. Coarse screen shall be SS 304 fitted with SS 304 frame	
6	MOC of Chlorine contact tank to be provided as per Spec. Vol. III P.810, Cl.1.10.	Kindly note that HCT/FFT MOC shall be of RCC and Hypo dosing tank of HDPE is provided. Kindly accept.	
7	MOC of Sump pumps, Centrifuge pump, Dual Media Filters & Activated Carbon Filter to be provided.	For MOC of Sump pumps, Centrifuge pump, Dual Media Filters & Activated Carbon Filter kindly refer separate documents nos PE-V0-412-673-A011, PE-V0-412-673-A012, PE-V0-412-673-A043.	



HYDRAULIC FLOW DIAGRAM

239

PROJECT	2x660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI
OWNER	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
CONSULTANT	DESEIN PRIVATE LIMITED, DESEIN HOUSE, NEW DELHI
	BHARAT HEAVY ELECTRICALS LIMITED (A GOVERNMENT OF INDIA ENTERPRISE), PROJECTS ENGINEERING MANAGEMENT, NOIDA
	PENNAR ENVIRO, Re-engineering Water, Environment & Energy

DEPT.	CODE	SCALE	WEIGHT(KG)	VENDOR DRAWING NO.	ITEM
---	---	NTS	-	PEL-12171037-PRO-HFD-001	---

TITLE: HFD FOR 75 KLD SEWAGE TREATMENT PLANT

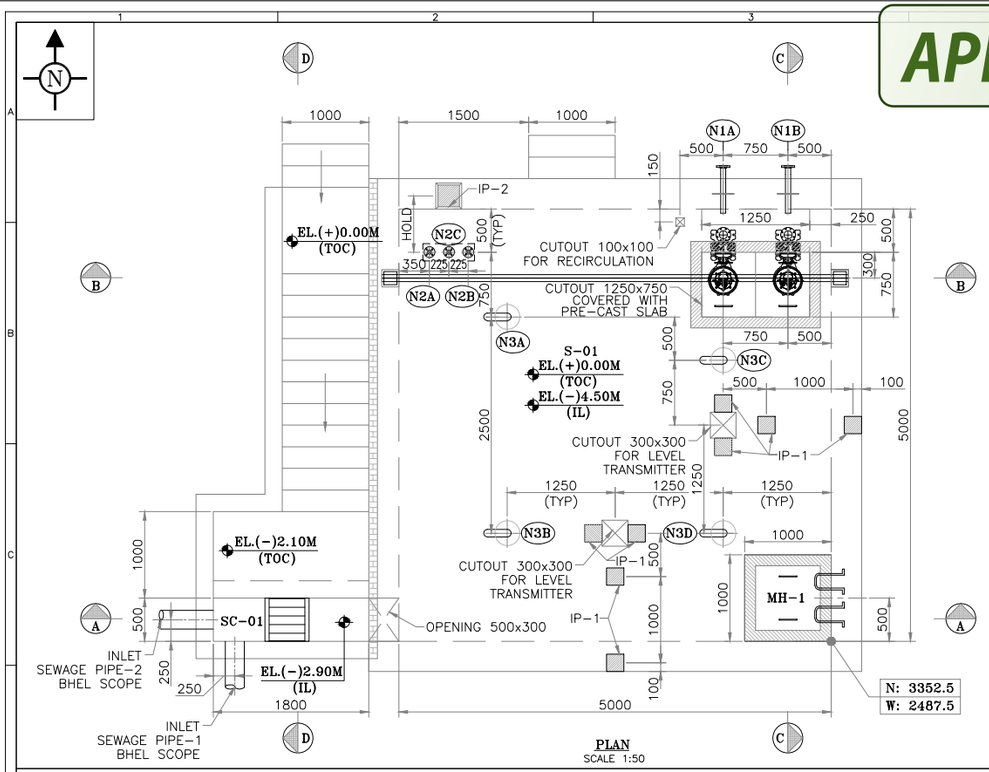
	NAME	SIGN	DATE
PREP	K L N S		17.04.18
CHKD	A S K		17.04.18
CHKD	H E		17.04.18
APPD	H S		17.04.18

DEPT.	CARD CODE	BHEL DRAWING NO.	REV
SIGN	-	PE-VO-412-673-A007	R1
DATE		NO. OF SHEETS : 2	

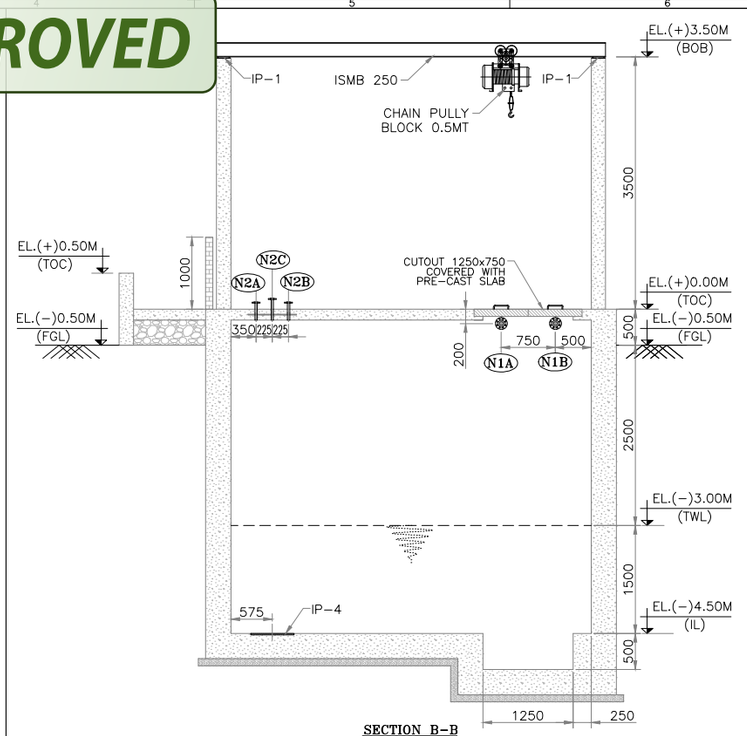
SIZE-A0

REV.	DATE	DESCRIPTION	PAK	KLNR	DSK	---	SR	HP
R1	06.09.18	DRAWING SUBMITTED FOR COMMENT/APPROVAL	PAK	KLNR	DSK	---	SR	HP
R0	17.04.18	DRAWING SUBMITTED FOR COMMENT/APPROVAL	PAK	KLNR	DSK	---	SR	HP

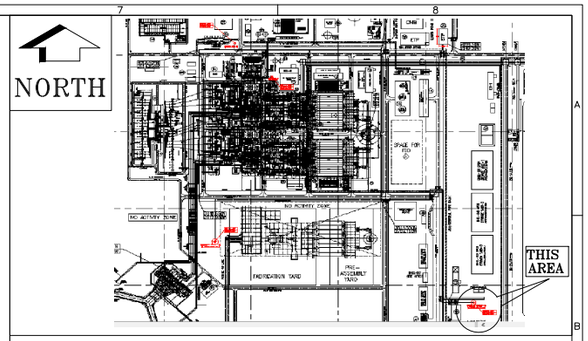
APPROVED



PLAN
SCALE 1:50



SECTION B-B
SCALE 1:60



KEY PLAN

LIST OF CIVIL EQUIPMENTS

TAG.NO	DESCRIPTION	SIZE / CAPACITY.	MOC	QTY.
CS-01	COARSE SCREEN CHAMBER-01	1.8m(L)x0.5(W)x0.8m(D)	RCC	01
S-01	SEWAGE SUMP-01	5.0m(L)x5.0(W)x4.5m(D)	RCC	01

PUDDLE PIPE LIST

MARK NO.	DESCRIPTION	ELEVATION	SIZE	PROJECTION	MOC.	QTY.
N1A/B	OUTLET	CL.EL.(-)0.30M	50NB	150	CS	2NOS.
N2A/B	LEVEL GAUGE	AS PER GA	25NB	100	CS	2NOS.
N2C	LEVEL GAUGE	AS PER GA	25NB	150	CS	1NO.
N3A/B/C/D	VENT	AS PER GA	80NB	AS PER DETAILS	CS	4NOS.

LIST OF INSERT PLATE

IP NO.	DESCRIPTION	SIZE	ELEVATION	QTY.
IP-1	INSERT PALTE-1	200x200x10THK.	AS PER GA.	10
IP-2	INSERT PALTE-2	250x250x10THK.	AS PER GA.	01
IP-3	INSERT PALTE-3	924x30x10THK.	AS PER GA.	04
IP-4	INSERT PALTE-4	600x200x10THK.	AS PER GA.	01

EQUIPMENT LOAD LIST

SL. NO.	TAG.NO.	DESCRIPTION	CAPACITY	QTY.	OPERATING LOAD FOR EACH
1	GRS01-AP001/002	SEWAGE TRANSFER PUMPS	8m3/hr@5.9kg/cm2	2NOS	350kgs

REFERENCE DWG NO:
1. P&I DIAGRAM :- PEL-12171037-PRO-PID-001 / PE-V0-412-673-A001
2. HYDRAULIC DIAGRAM :- PEL-12171037-PRO-HFD-003A
3. PLOT PLAN :- PE-DG-412-100-M001

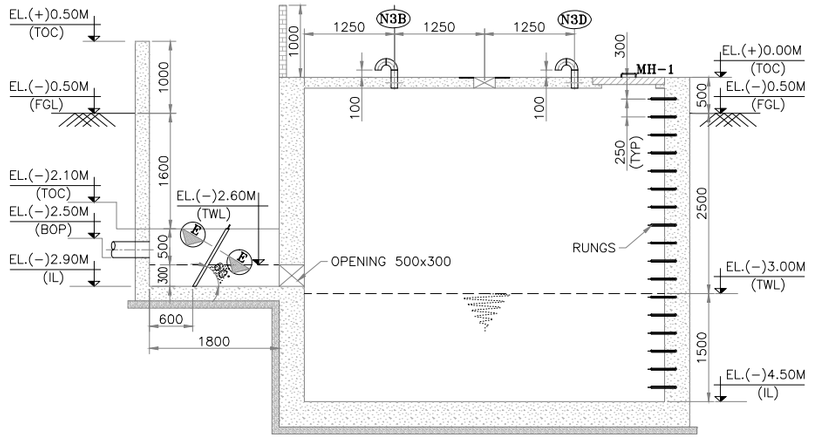
NOTES :-
1. ALL DIMENSIONS ARE IN mm AND LEVELS ARE IN METER UNLESS OTHERWISE NOTED.
2. FGL (-)0.50M.
3. PLANT FINISH GRADED LEVEL (FGL) SHALL BE RL (+) 9.5M. POWER HOUSE (TG BUILDING) FINISH GROUND FLOOR LEVEL IS EL (±)0.00M. WHICH CORR. TO RL (+)10.0M.
4. ALL CIVIL DESIGN & CONSTRUCTION ARE IN CLIENT'S SCOPE.

LEGEND:-

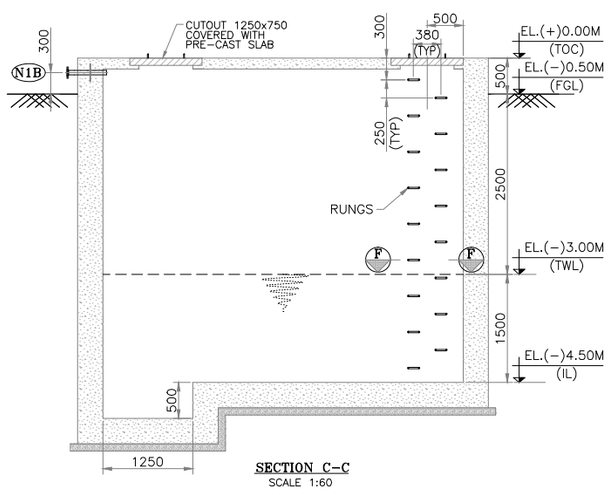
LEVEL / LEVEL — SECTION / FINISHED GROUND LEVEL

TEXT LEGENDS:-

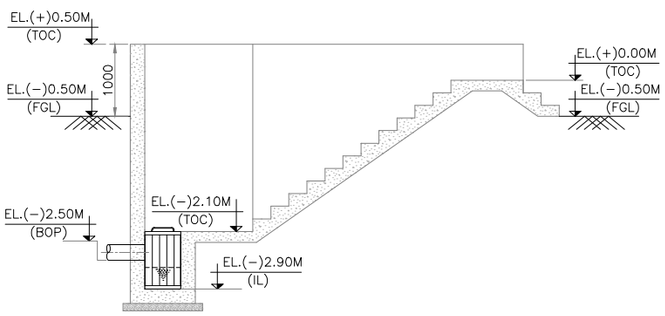
IL	:	INVERT LVL.	BOB	:	BOTTOM OF BEAM.
EL	:	ELEVATION.	TOC	:	TOP OF CONCRETE.
FGL	:	FINISHED GROUND LEVEL.	MH	:	MANHOLE.
TYP	:	TYPICAL.	BOP	:	BOTTOM OF PIPE.
TWL	:	TOP WATER LEVEL.			



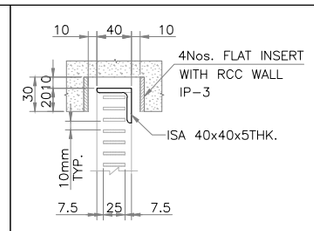
SECTION A-A
SCALE 1:60



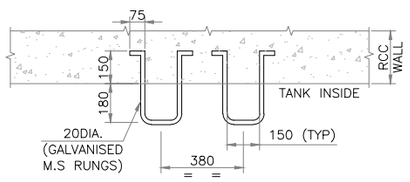
SECTION C-C
SCALE 1:60



SECTION D-D
SCALE 1:60



SECTION E-E
SCALE 1:5



SECTION F-F
(TYP. DETAILS OF RUNGS)
SCALE 1:20

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

OWNER :- TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED

OWNER'S CONSULTANT:- DESEIN PRIVATE LIMITED, DESEIN HOUSE, NEW DELHI

BHARAT HEAVY ELECTRICALS LIMITED (A GOVERNMENT OF INDIA ENTERPRISE), PROJECTS ENGINEERING MANAGEMENT, NOIDA

PENNAR ENVIRO Re-engineering Water, Environment & Energy
Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad – 500 084

DEPT.	CODE	SCALE	WEIGHT (KG)	VENDOR DRAWING NO.	ITEM
--	--	AS SHOWN	-	A2-PEL-1037-GA-001	

TITLE: Mech.GA Drawings of all Sewage sumps & tanks for STP (Part-1)

MECH. G.A. OF SEWAGE SUMP-1

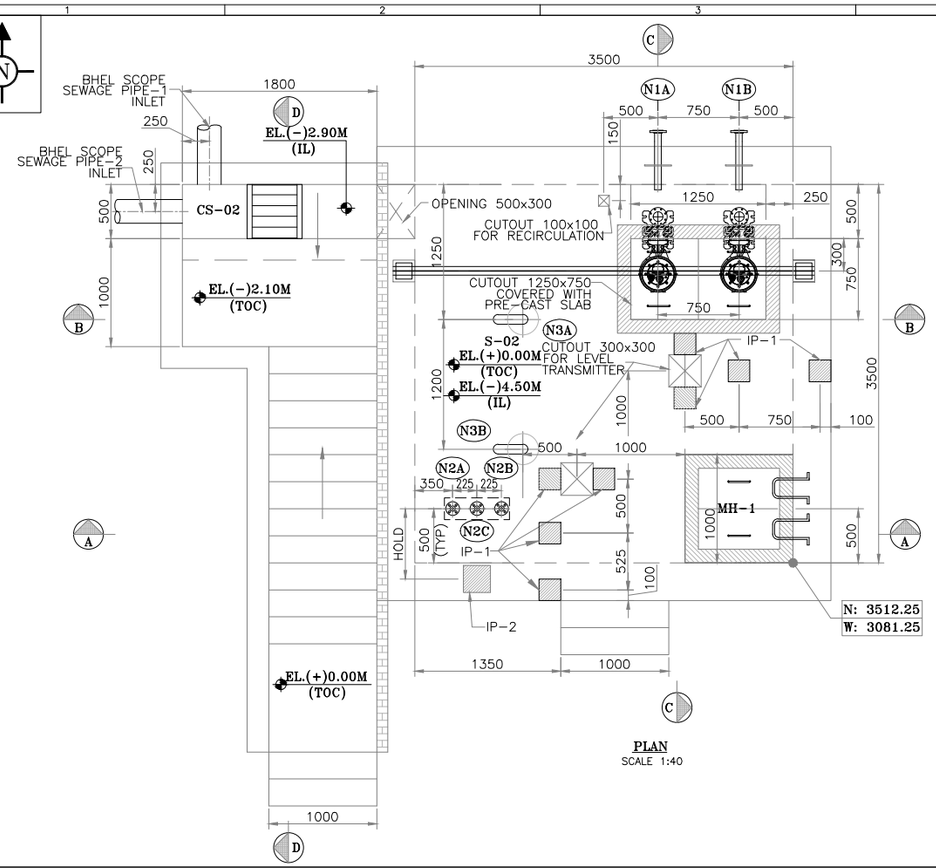
	NAME	SIGN	DATE
PREP	ESN		28.03.2018
CHKD	AJP		28.03.2018
CHKD	ESN		28.03.2018
APPD	PAK		28.03.2018

REV	DATE	DESCRIPTION	MECH.	DRAWN	CHK.	ARCH.	ELEC.	C&I
1	01.11.2018	REVISED AS PER CLIENT COMMENT & REISSUED FOR APPROVAL	SSY	MGAN	AJP			
0	28.03.2018	ISSUED FOR APPROVAL		ESN	AJP			

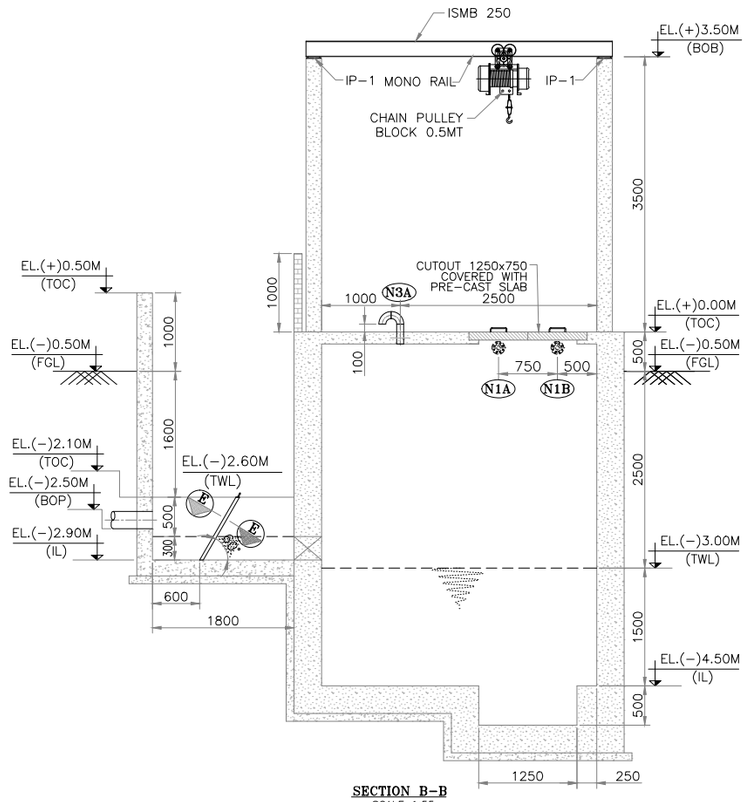
DEPT. / SIGN / DATE — N.A. — CARD CODE -

BHEL DRAWING NO. PE-V0-412-673-A005A REV 1

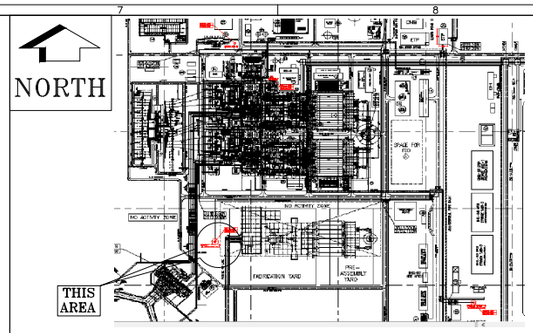
NO. OF SHEETS - 1 OF 6



PLAN
SCALE 1:40



SECTION B-B
SCALE 1:55



KEY PLAN

LIST OF CIVIL EQUIPMENTS

TAG.NO	DESCRIPTION	SIZE / CAPACITY.	MOC	QTY.
CS-02	CORSE SCREEN CHAMBER-02	1.8m(L)x0.5(W)x0.8m(D)	RCC	01
S-02	SEWAGE SUMP-02	3.5m(L)x3.5(W)x4.5m(D)	RCC	01

PUDDLE PIPE LIST

MARK NO.	DESCRIPTION	ELEVATION	SIZE	PROJECTION	MOC.	QTY.
N1A/B	OUTLET	CL.EL.(−)0.30M	50NB	150	CS	2NOS.
N2A/B	LEVEL GAUGE	AS PER GA	25NB	100	CS	2NOS.
N2C	LEVEL GAUGE	AS PER GA	25NB	150	CS	1NO.
N3A/B	VENT	AS PER GA	100NB	AS PER DETAILS	CS	2NOS.

LIST OF INSERT PLATE

IP NO.	DESCRIPTION	SIZE	ELEVATION	QTY.
IP-1	INSERT PALTE-1	200x200x10THK.	AS PER GA.	10
IP-2	INSERT PALTE-2	250x250x10THK.	AS PER GA.	01
IP-3	INSERT PALTE-3	924x30x10THK.	AS PER GA.	04
IP-4	INSERT PALTE-4	600x200x10THK.	AS PER GA.	01

EQUIPMENT LOAD LIST

SL. NO.	TAG.NO.	DESCRIPTION	CAPACITY	QTY.	OPERATING LOAD FOR EACH
1	GRS02-AP001/002	SEWAGE TRANSFER PUMPS	8m3/hr@7.5kg/cm2	2NOS	350kgs

REFERENCE DWG NO:

1. P&I DIAGRAM :- PEL-12171037-PRO-PID-001 / PE-V0-412-673-A001
2. HYDRAULIC DIAGRAM :- PEL-12171037-PRO-HFD-003A
3. PLOT PLAN :- PE-DG-412-100-M001

NOTES :-

1. ALL DIMENSIONS ARE IN mm AND LEVELS ARE IN METER UNLESS OTHERWISE NOTED.
2. FGL (−)0.50M.
3. PLANT FINISH GRADED LEVEL (FGL) SHALL BE RL (+) 9.5M. POWER HOUSE (TG BUILDING) FINISH GROUND FLOOR LEVEL IS EL (±)0.00M. WHICH CORR. TO RL (+)10.0M.
4. ALL CIVIL DESIGN & CONSTRUCTION ARE IN CLIENT'S SCOPE.

LEGEND:-

LEVEL / LEVEL — SECTION / FINISHED GROUND LEVEL

TEXT LEGENDS:-

IL	:	INVERT LVL.	BOB	:	BOTTOM OF BEAM.
EL	:	ELEVATION.	TOC	:	TOP OF CONCRETE.
FGL	:	FINISHED GROUND LEVEL.	MH	:	MANHOLE.
TYP	:	TYPICAL.	BOP	:	BOTTOM OF PIPE.
TWL	:	TOP WATER LEVEL.			

PROJECT	2x660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI
OWNER :-	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT:-	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
	BHARAT HEAVY ELECTRICALS LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
	PENNAR ENVIRO Re-engineering Water, Environment & Energy. Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad – 500 084

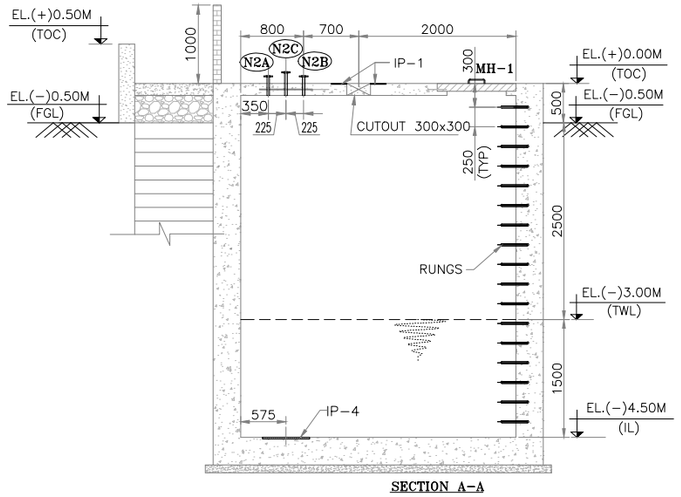
DEPT.	CODE	SCALE	WEIGHT (KG)	VENDOR DRAWING NO.	ITEM
--	--	AS SHOWN	-	A2-PEL-1037-GA-002	

TITLE :Mech.GA Drawings of all Sewage sumps and tanks for STP (Part – 1)
MECH. G.A. OF SEWAGE SUMP-2

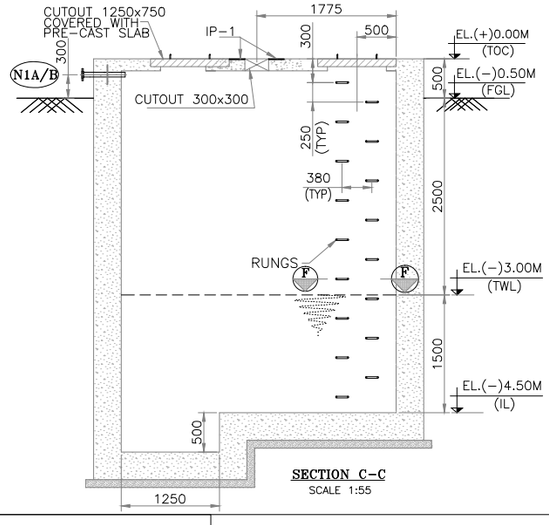
	NAME	SIGN	DATE
PREP	MKK		30.03.2018
CHKD	AJP		30.03.2018
CHKD	ESN		30.03.2018
APPD	PAK		30.03.2018

DEPT.	SIGN	DATE	CARD CODE	BHEL DRAWING NO.	REV
		N.A.	-	PE-V0-412-673-A005A	1

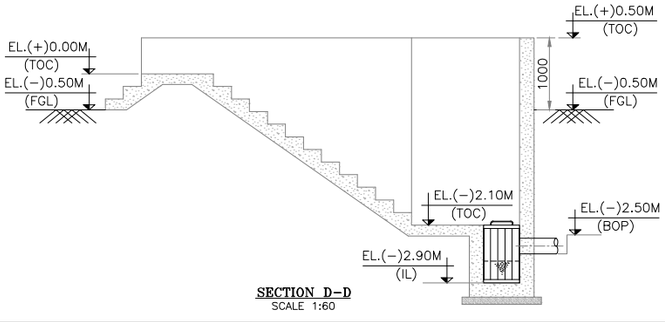
NO. OF SHEETS – 2 OF 6



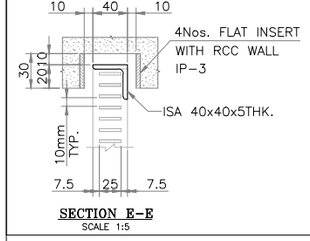
SECTION A-A
SCALE 1:55



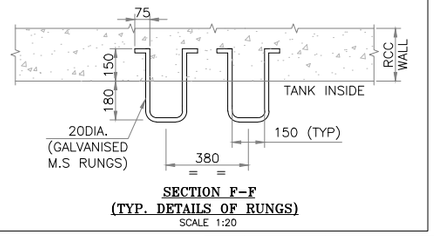
SECTION C-C
SCALE 1:55



SECTION D-D
SCALE 1:60



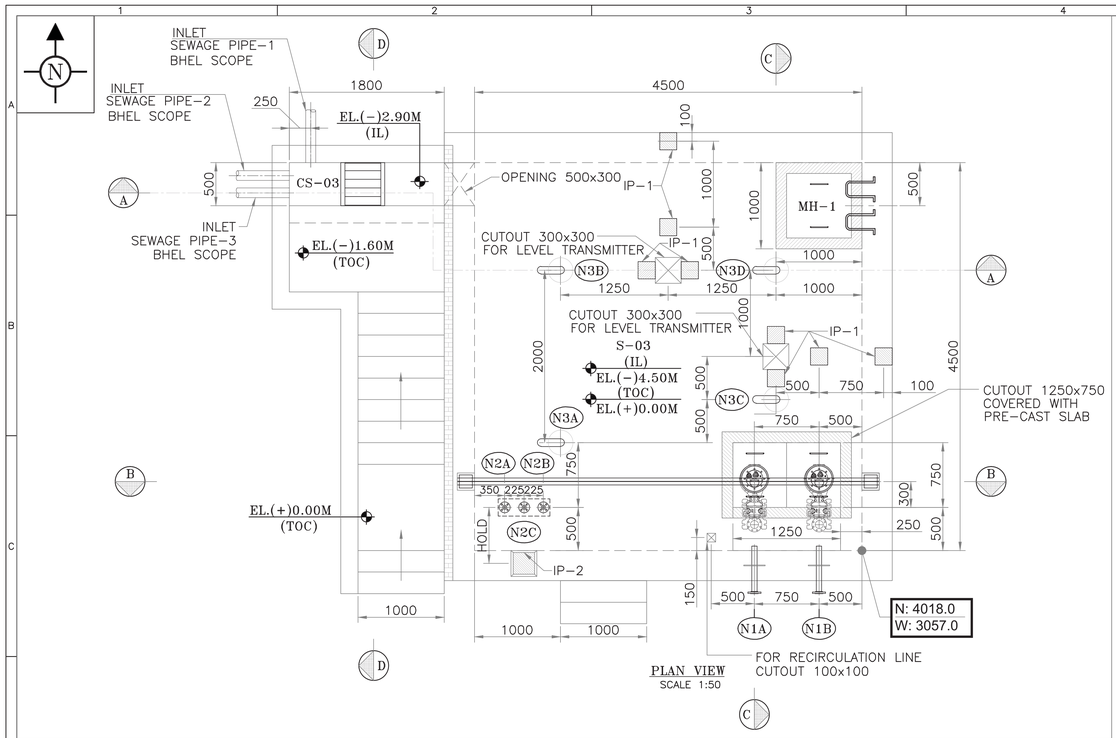
SECTION E-E
SCALE 1:5

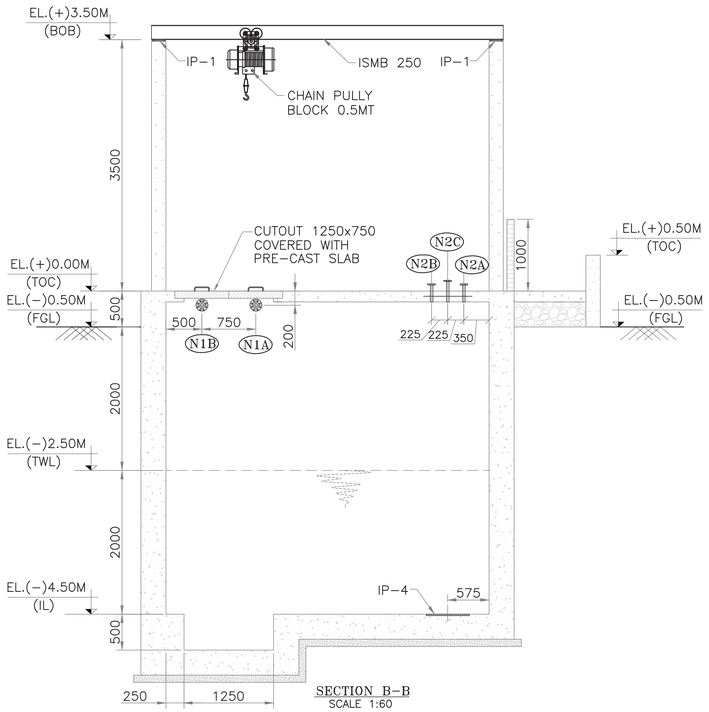


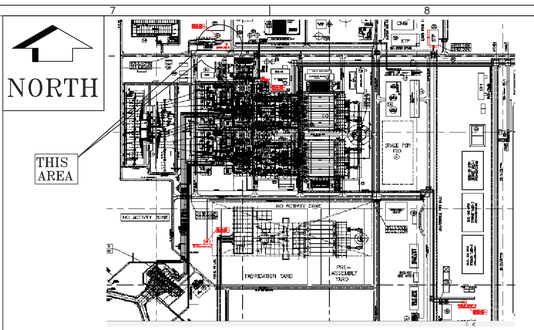
SECTION F-F
(TYP. DETAILS OF RUNGS)
SCALE 1:20

REV	DATE	DESCRIPTION	MECH.	DRAWN	CHK.	ARCH.	ELEC.	C&I
1	01.11.2018	REVISED AS PER CLIENT COMMENT & REISSUED FOR APPROVAL	SSY	MGAN	AJP			
0	30.03.2018	ISSUED FOR APPROVAL		MKK	AJP			

PEL/D&D-F003







KEY PLAN

LIST OF CIVIL EQUIPMENTS

TAG.NO	DESCRIPTION	SIZE / CAPACITY.	MOC	QTY.
CS-03	COARSE SCREEN CHAMBER-03	1.8m(L)x0.5(W)x0.8m(D)	RCC	01
S-03	SEWAGE SUMP-03	4.5m(L)x4.5(W)x4.5m(D)	RCC	01

PUDDLE PIPE LIST

MARK NO.	DESCRIPTION	ELEVATION	SIZE	PROJECTION	MOC.	QTY.
N1A/B	OUTLET	CL.EL.(−)0.30M	50NB	150	CS	2NOS.
N2A/B	LEVEL GAUGE	AS PER GA	25NB	100	CS	2NOS.
N2C	LEVEL GAUGE	AS PER GA	25NB	150	CS	1NO.
N3A/B/C/D	VENT	AS PER GA	80NB	AS PER DETAILS	CS	4NOS.

LIST OF INSERT PLATE

IP NO.	DESCRIPTION	SIZE	ELEVATION	QTY.
IP-1	INSERT PALTE-1	200x200x10THK.	AS PER GA.	10
IP-2	INSERT PALTE-2	250x250x10THK.	AS PER GA.	01
IP-3	INSERT PALTE-3	924x30x10THK.	AS PER GA.	04
IP-4	INSERT PALTE-4	600x200x10THK.	AS PER GA.	01

EQUIPMENT LOAD LIST

SL. NO.	TAG.NO.	DESCRIPTION	CAPACITY	QTY.	OPERATING LOAD FOR EACH
1	GRS03-AP001/002	SEWAGE TRANSFER PUMPS	8m3/hr@4.5kg/cm2	2NOS	350kgs

REFERENCE DWG NO:

1. P&I DIAGRAM :- PEL-12171037-PRO-PID-001 / PE-V0-412-673-A001
2. HYDRAULIC DIAGRAM :- PEL-12171037-PRO-HFD-003A
3. PLOT PLAN :- PE-DG-412-100-M001

NOTES :-

1. ALL DIMENSIONS ARE IN mm AND LEVELS ARE IN METER UNLESS OTHERWISE NOTED.
2. FGL (−)0.50M.
3. PLANT FINISH GRADED LEVEL (FGL) SHALL BE RL (+) 9.5M. POWER HOUSE (TG BUILDING) FINISH GROUND FLOOR LEVEL IS EL (±)0.00M. WHICH CORR. TO RL (+)10.0M.
4. ALL CIVIL DESIGN & CONSTRUCTION ARE IN CLIENT'S SCOPE.

LEGEND:-

LEVEL / LEVEL — SECTION — FINISHED GROUND LEVEL

TEXT LEGENDS:-

IL	:	INVERT LVL.	BOB	:	BOTTOM OF BEAM.
EL	:	ELEVATION.	TOC	:	TOP OF CONCRETE.
FGL	:	FINISHED GROUND LEVEL.	MH	:	MANHOLE.
TYP	:	TYPICAL.	BOP	:	BOTTOM OF PIPE.
TWL	:	TOP WATER LEVEL.			

PROJECT	2x660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI
OWNER :-	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT:-	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
	BHARAT HEAVY ELECTRICALS LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
	PENNAR ENVIRO Re-engineering Water, Environment & Energy. Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad – 500 084

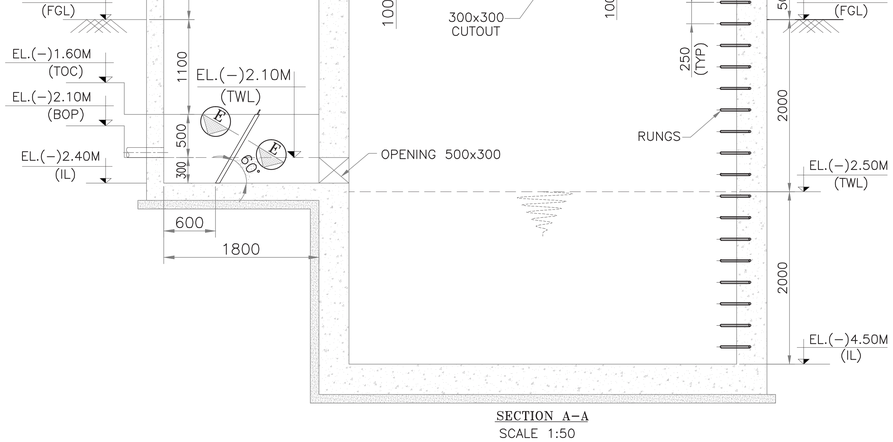
DEPT.	CODE	SCALE AS SHOWN	WEIGHT (KG)	VENDOR DRAWING NO.	ITEM
--	--		-	A2-PEL-1037-GA-003	

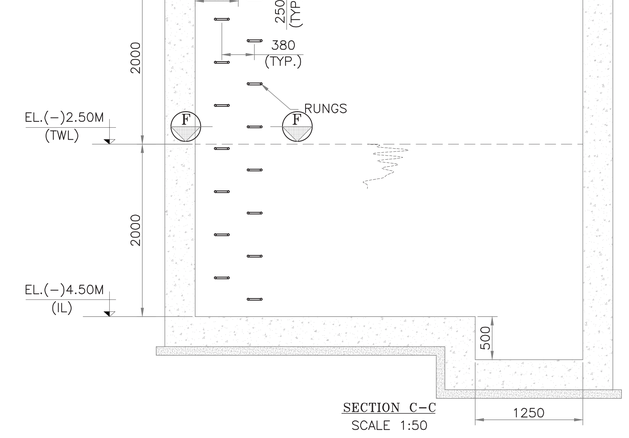
TITLE: Mech.GA Drawings of all Sewage sumps & tanks for STP (Part-1)

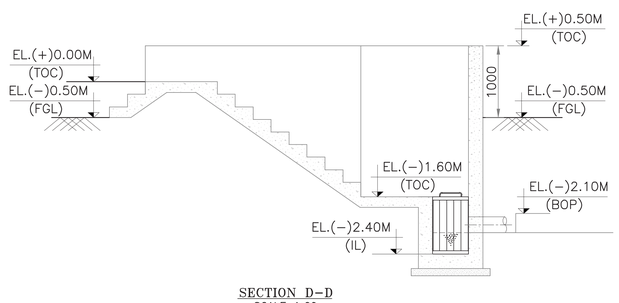
MECH. G.A. OF SEWAGE SUMP-3

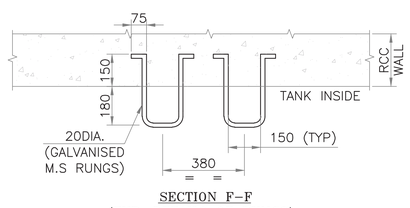
	NAME	SIGN	DATE
PREP	MGAN		29.03.2018
CHKD	AJP		29.03.2018
CHKD	ESN		29.03.2018
APPD	PAK		29.03.2018

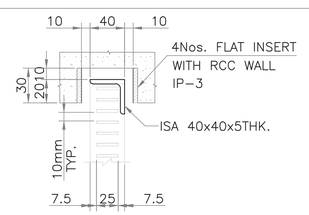
DEPT.							CARD CODE	BHEL DRAWING NO.	REV
SIGN				N.A.			-	PE-V0-412-673-A005A	1
DATE								NO. OF SHEETS – 3 OF 6	





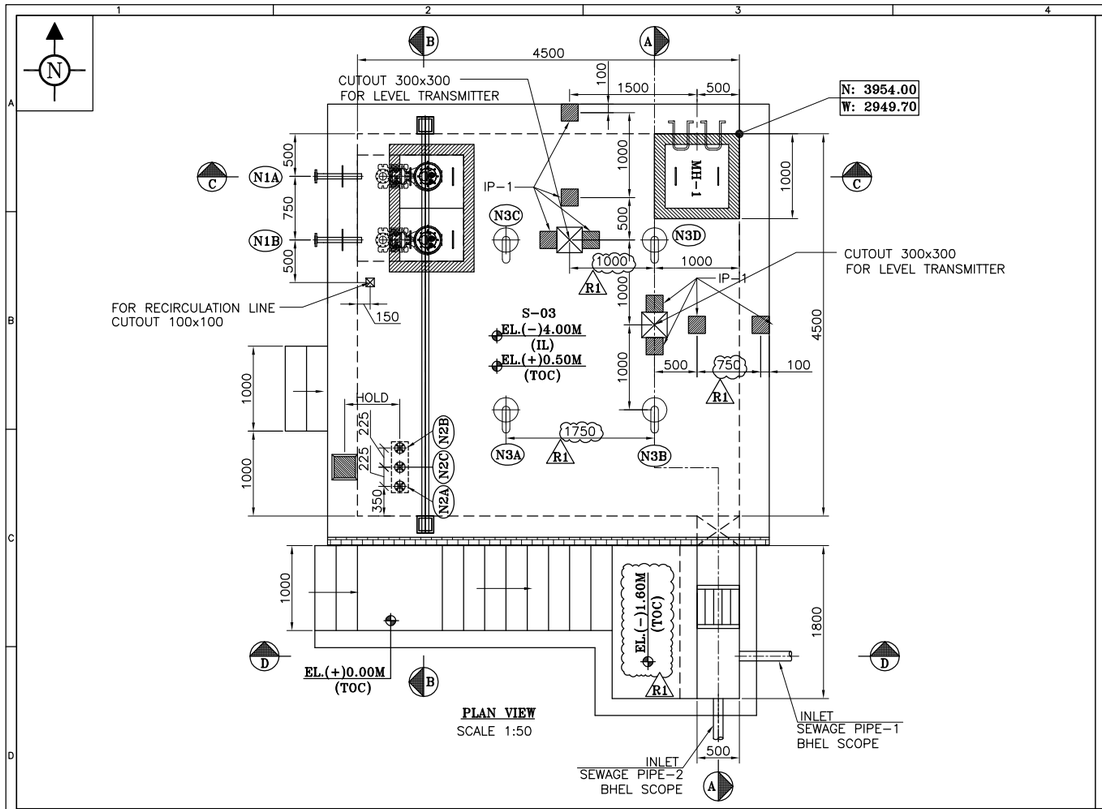




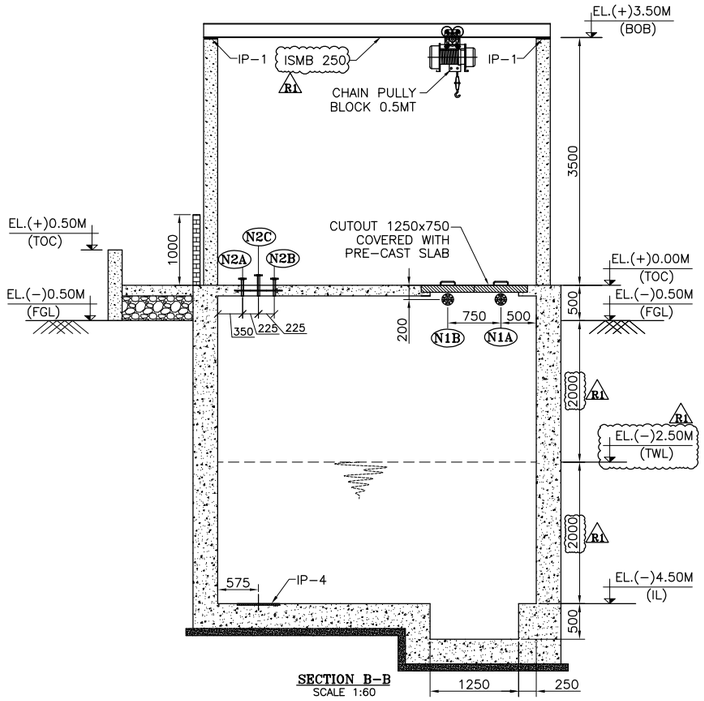


REV	DATE	DESCRIPTION	MECH.	DRAWN	CHK.	ARCH.	ELEC.	C&I
1	01.11.2018	REVISED AS PER CLIENT COMMENT & REISSUED FOR APPROVAL	SSY	MGAN	AJP			
0	29.03.2018	ISSUED FOR APPROVAL		MGAN	AJP			

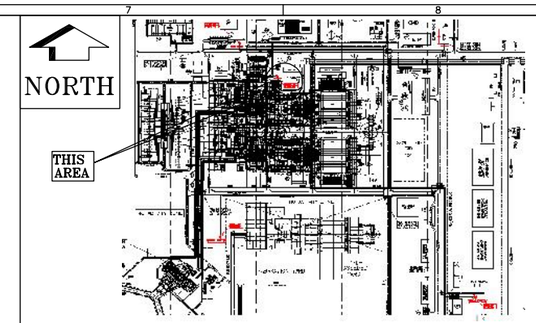
PEL/D&D-F003



PLAN VIEW
SCALE 1:50



SECTION B−B
SCALE 1:60



KEY PLAN

LIST OF CIVIL EQUIPMENTS

TAG.NO	DESCRIPTION	SIZE / CAPACITY.	MOC	QTY.
CS−04	COARSE SCREEN CHAMBER−04	(1.8m(L)x0.5(W)x0.8m(D))	RCC	01
S−04	SEWAGE SUMP−04	R1 (4.5m(L)x4.5(W)x4.5m(D))	RCC	01

PUDDLE PIPE LIST

MARK NO.	DESCRIPTION	ELEVATION	SIZE	PROJECTION	MOC.	QTY.
N1A/B	OUTLET	CL.EL.(−)0.30M	50NB	150	CS	2NOS.
N2A/B	LEVEL GAUGE	AS PER GA	25NB	100 R1	CS	2NOS.
N2C	LEVEL GAUGE	AS PER GA	25NB	150	CS	1NO.
N3A/B/C/D	VENT	AS PER GA	80NB	AS PER DETAILS	CS	4NOS.

LIST OF INSERT PLATE

IP NO.	DESCRIPTION	SIZE	ELEVATION	QTY.
IP−1	INSERT PALTE−1	200x200x10THK.	AS PER GA.	10
IP−2	INSERT PALTE−2	250x250x10THK.	AS PER GA.	01
IP−3	INSERT PALTE−3	924x30x10THK.	AS PER GA.	04
IP−4	INSERT PALTE−4	600x200x10THK.	AS PER GA.	01

EQUIPMENT LOAD LIST

SL. NO.	TAG.NO.	DESCRIPTION	CAPACITY R1	QTY.	OPERATING LOAD FOR EACH
1	GRS04−AP001/002	SEWAGE TRANSFER PUMPS	8m3/hr@4.5kg/cm2	2NOS	350kgs

REFERENCE DWG NO:

1. P&I DIAGRAM :− PEL−12171037−PRO−PID−001 / PE−V0−412−673−A001
2. HYDRAULIC DIAGRAM :− PEL−12171037−PRO−HFD−003A
3. PLOT PLAN :− PE−DG−412−100−M001

NOTES :−

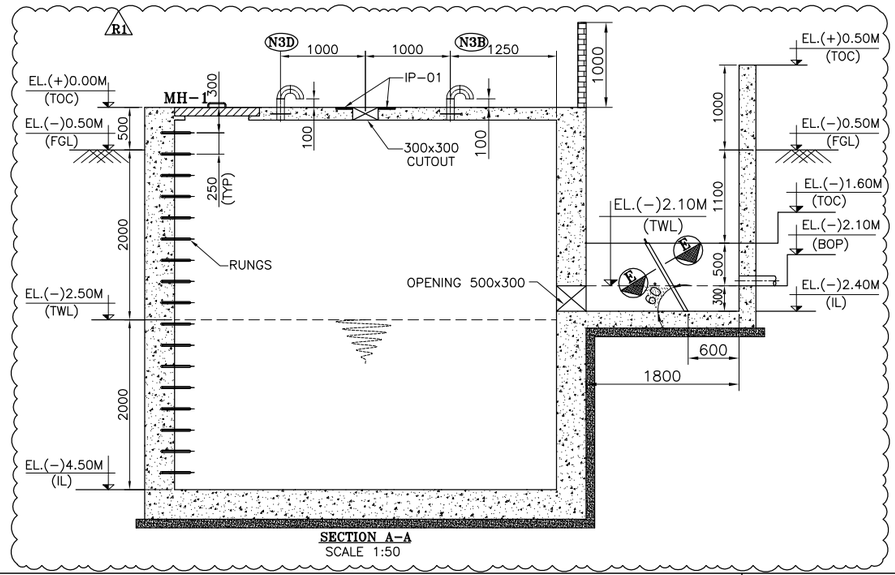
1. ALL DIMENSIONS ARE IN mm AND LEVELS ARE IN METER UNLESS OTHERWISE NOTED.
2. FGL (−)0.50M.
3. PLANT FINISH GRADED LEVEL (FGL) SHALL BE RL (+) 9.5M. POWER HOUSE (TG BUILDING) FINISH GROUND FLOOR LEVEL IS EL (±)0.00M. WHICH CORR. TO RL (+)10.0M.
4. ALL CIVIL DESIGN & CONSTRUCTION ARE IN CLIENT'S SCOPE.

LEGEND:−

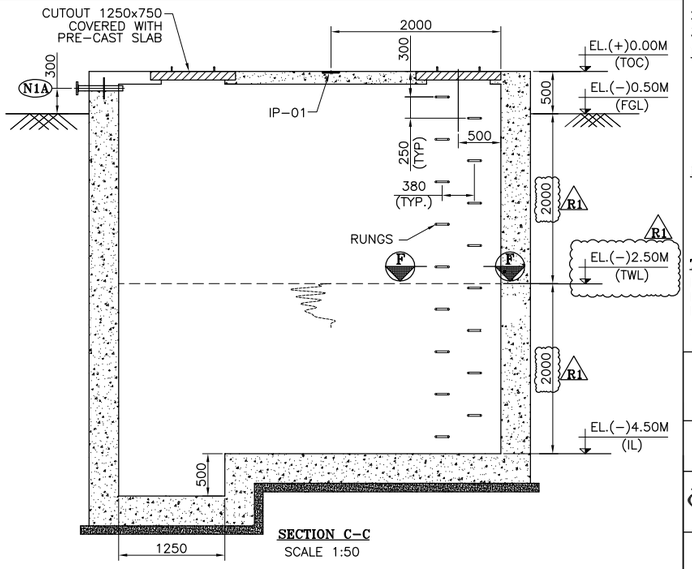
LEVEL / LEVEL — SECTION / FINISHED GROUND LEVEL

TEXT LEGENDS:−

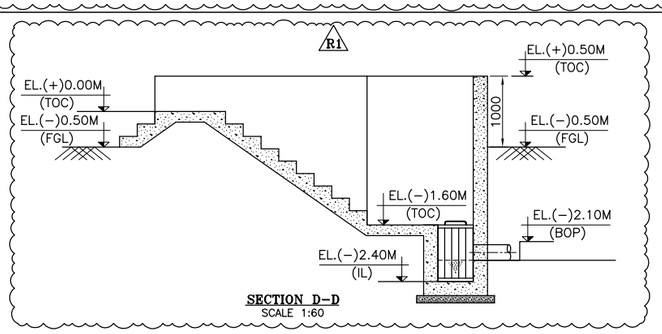
IL	:	INVERT LVL.	BOB	:	BOTTOM OF BEAM.
EL	:	ELEVATION.	TOC	:	TOP OF CONCRETE.
FGL	:	FINISHED GROUND LEVEL.	MH	:	MANHOLE.
TYP	:	TYPICAL.	BOP	:	BOTTOM OF PIPE.
TWL	:	TOP WATER LEVEL.			



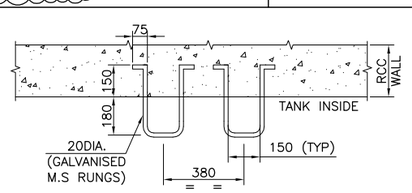
SECTION A−A
SCALE 1:50



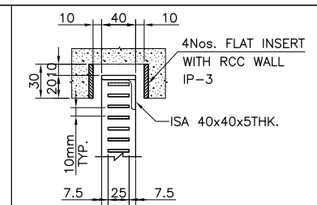
SECTION C−C
SCALE 1:50



SECTION D−D
SCALE 1:60



SECTION F−F
(TYP. DETAILS OF RUNGS)
SCALE 1:20



SECTION E−E
SCALE 1:5

REV	DATE	DESCRIPTION	MECH.	DRAWN	CHK.	ARCH.	ELEC.	C&I
1	01.11.2018	REVISED AS PER CLIENT COMMENT & REISSUED FOR APPROVAL	SSY	MGAN	AJP			
0	30.03.2018	ISSUED FOR APPROVAL		MGAN	AJP			

PROJECT	2x660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI
OWNER :−	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT:−	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
	BHARAT HEAVY ELECTRICALS LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
	PENNAR ENVIRO Re-engineering Water, Environment & Energy. Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad − 500 084

DEPT.	CODE	SCALE AS SHOWN	WEIGHT (KG)	VENDOR DRAWING NO.	ITEM
__	__		−	A2−PEL−1037−GA−004	

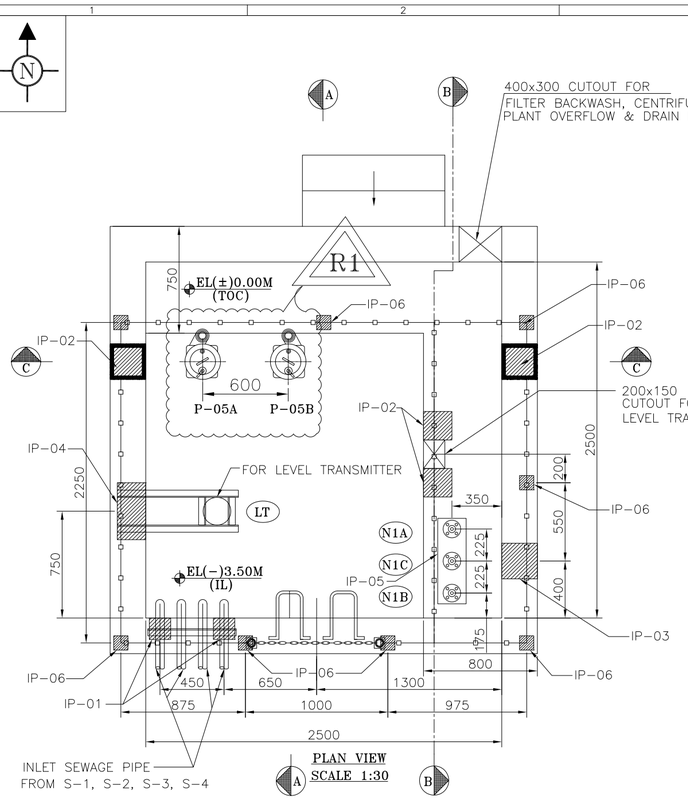
TITLE: **Mech.GA Drawings of all Sewage sumps & tanks for STP (Part −1)**

MECH. G.A. OF SEWAGE SUMP−4

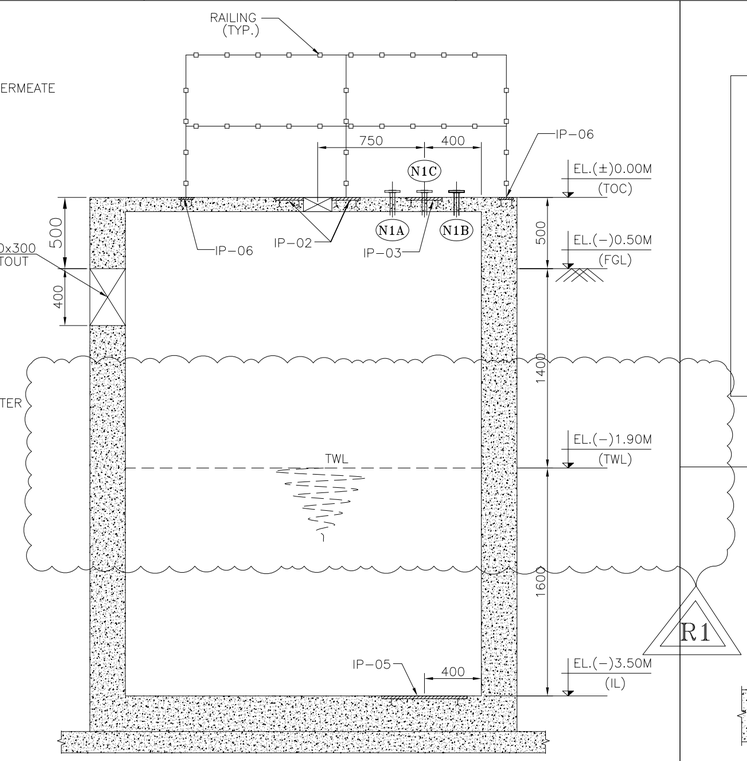
	NAME	SIGN	DATE
PREP	MGAN		30.03.2018
CHKD	AJP		30.03.2018
CHKD	ESN		30.03.2018
APPD	PAK		30.03.2018

DEPT.	CARD CODE	BHEL DRAWING NO.	REV
SIGN	−	PE−V0−412−673−A005A	1
DATE		NO. OF SHEETS − 4 OF 6	

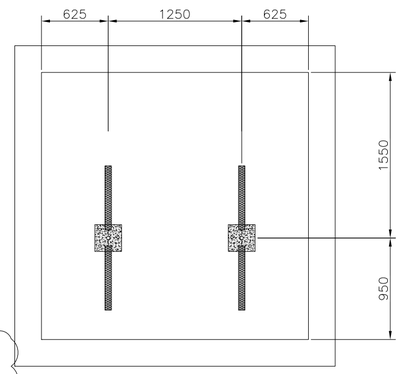
PEL/D&D-F003



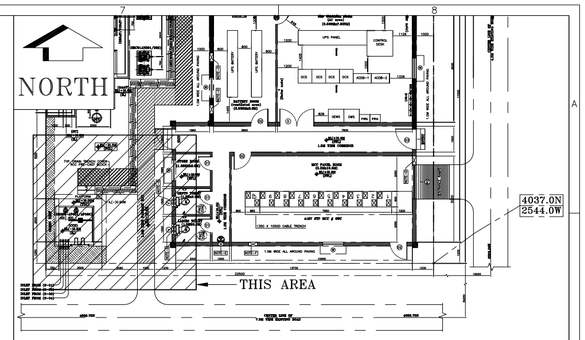
PLAN VIEW
SCALE 1:30



SECTION B-B
SCALE 1:30



DIFFUSER ARRANGEMENT
SCALE 1:40



KEY PLAN

LIST OF CIVIL EQUIPMENTS

TAG.NO	DESCRIPTION	SIZE / CAPACITY.	MOC	QTY.
CCS	COMMON COLLECTION TANK	2.5m(L)x2.5(W)x3.0m(D)	RCC	01

PUDDLE PIPE LIST

MARK NO.	DESCRIPTION	ELEVATION	SIZE	PROJECTION	MOC.	QTY.
N1A/B	LEVEL GAUGE	AS PER GA	25NB	100	MS	2NOS.
N1C	LEVEL GAUGE	AS PER GA	25NB	150	MS	1NO.

LIST OF INSERT PLATE

IP NO.	DESCRIPTION	SIZE	ELEVATION	QTY.
IP-01	INSERT PALTE-01	150x150x10THK.	AS PER GA.	02
IP-02	INSERT PALTE-02	200x200x10THK.	AS PER GA.	04
IP-03	INSERT PALTE-03	250x250x10THK.	AS PER GA.	01
IP-04	INSERT PALTE-04	400x200x10THK.	AS PER GA.	01
IP-05	INSERT PALTE-05	600x200x10THK.	AS PER GA.	01
IP-06	INSERT PALTE-05	100x100x10THK.	AS PER GA.	08

EQUIPMENT LOAD LIST

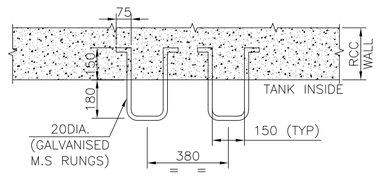
SL. NO.	TAG.NO.	DESCRIPTION	CAPACITY	QTY.	OPERATING LOAD FOR EACH
1	GRS05-AP001/AP002	SEWAGE TRANSFER PUMPS	4m3/hr@1.2kg/cm2	2NOS	350kgs

REFERENCE DWG NO:

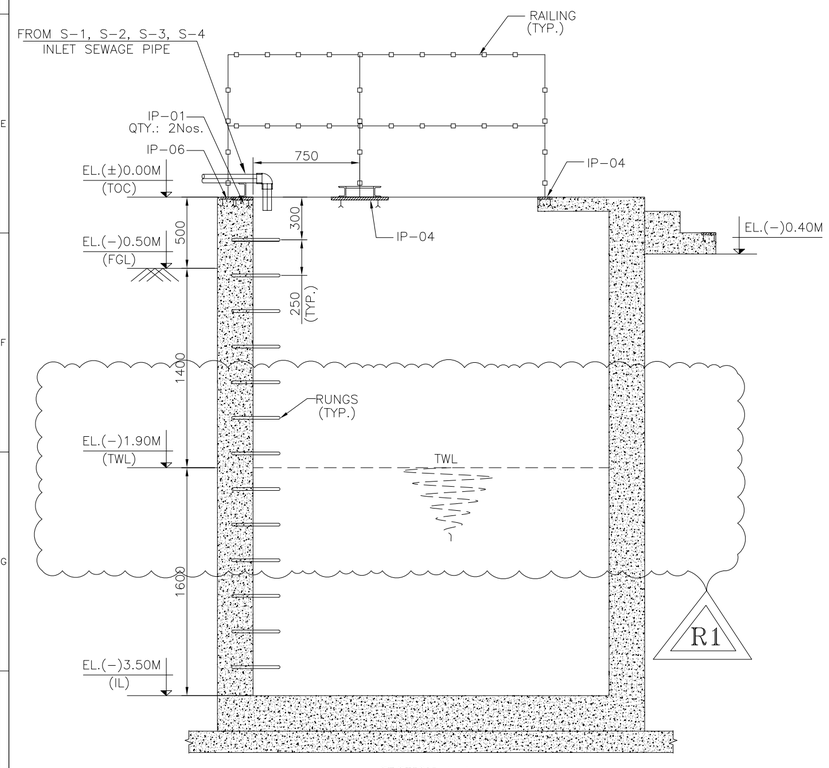
1. P&I DIAGRAM :- PEL-12171037-PRO-PID-001 / PE-V0-412-673-A001
2. HYDRAULIC DIAGRAM :- PEL-12171037-PRO-HFD-003A
3. EQUIPMENT LAYOUT :- PE-DG-412-100-M001

NOTES :-

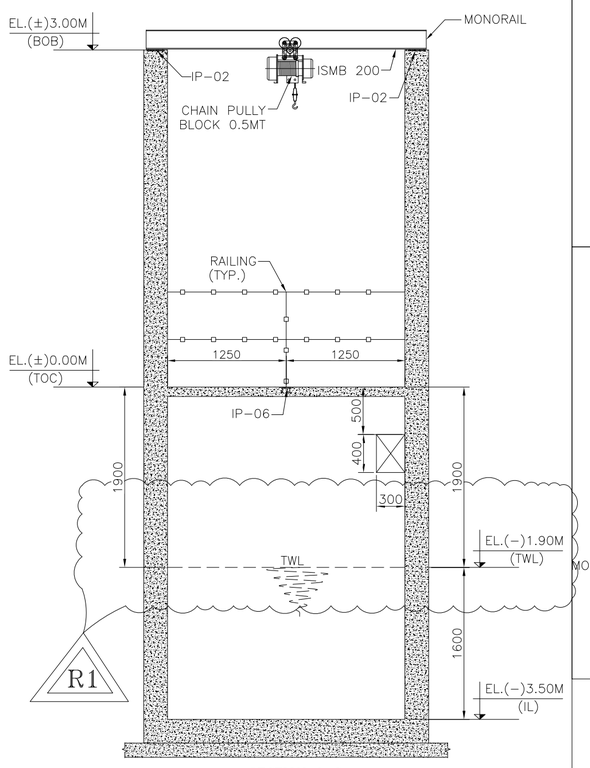
1. ALL DIMENSIONS ARE IN mm AND LEVELS ARE IN METER UNLESS OTHERWISE NOTED.
2. FGL (−)0.50M.
3. PLANT FINISH GRADED LEVEL (FGL) SHALL BE RL (+) 9.5M. POWER HOUSE (TG BUILDING) FINISH GROUND FLOOR LEVEL IS EL (±)0.00M. WHICH CORR. TO RL (+)10.0M.
4. ALL CIVIL DESIGN & CONSTRUCTION ARE IN CLIENT'S SCOPE.



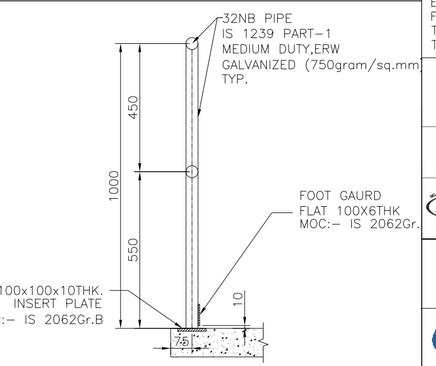
(TYP. DETAILS OF RUNGS)
SCALE 1:20



SECTION A-A
SCALE 1:30



SECTION C-C
SCALE 1:45



TYPICAL DETAILS OF
HAND RAILING
SCALE 1:15

LEGEND:-

LEVEL
LEVEL
SECTION
FINISHED GROUND LEVEL

TEXT LEGENDS:-

IL	:	INVERT LVL.	BOB	:	BOTTOM OF BEAM.
EL	:	ELEVATION.	TOC	:	TOP OF CONCRETE.
FGL	:	FINISHED GROUND LEVEL.	MH	:	MANHOLE.
TYP	:	TYPICAL.	BOP	:	BOTTOM OF PIPE.
TWL	:	TOP WATER LEVEL.			

PROJECT	2x660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI
OWNER :-	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT:-	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
	BHARAT HEAVY ELECTRICALS LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
	PENNAR ENVIRO Re-engineering Water, Environment & Energy. Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad – 500 084

DEPT.	CODE	SCALE AS SHOWN	WEIGHT (KG)	VENDOR DRAWING NO.	ITEM
--	--		-	A2-PEL-1037-GA-005	

TITLE :Mech.GA Drawings of all Sewage sumps & tanks for STP (Part -1)
COMMON COLLECTON SUMP-CCS

	NAME	SIGN	DATE
PREP	MGAN		02.04.2018
CHKD	AJP		02.04.2018
CHKD	ESN		02.04.2018
APPD	PAK		02.04.2018

DEPT.	CARD CODE	BHEL DRAWING NO.	REV
SIGN	-	PE-V0-412-673-A005A	1
DATE		NO. OF SHEETS – 5 OF 6	

REV	DATE	DESCRIPTION	MECH.	DRAWN	CHK.	ARCH.	ELEC.	C&I
1	27.09.2018	REVISIED AS PER COMMENTS RE-ISSUED FOR APPROVAL	PAK	KVK	SSY			
0	02.04.2018	ISSUED FOR APPROVAL	PAK	MGAN	AJP			

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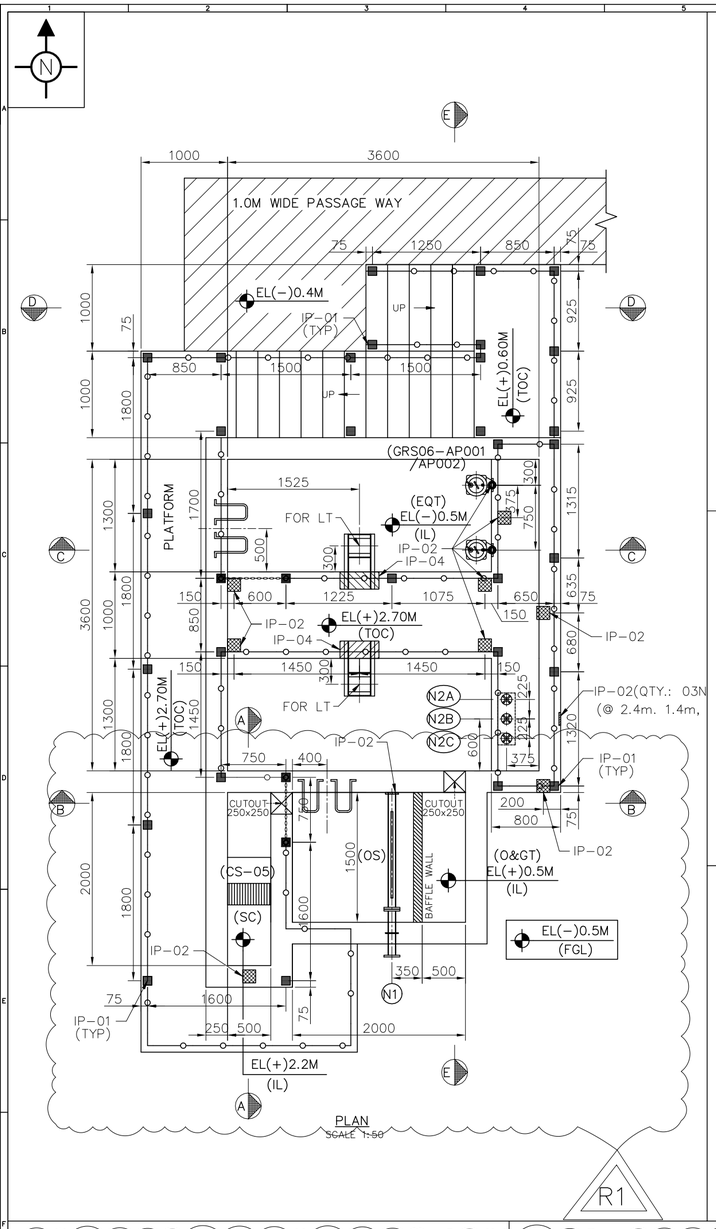
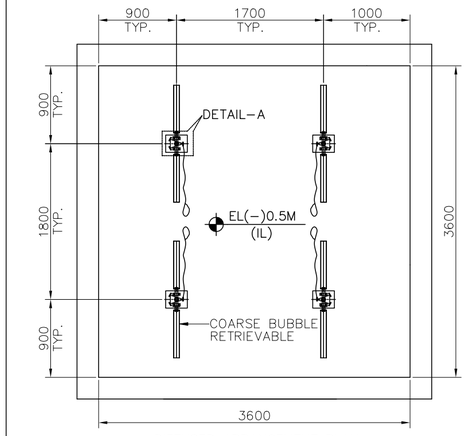
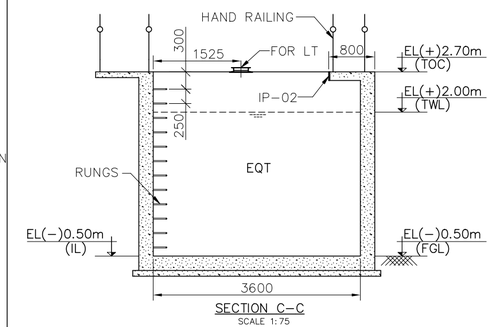


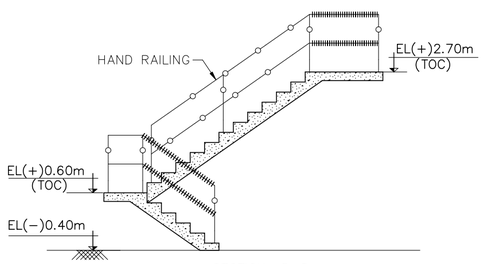
PLAN
SCALE 1:50



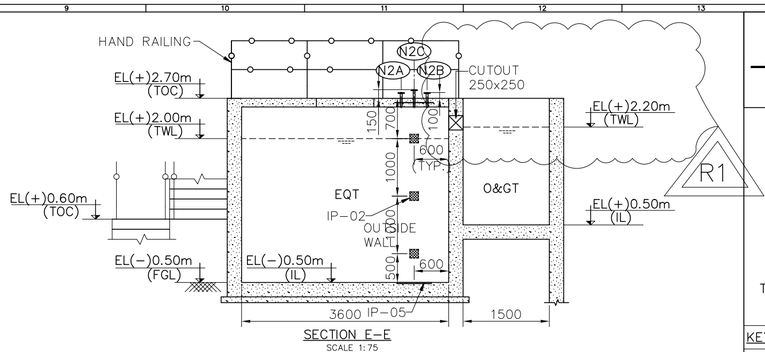
DIFFUSER ARRANGEMENT PLAN FOR EQUALIZATION TANK
SCALE 1:50



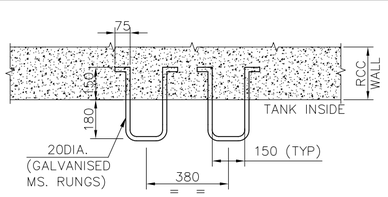
SECTION C−C
SCALE 1:75



SECTION D−D
SCALE 1:75

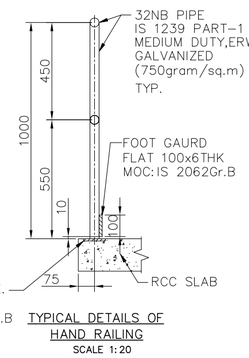


SECTION E−E
SCALE 1:75

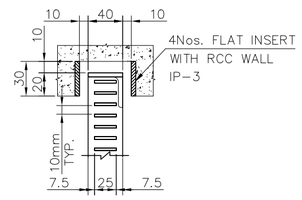


(TYP. DETAILS OF RUNGS)
SCALE 1:20

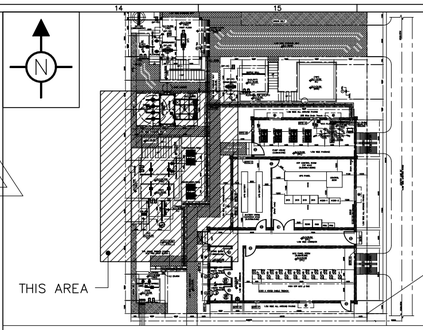
PRECAST PCC SUPPORT BLOCK DETAIL−A
QTY.: 04NOS.
(REFER SPECIAL NOTE)
SCALE 1:20



TYPICAL DETAILS OF HAND RAILING
SCALE 1:20



SECTION F−F
SCALE 1:5



KEY PLAN

LIST OF CIVIL EQUIPMENTS

TAG NO.	DESCRIPTION	SIZE / CAPACITY	MOC	QTY.
SC	SCREEN CHAMBER	2.0m(L) x 0.5m(W) x 0.1m(SWD)+0.5m (FB)	RCC	1 No.
O&GT	OIL & GREASE TRAP	2.0m(L) x 1.5m(W) x 1.6m(SWD)+0.6m (FB)	RCC	1 No.
EQT	EQUALIZATION TANK	3.6m(L) x 3.6m(W) x 2.5m(SWD)+0.7m(FB)	RCC	1 No.

SCREENS

TAG.NO	DESCRIPTION	OPENING	MOC	QTY.
CS−05	COARSE SCREEN	10mm	SS304	01

PUDDLE PIPE LIST

SL. NO.	MARK NO.	DESCRIPTION	ELEVATION	SIZE	PROJECTION	MOC.	QTY.
1	N1	OIL SKIMMER OUTLET	BOP.EL(+)2.075m	80NB	100	CS	1NO.
2	N2A/B	LEVEL INDICATOR FOR EQT	AS PER G.A	25NB	100	CS	2NOS.
3	N2C	LEVEL INDICATOR FOR EQT	AS PER G.A	25NB	150	CS	1NO.

INSERT PLATE DETAILS

IP NO.	SIZE(LxBxT)	ELEVATION	QTY.
IP−01	100x100x10THK.	AS PER GA.	34
IP−02	150x150x10THK.	AS PER GA.	17
IP−03	693x30x10THK.	AS PER GA.	04
IP−04	450x200x10THK.	AS PER GA.	02
IP−05	600x200x10THK.	AS PER GA.	01

NOTES :−

1. ALL DIMENSIONS ARE IN mm AND LEVELS ARE IN METER UNLESS OTHERWISE NOTED.
2. FGL(−)0.50M.
3. PLANT FINISH GRADED LEVEL (FGL) SHALL BE RL (+) 9.5M. POWER HOUSE (TG BUILDING) FINISH GROUND FLOOR LEVEL IS EL (±)0.00M. WHICH CORR. TO RL (+)10.0M.
4. ALL CIVIL DESIGN & CONSTRUCTION ARE IN CLIENT SCOPE.

SPECIAL NOTES:

1. CASTING OF PRECAST PCC SUPPORT BLOCK SHALL BE DONE AFTER RECEIVING MOUNTING ACCESSORIES FROM DIFFUSER VENDOR.
2. MOUNTING DETAILS OF PUMPS ARE UNDER HOLD.

REFERENCE DRAWINGS :−

1. P&ID : −PEL−12171037−PRO−PID−001−R0/ PE−V0−412−673−A001
2. HFD : −PEL−12171037−PRO−HFD−003−R0/ PE−V0−412−673−A007
3. EQUIPMENT LAYOUT : −A1−PEL−1037−EL−001−R0/ PE−V0−412−673−A002

LEGEND:−

LEVEL
SECTION
LEVEL
BASE LEVEL

TEXT LEGENDS:−

IL : INVERT LVL.
EL : ELEVATION.
CL : CENTER LINE.
FGL : FINISHED GROUND LEVEL.
TYP : TYPICAL.
TWL : TOP WATER LEVEL.
TOC : TOP OF CONCRETE.

REV	DATE	DESCRIPTION	MECH.	DRAWN	CHK.
1	27.09.2018	REVISIED AS PER COMMENTS RE−ISSUED FOR APPROVAL	PAK	KVK	SSY
0	25.04.2018	ISSUED FOR APPROVAL	PAK	AP	ESN

PROJECT:	2 X 660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI.
OWNER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT:	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
EPC CONTRACTOR:	BHARAT HEAVY ELECTRICALS LIMITED. (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
SUB CONTRACTOR :	PENNAR ENVIRO Re-engineering Water, Environment & Energy Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad − 500 084

DEPT.	CODE	SCALE	WEIGHT (KG)	VENDOR DRAWING NO.	ITEM
−−	−−	AS SHOWN	−	A2−PEL−1037−GA−006	

TITLE Mech.GA Drawings of all Sewage sumps & tanks for STP(Part−1) SCREEN CHAMBER, OIL & GREASE TRAP & EQUALIZATION TANK

	NAME	SIGN	DATE
PREP	AP		25.04.2018
CHKD	ESN		25.04.2018
CHKD	AJP		25.04.2018
APPD	PAK		25.04.2018

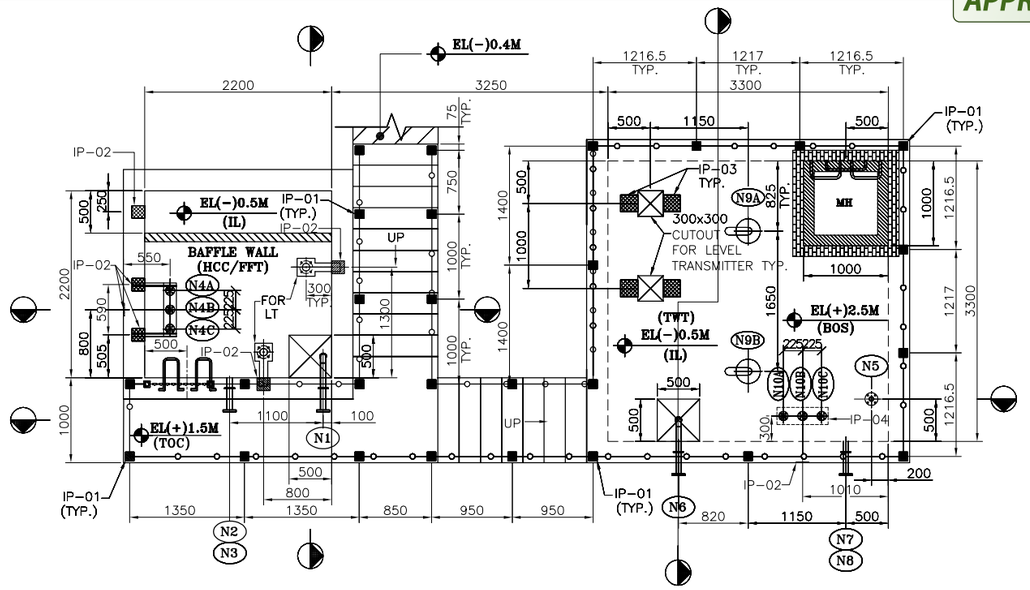
CARD CODE: −

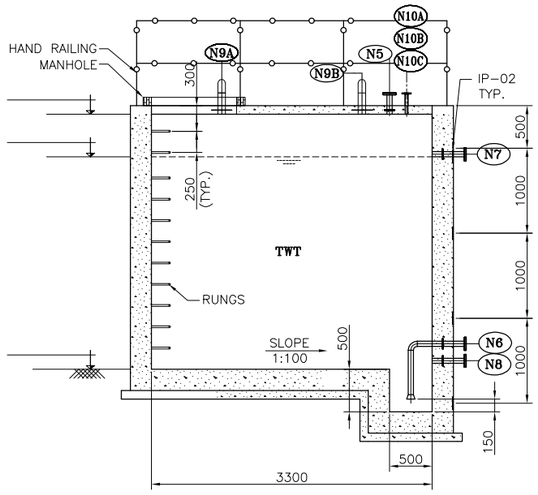
BHEL DRAWING NO. PE−V0−412−673−A005A REV 1

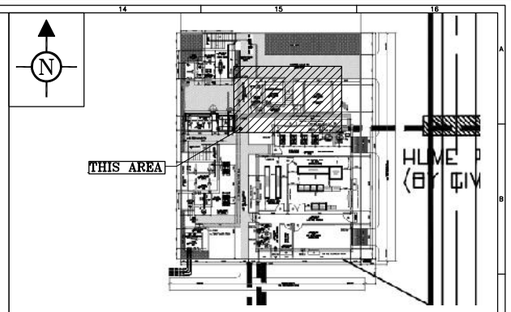
NO. OF SHEETS − 6 OF 6

APPROVED

PEL/D&D-F003







KEY PLAN

LIST OF CIVIL EQUIPMENTS

TAG NO.	DESCRIPTION	SIZE / CAPACITY	MOC	QTY.
HCT/FFT	HYPO CONTACT TANK CUM FILTER FEED TANK	2.2m(L) x 2.2m(W) x 1.5m(SWD)+0.5m (FB)	RCC	1 No.
TWT	TREATED WATER TANK	3.3m(L) x 3.3m(W) x 2.5m(SWD)+0.5m (FB)	RCC	1 No.

PUDDLE PIPE LIST

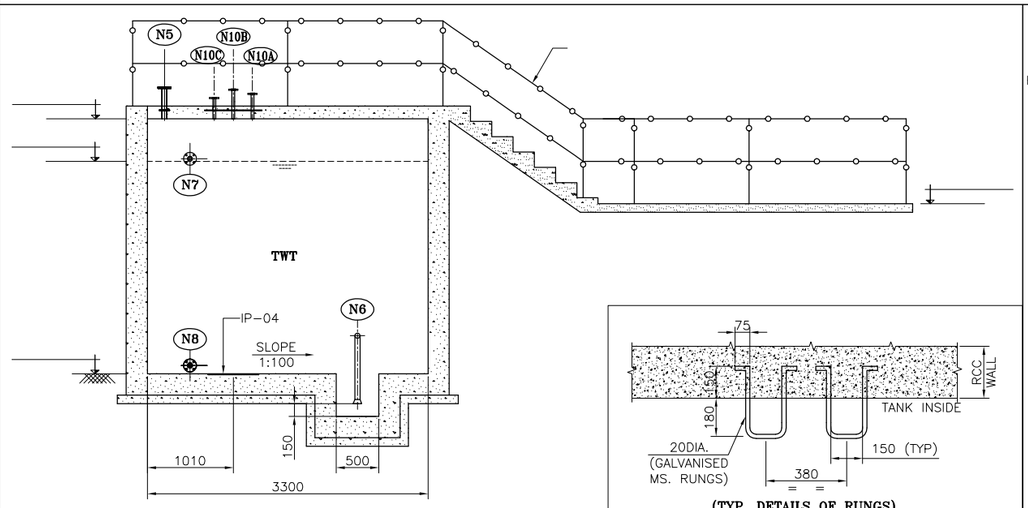
SL. NO.	MARK NO.	DESCRIPTION	ELEVATION	SIZE	PROJE-CTION	MOC.	QTY.
1	N1	OUTLET FOR HCT/FFT	HOLD	50NB	150	SS304	1NO.
2	N2	OVERFLOW FOR HCT/FFT	BOP.EL(+)1.00m	50NB	150	CS	1NO.
3	N3	DRAIN FOR HCT/FFT	CL.EL(−)0.40m	50NB	150	CS	1NO.
4	N4A/C	LEVEL GAUGE FOR HCT/FFT	AS PER G.A	25NB	100	CS	2NOS.
5	N4B	LEVEL GAUGE FOR HCT/FFT	AS PER G.A	25NB	150	CS	1NO.
6	N5	INLET FOR TWT	AS PER G.A	50NB	150	SS304	1NO.
7	N6	OUTLET FOR TWT	HOLD	50NB	150	SS304	1NO.
8	N7	OVERFLOW FOR TWT	BOP.EL(+)2.00m	80NB	150	CS	1NO.
9	N8	DRAIN FOR TWT	CL.EL(−)0.40m	50NB	150	CS	1NO.
10	N9A/B	VENT FOR TWT	AS PER G.A	80NB	–	CS	2NOS.
11	N10A/C	LEVEL GAUGE FOR HCT/FFT	AS PER G.A	25NB	100	CS	2NOS.
12	N10B	LEVEL GAUGE FOR HCT/FFT	AS PER G.A	25NB	150	CS	1NO.

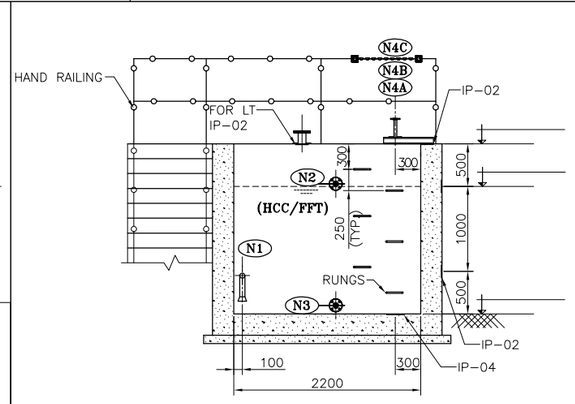
INSERT PLATE DETAILS

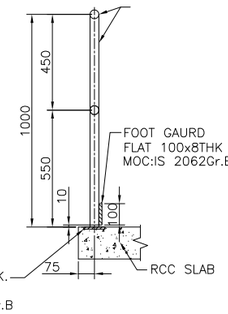
IP NO.	SIZE(LxBxT)	ELEVATION	QTY.
IP−01	100x100x10THK.	AS PER GA.	27
IP−02	150x150x10THK.	AS PER GA.	11
IP−03	200x200x10THK.	AS PER GA.	04
IP−04	600x200x10THK.	AS PER GA.	02

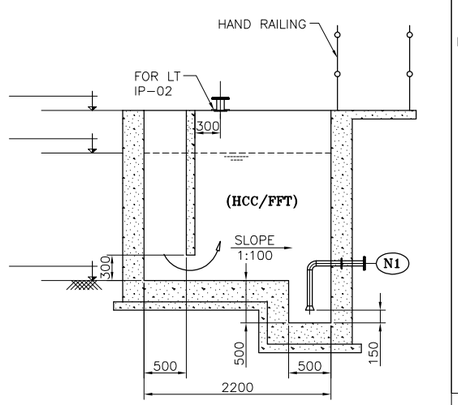
NOTES :−

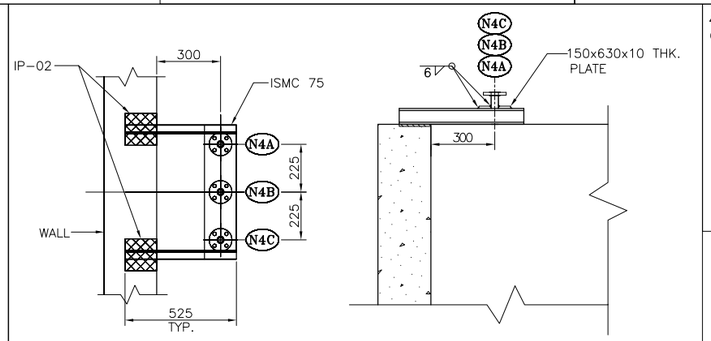
1. ALL DIMENSIONS ARE IN mm AND LEVELS ARE IN METER UNLESS OTHERWISE NOTED.
2. FGL(−)0.50M.
3. PLANT FINISH GRADED LEVEL (FGL) SHALL BE RL (+) 9.5M. POWER HOUSE (TG BUILDING) FINISH GROUND FLOOR LEVEL IS EL (±)0.00M. WHICH CORR. TO RL (+)10.0M.
4. ALL CIVIL DESIGN & CONSTRUCTION ARE IN CLIENT SCOPE.

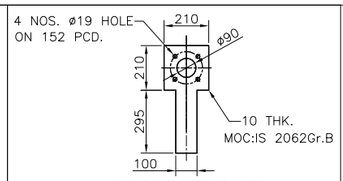












REFERENCE DRAWINGS :−

1. P&ID :−PEL−12171037−PRO−PID−001−R0/PE−V0−412−673−A001
2. HFD :−PEL−12171037−PRO−HFD−003−R0/PE−V0−412−673−A007
3. EQUIPMENT LAYOUT :−A1−PEL−1037−EL−001−R0/PE−V0−412−673−A002

LEGEND:−

LEVEL
SECTION
LEVEL
BASE LEVEL

TEXT LEGENDS:−

IL : INVERT LVL.
EL : ELEVATION.
CL : CENTER LINE.
FGL : FINISHED GROUND LEVEL.
TYP : TYPICAL.
TWL : TOP WATER LEVEL.
TOC : TOP OF CONCRETE.
BOS : BOTTOM OF SLAB.

REV	DATE	DESCRIPTION	MECH.	DRAWN	CHK.
1	03.11.2018	ISSUSED FOR APPROVAL	PAK	PSR	ESN
0	09.05.2018	ISSUSED FOR APPROVAL	PAK	AP	ESN

PROJECT:	2 X 660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI.
OWNER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT:	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
EPC CONTRACTOR:	BHARAT HEAVY ELECTRICALS LIMITED. (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
SUB CONTRACTOR :	PENNAR ENVIRO Re-engineering Water, Environment & Energy Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad – 500 084

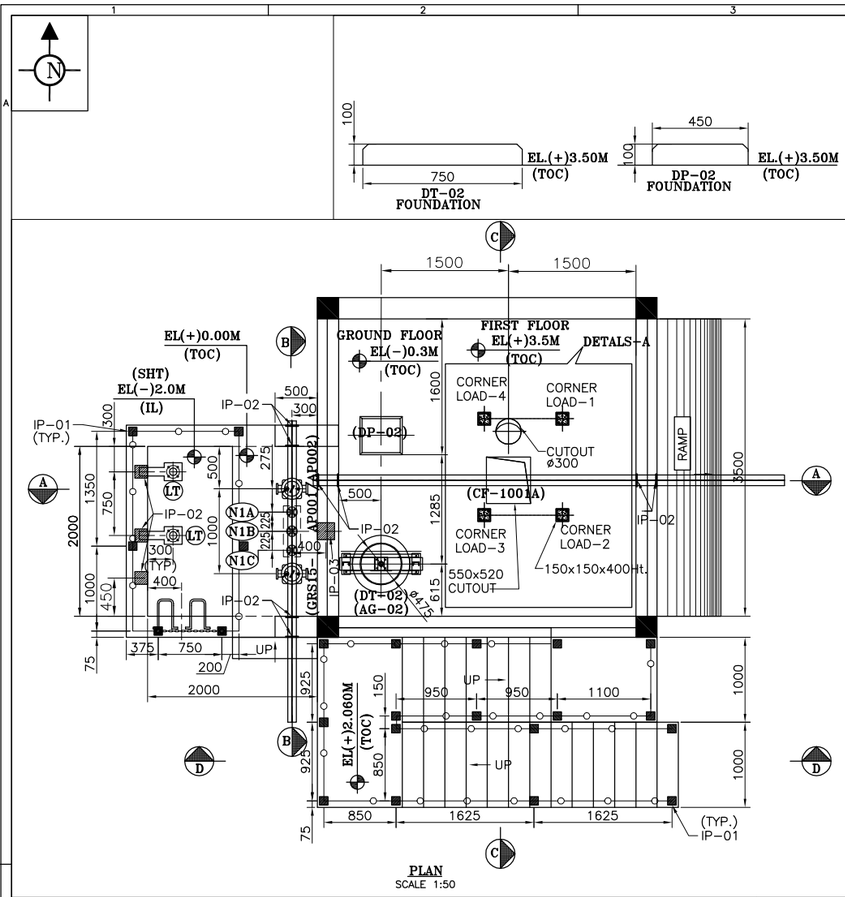
DEPT.	CODE	SCALE AS SHOWN	WEIGHT (KG)	VENDOR DRAWING NO.	ITEM
−−	−−		−	A2−PEL−1037−GA−007	

TITLE: Mech GA Drawings of all Sewage Sumps and Tanks for Sewage Treatment Plant (Part-2)

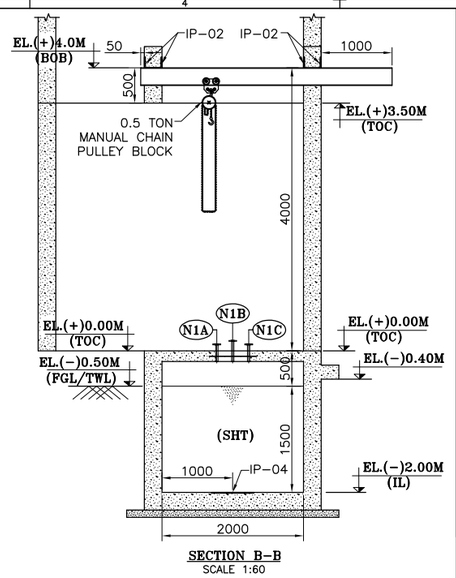
MECH.GA. DRAWING FOR HYPO CONTACT TANK CUM FILTER FEED TANK AND TREATED WATER TANK

	NAME	SIGN	DATE
PREP	AP		09.05.2018
CHKD	ESN		09.05.2018
CHKD	AJP		09.05.2018
APPD	PAK		09.05.2018

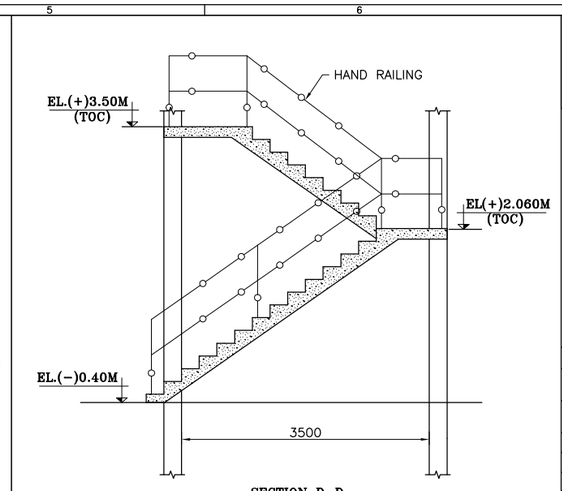
DEPT.	CARD CODE	BHEL DRAWING NO.	REV
SIGN	−	PE−V0−412−673−A005B	1
DATE		NO. OF SHEETS − 1 OF 2	



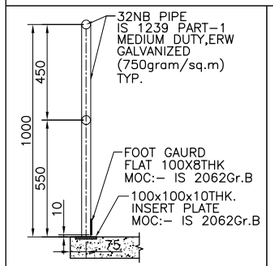
PLAN
SCALE 1:50



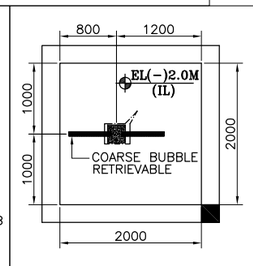
SECTION B-B
SCALE 1:60



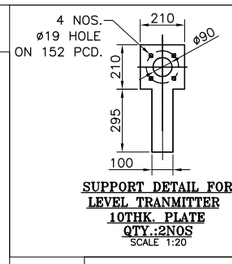
SECTION D-D
SCALE 1:60



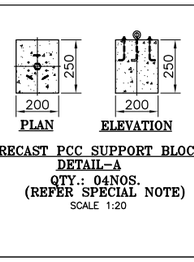
TYPICAL DETAILS OF HAND RAILING
SCALE 1:20



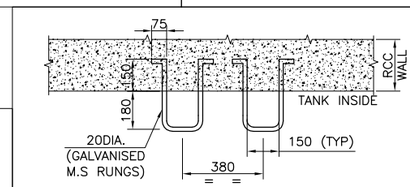
SCALE 1:60



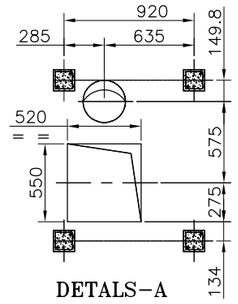
SUPPORT DETAIL FOR LEVEL TRANMITTER 10THK. PLATE QTY.:2NOS
SCALE 1:20



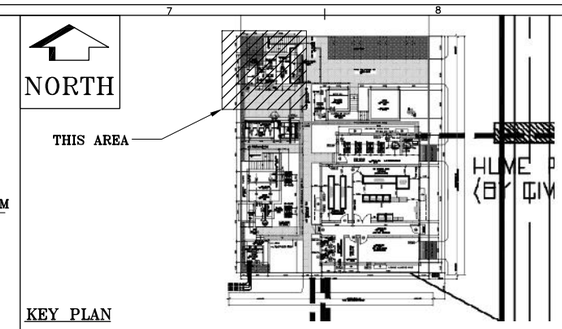
PRECAST PCC SUPPORT BLOCK DETAIL-A
QTY.: 04NOS.
(REFER SPECIAL NOTE)
SCALE 1:20



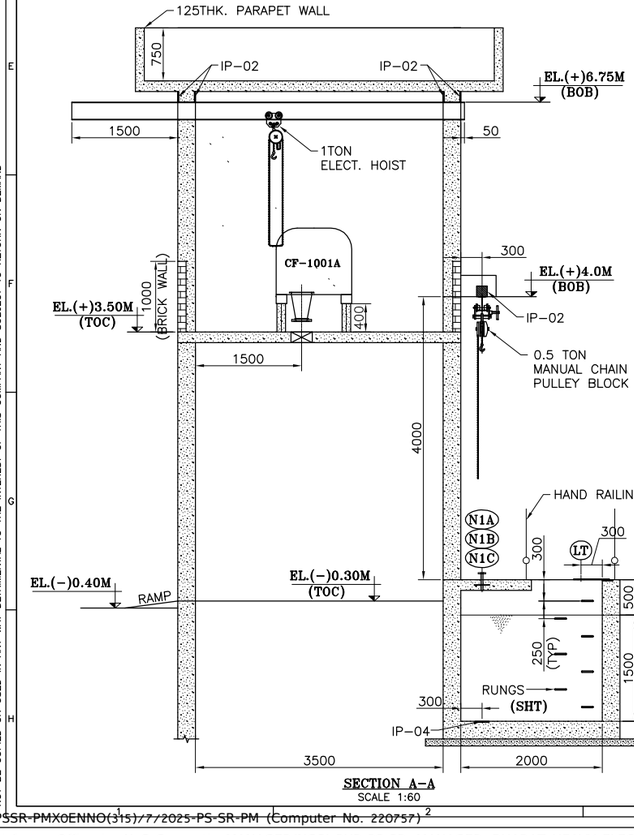
(TYP. DETAILS OF RUNGS)
SCALE 1:20



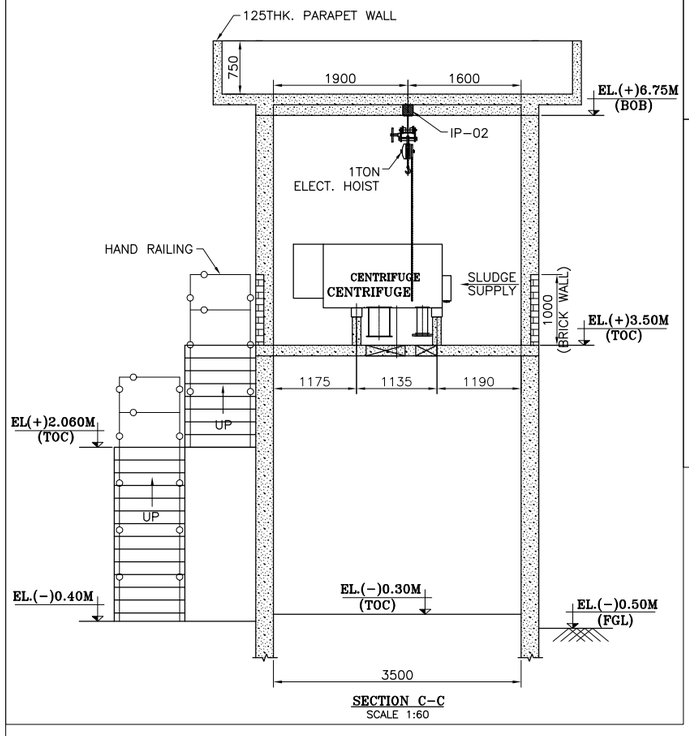
DETALS-A
SCALE 1:30



KEY PLAN



SECTION A-A
SCALE 1:60



SECTION C-C
SCALE 1:60

LEGEND:-

- LEVEL
- LEVEL
- SECTION
- FINISHED GROUND LEVEL

TEXT LEGENDS:-

IL	:	INVERT LVL.
EL	:	ELEVATION.
FGL	:	FINISHED GROUND LEVEL.
TYP	:	TYPICAL.
BOB	:	BOTTOM OF BEAM.
TOC	:	TOP OF CONCRETE.
TWL	:	TOP WATER LEVEL.

LIST OF CIVIL EQUIPMENTS

TAG.NO	DESCRIPTION	SIZE / CAPACITY.	MOC	QTY.
SHT	SLUDGE HOLDING TANK	2.0m(L)x2.0(W)x 1.5m(SWD)+0.5m(FB)	RCC-COAL TAR EPOXY SCREENED LINING	01
CFB	CENTRIFUGE BUILDING	3.5m(L)x3.5(W)x 6.75m(HT)	RCC	01

PUDDLE PIPE LIST

MARK NO.	DESCRIPTION	ELEVATION	SIZE	PROJECTION	MOC.	QTY.
N1A/C	LEVEL GAUGE	AS PER GA	25NB	100	MS	2NOS.
N1B	LEVEL GAUGE	AS PER GA	25NB	150	MS	1NO.

LIST OF INSERT PLATE

IP NO.	DESCRIPTION	SIZE	ELEVATION	QTY.
IP-01	INSERT PALTE-01	100x100x10THK.	AS PER GA.	23
IP-02	INSERT PALTE-02	150x150x10THK.	AS PER GA.	11
IP-03	INSERT PALTE-03	200x200x10THK.	AS PER GA.	01
IP-04	INSERT PALTE-04	600x200x10THK.	AS PER GA.	01

EQUIPMENT LOAD LIST

TAG.NO.	DESCRIPTION	CAPACITY	QTY.	OPERATING LOAD FOR EACH
(GRS15-AP001 /AP002)	SLUDGE TRANSFER PUMPS	2m3/hr@2.9kg/cm2	2NOS	500kgs
DP-02	HYPO DOSING PUMP	0-4LPH@4.5kg/cm2	1NO	150kgs
DT-02&AG-02	HYPO DOSING TANK WITH AGITATOR	100LTRS.	1NO	300kgs

LOAD LIST FOR CENTRIFUGE (DETAIL-A):-

CORNER LOAD NO.	STATIC LOAD INCL. BOWL CHARGE (KN)	DYNAMICAL LOAD (KN/EACH)			
		IN VERTICAL DIRECTION		IN HORIZONTAL DIRECTION	
		OPERATING SPEED	WHEN PASSING RESONANCE	OPERATING SPEED	WHEN PASSING RESONANCE
1 & 4	1.35	0.07	0.41	0.03	0.14
2 & 3	2.45	0.12	0.74	0.05	0.25

REFERENCE DWG NO:

1. P&I DIAGRAM :- PEL-12171037-PRO-PID-001/PE-V0-412-673-A001
2. HYDRAULIC DIAGRAM :- PEL-12171037-PRO-HFD-003A
3. EQUIPMENT LAYOUT :- PE-DG-412-100-M001

NOTES :-

1. ALL DIMENSIONS ARE IN mm AND LEVELS ARE IN METER UNLESS OTHERWISE NOTED.
2. FGL (−)0.50M.
3. PLANT FINISH GRADED LEVEL (FGL) SHALL BE RL (+) 9.5M. POWER HOUSE (TG BUILDING) FINISH GROUND FLOOR LEVEL IS EL (±)0.00M. WHICH CORR. TO RL (+)10.0M.
4. ALL CIVIL DESIGN & CONSTRUCTION ARE IN CLIENT'S SCOPE.

SPECIAL NOTE:-

1. CASTING OF PRECAST PCC SUPPORT BLOCK SHALL BE DONE AFTER RECEIVING MOUNTING ACCESSORIES FROM DIFFUSER VENDOR.

PROJECT	2x660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI
OWNER :-	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT:-	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
BHEL	BHARAT HEAVY ELECTRICALS LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
PENNAR ENVIRO	Re-engineering Water, Environment & Energy. Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad - 500 084

DEPT.	CODE	SCALE AS SHOWN	WEIGHT (KG)	VENDOR DRAWING NO.	ITEM
--	--	-	-	A2-PEL-1037-GA-008	

TITLE: Mech GA Drawings of all Sewage Sumps and Tanks for Sewage Treatment Plant (Part-2)

MECHANICAL G.A. DRG. FOR SLUDGE HOLDING TANK AND CENTRIFUGE BUILDING

	NAME	SIGN	DATE
PREP	ESN		08.05.2018
CHKD	AJP		08.05.2018
CHKD	SSY		08.05.2018
APPD	PAK		08.05.2018

DEPT.	CARD CODE	BHEL DRAWING NO.	REV
SIGN	-	PE-V0-412-673-A005B	1
DATE		NO. OF SHEETS - 2 OF 2	

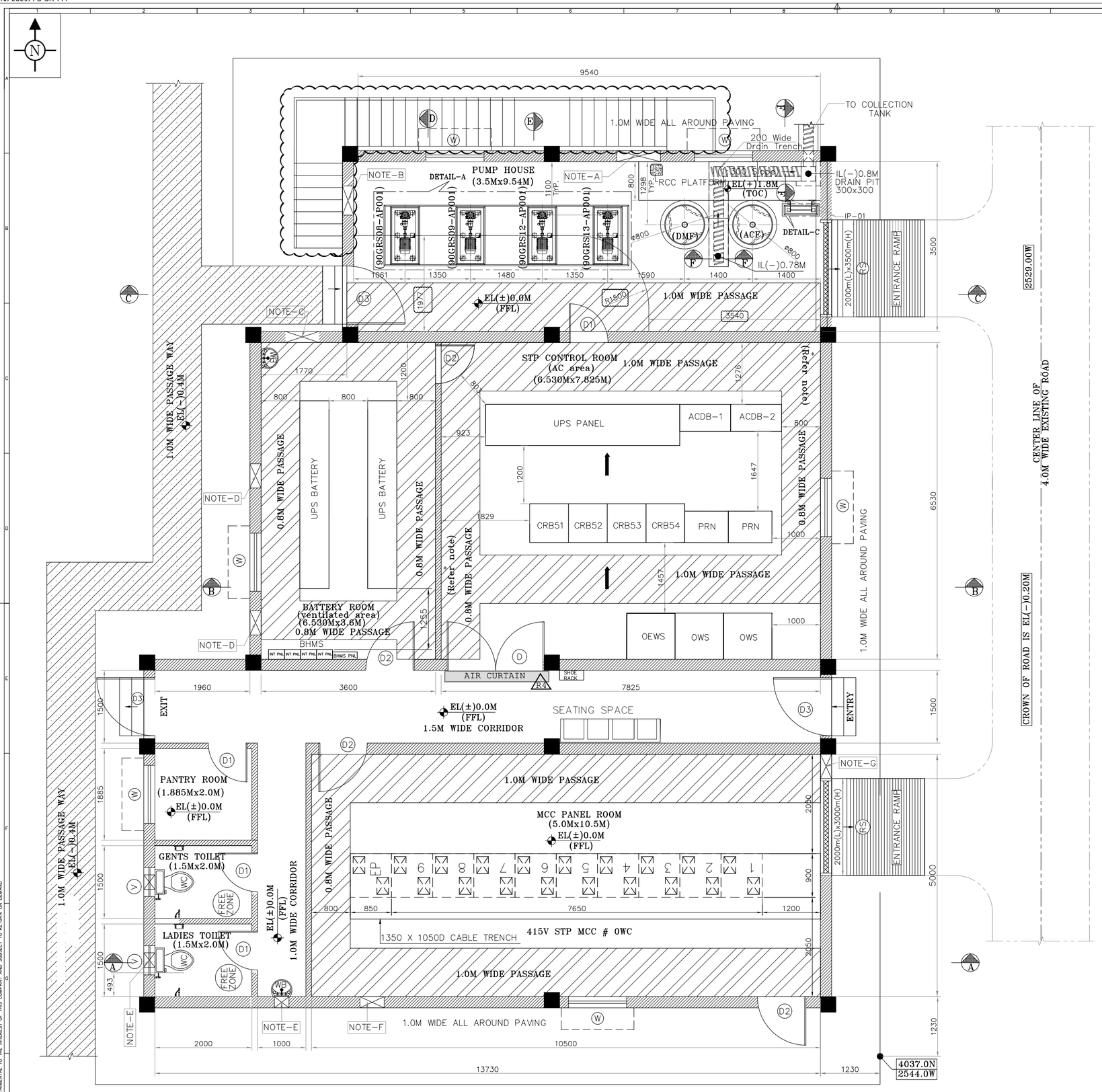
REV	DATE	DESCRIPTION	MECH.	DRAWN	CHK.	ARCH.	ELEC.	C&I
1	03.11.2018	ISSUED FOR APPROVAL	PAK	PSR	SSY			
0	08.05.2018	ISSUED FOR APPROVAL	PAK	ESN	SSY			

APPROVED

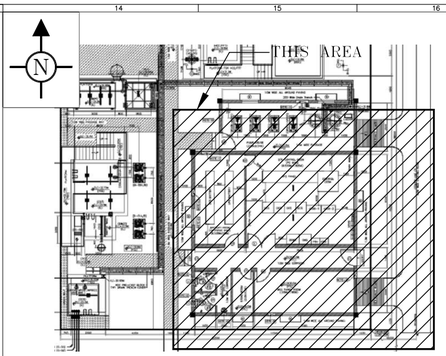
PROJECT: 1X660MW ENNORE SEZ SSCTPP AT ASH DYKE OF NCTPS, CHENNAI							Package: Sewage Treatment Plant		
Document No. PE-V0-412-673-A005C (MECH. GA DRAWINGS OF ALL SEWAGE SUMPS AND TANKS FOR SEWAGE TREATMENT PLANT - Part 3)									
Sr. No.	TANGEDCO Comments	Reply	TANGEDCO Comments	Reply	TANGEDCO Comments (R2)	Reply	Comment on R3	Reply	
1.	BHEL to provide shoes/foot rack and seats at main entrance of control room.	Noted and confirm compliance.	Comment is not incorporated.	Noted. Indicated/marked in drg in line with comment.	Seats are not indicated at main entrance of control room as per comment.	Seats indicated at main entrance of control room.	--	--	
2.	Air Curtains and Air lock at entrance to control room shall be provided as per specification, Vol. V, cl. no. 6.16.01. In General, Control room shall be designed in line with specification, Vol. V, Chapter 6.	Air Curtain shall be provided at the entrance of Control Room. With the offered design (closed corridor outside of control room, air lock arrangement provision is full filled.	Follow the contract specification.	Pl. note that entrance door to control room shall be push type with spring/damper for self/auto closing. Also refer 1.5M corridor outside control room, which has doors (markedD3), at each end of corridor, which will serve the purpose of Air Lock without making the area cramped.	Follow the contract specification.	Kindly note that confirmation wrt providing Air Curtain is already given. Push type door with spring/damper for self/auto closing is provided, and same is not opening to outside atmosphere for this offsite package. Additionally, corridor has doors (marked D3), and same will be providing air lock. Accordingly, no change in drawing is envisaged.	Mark air curtain in the drawing	Incorporate d in drg.	
3.	Backup control desk shall be placed next to OWS for ease of operation.	Backup control desk is placed in front of OWS for viewing the mimic, annunciation and for ease of operation.	Please note that requirement of Back up control desk shall be finalized as per	In layout 1 no. OWS, 1 no. OEWS and printers are indicated. Further, 1 no. 43" LED TV shall also be provided in	Please update the layout as per comment.	Layout revised. In revised layout 2 no. OWS, 1 no. OEWS and printers are indicated.	Only 1 OWS is shown instead of 2 confirmed by you.	2 nos OWS shown in drg.	

			TANGEDCO letter no:CE/P/SE/ETHPro./EE2/AEE/F.BHEL/EDN app/D.65/19 dtd 23.01.2019. 1 no. 43" LED TV and 1 no.OWS with monitor in lieu of BUP will be provided. Drawing shall be updated accordingly.	line with EDN's document "HMI BOM FOR OFFSITE PACKAGES AND MISCELLANEOUS AREAS, Dwg No. EN-DC-1174-9011".		Further, 1 no. 43" LED TV shall also be provided in line with EDN's document "HMI BOM FOR OFFSITE PACKAGES AND MISCELLANEOUS AREAS, Dwg No. EN-DC-1174-9011".	Please indicate LED in the drawing	Note at s.no 8 added wrt LED TV.	
4.	Provide roof access to all roofs.	Noted and incorporated.	Indicate the same	Roof access/ staircase is indicated in this mechanical GA drg. Kindly note that final arrangement of the stairs shall be indicated in the respective civil drg (after suitably taking care of civil design aspects). Roof top of pump room and roof above control room shall be connected with suitable steps (shown in view EE in drg).	Please show the location of staircase in layout.	Pl. refer to zone A,B-3,4 sheet 1/3 in the drg. Staircase is shown. Additionally, we have marked as "STAIRCASE TO ROOF TOP" and accentuated for clarity now in present Rev-3. Also refer View EE in sheet 3/3 of document wrt staircase approach between Pump house roof and control room roof.	--	--	

	Additional Comments:								
5			Operator Room & Panel room shall be segregated with partition.	As per space consideration in offsite areas, OWS & printers are placed along with the DDCMIS panels in AC room. Please accept the same.	Follow the comment.	All the equipment which require AC environment are placed together in one room. Hence further partition is not required between OWS & Panels. Accordingly pl. approve.	--	--	



PLAN VIEW



LIST OF CIVIL EQUIPMENT

S.NO.	DESCRIPTION	SIZE	MOC	QTY.
1	MCC ROOM	10.5m(L) x 5.0m(W) x 3.5m(HT)	RCC/ BRICK	01
2	PANTRY ROOM	1.885m(L) x 2.0m(W) x 3.5m(HT)	RCC/ BRICK	01
3	STP CONTROL ROOM	7.825m(L) x 6.530m(W) x 3.5m(HT)	RCC/ BRICK	01
4	BATTERY ROOM	3.6m(L) x 6.530m(W) x 3.5m(HT)	RCC/ BRICK	01
5	PUMP HOUSE	9.540m(L) x 3.5m(W) x 3.5m(HT)	RCC/ BRICK	01

LIST OF INSERT PLATE

IP NO.	DESCRIPTION	SIZE	ELEVATION	QTY.
IP-01	INSERT PLATE-1	150x150x10THK.	AS PER GA.	02
IP-02	INSERT PLATE-1	100x100x10THK.	AS PER GA.	05

NOTES :-

1. ALL DIMENSIONS ARE IN mm AND LEVELS ARE IN METER UNLESS OTHERWISE NOTED.
2. FGL (-)0.50M.
3. PLANT FINISH GRADED LEVEL (FGL) SHALL BE RL (+) 9.5M. POWER HOUSE (TG BUILDING) FINISH GROUND FLOOR LEVEL IS EL (±)0.00M. WHICH CORR. TO RL (+)10.0M.
4. FOR PUMPS ALL THE DIMENSION INDICATED FROM DISCHARGE OF PUMPS.
5. ALL CIVIL DESIGN & CONSTRUCTION ARE IN BHEL SCOPE.
6. CROWN OF ROAD IS 300MM ABOVE FGL(9.5M)
7. WALL (MARKED WITH '*') TO BE CONSTRUCTED AFTER ERECTION OF BATTERY/PANELS.
8. 1 NO. 43" LED TV SHALL BE PROVIDED IN CONTROL ROOM

R4

REFERENCE DRAWINGS :-

1. P&ID : -PEL-12171037-PRO-PID-001 / PE-V0-412-673-A001
2. HFD : -PEL-12171037-PRO-HFD-003 / PE-V0-412-673-A007
3. EQUIPMENT LAYOUT : -PE-V0-412-673-A002

TEXT LEGENDS :-

IL	: -INVERT LVL.
EL	: -ELEVATION.
FFL	: -FINISHED FLOOR LEVEL.
FGL	: -FINISHED GROUND LEVEL.
TYP	: -TYPICAL.
TOC	: -TOP OF CONCRETE.
TOS	: -TOP OF STEEL.
BOS	: -BOTTOM OF SLAB.
RL	: -ROAD LVL.

PROJECT:		2 X 660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI.
TANGEDCO	OWNER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
DESEIN	OWNER'S CONSULTANT:	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
BHEL	EPC CONTRACTOR:	BHARAT HEAVY ELECTRICALS LIMITED. (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
	SUB CONTRACTOR :	PENNAR ENVIRO Water, Environment & Energy Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad - 500 084

DEPT.	CODE		SCALE	WEIGHT (KG)	VENDOR DRAWING NO.	ITEM
--	--		AS SHOWN	-	A2-PEL-1037-GA-007	

TITLE: Mech GA Drawings of all Sewage Sumps and Tanks for Sewage Treatment Plant (Part-3)

MECHANICAL GA DRAWING. FOR MCC, DCS, UPS, PANTRY ROOM & PUMP HOUSE

	NAME	SIGN	DATE
PREP	MGAN		19.05.2018
CHKD	AJP		19.05.2018
CHKD	SSY		19.05.2018
APPD	PAK		19.05.2018

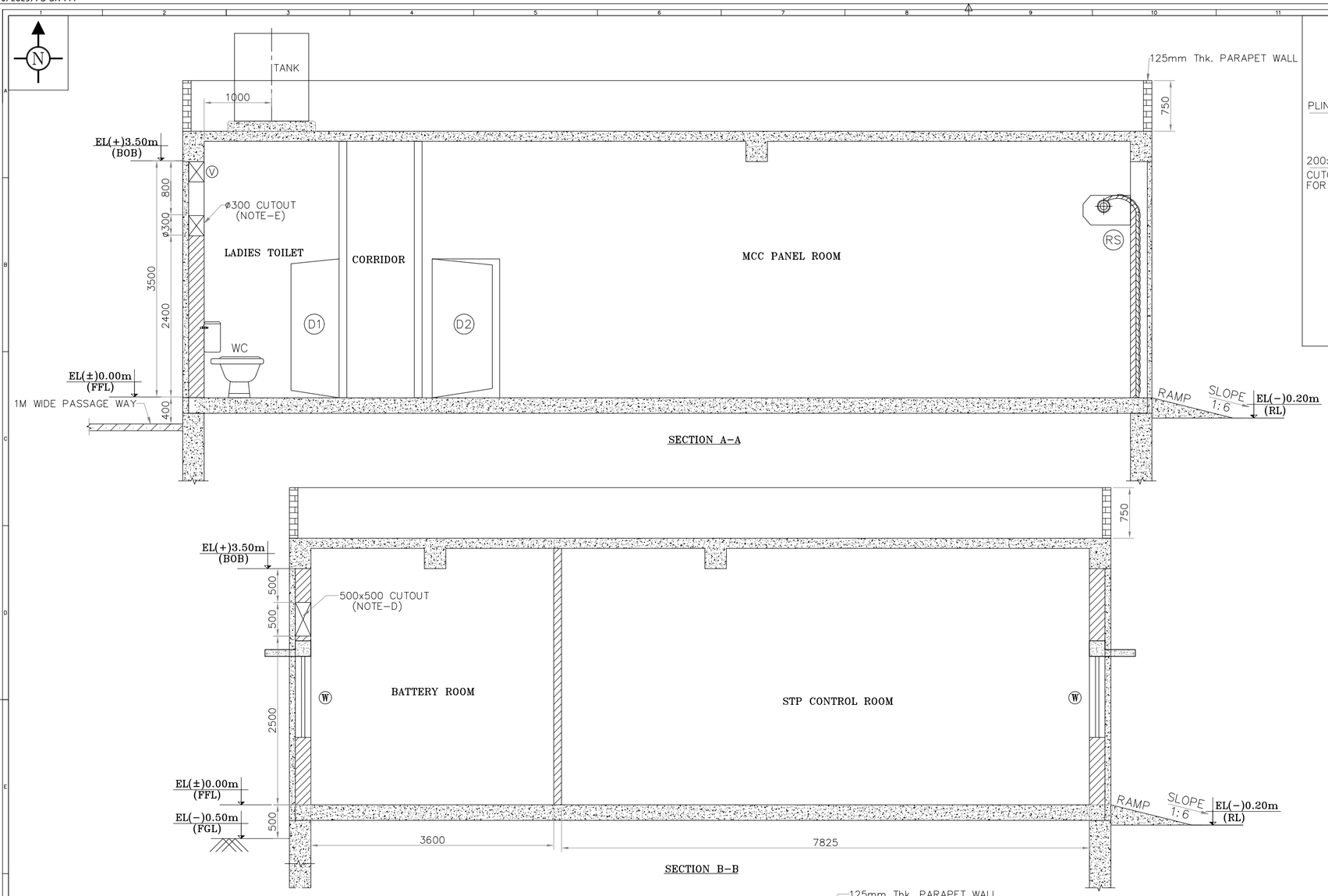
REV	DATE	DESCRIPTION	MECH.	DRAWN	CHK.
2	18.01.19	REVISED AS PER TANGEDCO COMMENTS	SSY	PSR	SSY
1	31.12.18	REVISED AS PER TANGEDCO COMMENTS	SSY	PSR	SSY
0	05.112018	REVISED AS PER BHEL COMMENTS	SSY	PSR	SSY
0-A	19.05.2018	ISSUSED FOR APPROVAL	PAK	MGAN	AJP

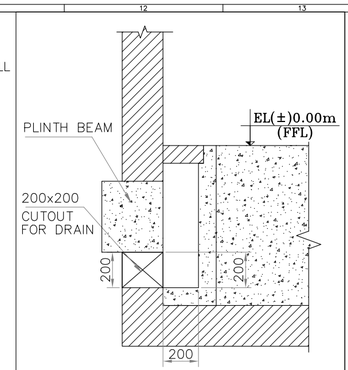
DEPT. | SIGN | DATE | CARD CODE: - | N.A.

BHEL DRAWING NO.: PE-V0-412-673-A005C | REV: 4

NO. OF SHEETS - 1 OF 3

PEL/D&D-F003





SECTION F-F
DRAIN TRENCH

LEGEND:-

- LEVEL
- LEVEL
- SECTION
- FINISHED GROUND LEVEL

NOTES FOR CONTROL ROOM:

1. WALL (MARKED WITH '*') TO BE CONSTRUCTED AFTER ERECTION OF BATTERY/PANELS.
2. MINIMUM CLEAR HEIGHT OF 3.0 MTR IS REQUIRED FOR ERECTION OF PANELS.

FRONT OF THE PANEL

NOTES FOR HVAC :-

A. 1NO. 900mmx700mm WALL OPENING FOR INLET LOUVER BOTTOM OF OPENING SHALL BE 800mm ABOVE FFL.
B. 1NO. 600x600mm WALL OPENING FOR EXHAUST FAN BOTTOM OF OPENING SHALL BE 2500mm ABOVE FFL OR AT SUITABLE HEIGHT CLEARING WALL BEAM
C. 1NO. 700mmx700mm WALL OPENING FOR INLET LOUVER BOTTOM OF OPENING SHALL BE 800mm ABOVE FFL.
D. 2NOS. 500x500mm WALL OPENING FOR EXHAUST FAN BOTTOM OF OPENING SHALL BE 2500mm ABOVE FFL OR AT SUITABLE HEIGHT CLEARING WALL BEAM. THIS MAY ACCORDINGLY BE SHOWN IN ELEVATION DRAWING.
E. 3NOS. 300 DIA WALL OPENING FOR EXHAUST FAN BOTTOM OF OPENING AT 2400mm FROM FFL.
F. 1NO. 500mmx500mm WALL OPENING FOR SUPPLY AIR FAN BOTTOM OF OPENING SHALL BE 800mm ABOVE FFL.
G. 1NO. 500mmx500mm WALL OPENING FOR GRAVITY DAMPER BOTTOM OF OPENING SHALL BE 2400mm ABOVE MCC FFL.

EQUIPMENTS LOAD LIST

SL NO.	TAG NO.	DESCRIPTION	SIZE	MOC	QTY.	STATIC LOAD	DYNAMIC LOAD
1.	(90GRS08-AP001)& (90GRS09-AP001)	FILTER FEED PUMS	4.0m3/hr. @3.5kg/cm2	CI/ CF8M	02NOS (1w+1s)	150 KG	300 KG
2.	(90GRS012-AP001)& (90GRS013-AP001)	TREATED WATER DISPOSAL PUMPS	4.0m3/hr. @2.0kg/cm2	CI/ CF8M	02NOS (1w+1s)	150 KG	300 KG
3.	DMF	DUAL MEDIA FILTER	0.8m(DIA) x 2.0m(HOS)	FRP	01NO	3.2 MT	4.8 MT
4.	ACF	ACTIVATED MEDIA FILTER	0.8m(DIA) x 2.4m(HOS)	FRP	01NO	3.7 MT	5.5 MT

REV	DATE	DESCRIPTION	MECH.	DRAWN	CHK.
2	18.01.19	REVISED AS PER TANGEDCO COMMENTS	SSY	PSR	SSY
1	31.12.18	REVISED AS PER TANGEDCO COMMENTS	SSY	PSR	SSY
0	05.11.2018	REVISED AS PER BHEL COMMENTS	SSY	PSR	SSY
0-A	19.05.2018	ISSUSED FOR APPROVAL	PAK	MGAN	AJP

PROJECT:	2 X 660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI.
OWNER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT:	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
EPC CONTRACTOR:	BHARAT HEAVY ELECTRICALS LIMITED. (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
SUB CONTRACTOR :	PENNAR ENVIRO Water, Environment & Energy Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad – 500 084

DEPT.	CODE	SCALE	WEIGHT (KG)	VENDOR DRAWING NO.	ITEM
--	--	AS SHOWN	-	A2-PEL-1037-GA-007	

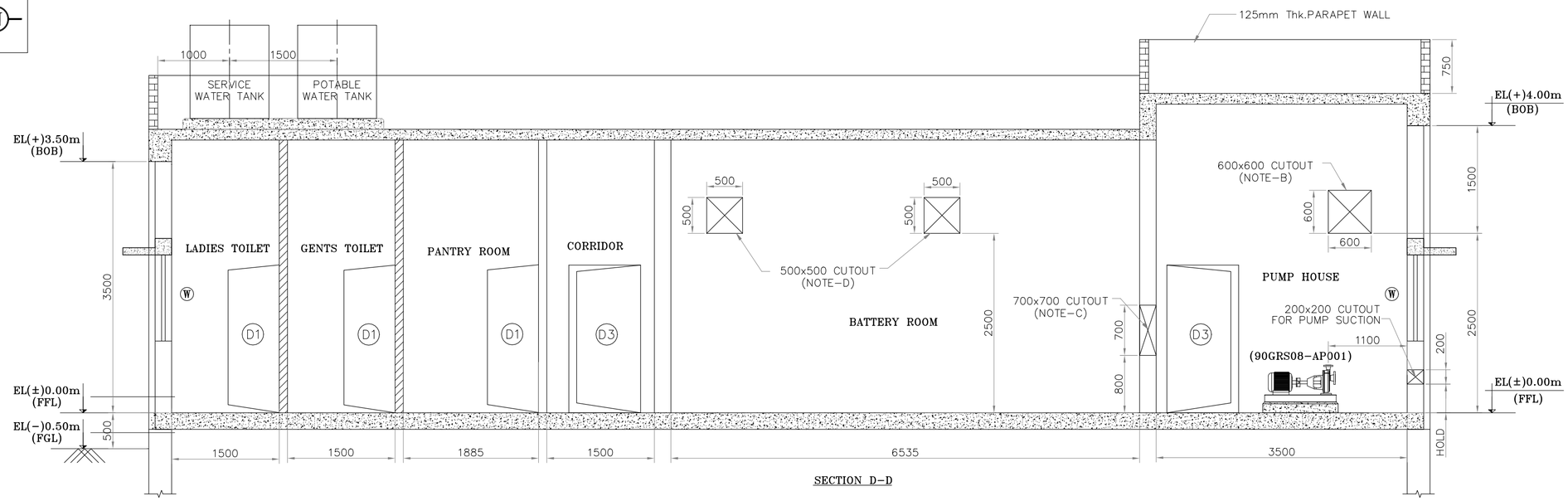
TITLE: Mech GA Drawings of all Sewage Sumps and Tanks for Sewage Treatment Plant (Part-3)

MECHANICAL GA DRAWING. FOR MCC, DCS, UPS, PANTRY ROOM & PUMP HOUSE

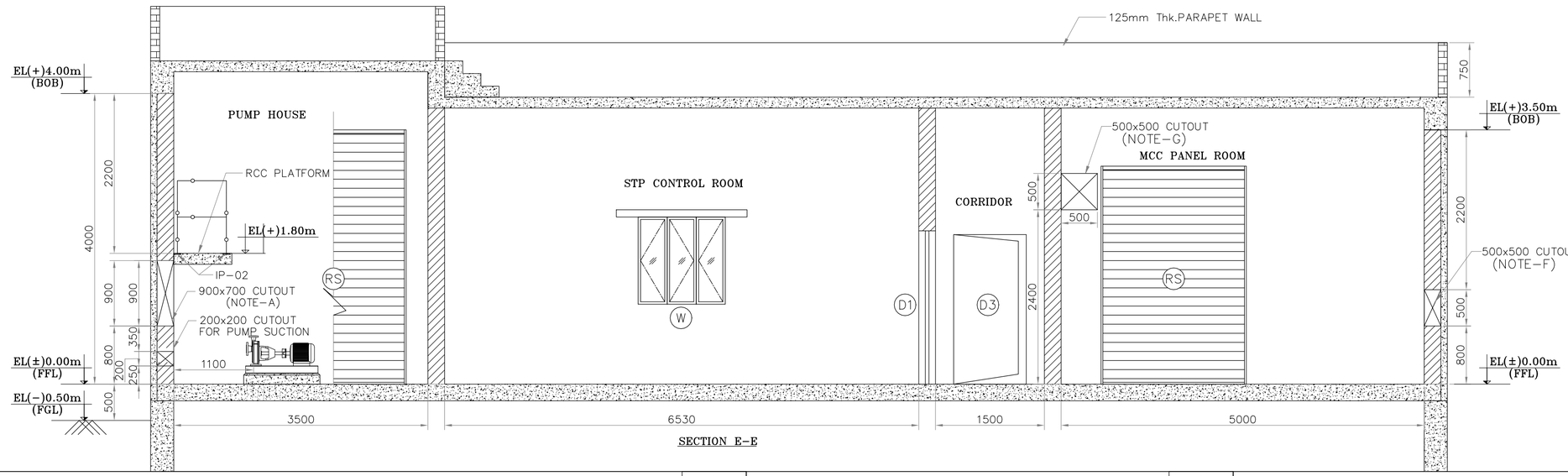
	NAME	SIGN	DATE
PREP	MGAN		19.05.2018
CHKD	AJP		19.05.2018
CHKD	SSY		19.05.2018
APPD	PAK		19.05.2018

DEPT.	CARD CODE	BHEL DRAWING NO.	REV
SIGN	-	PE-V0-412-673-A005C	4
DATE		NO. OF SHEETS - 2 OF 3	

PEL/D&D-F003



SECTION D-D



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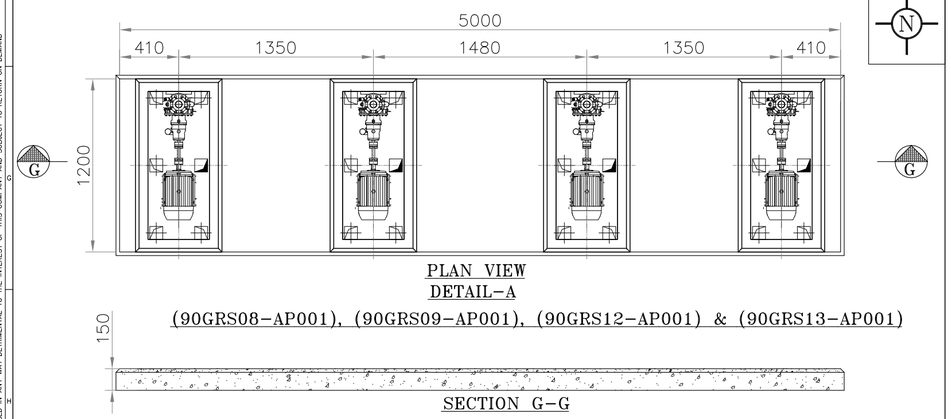
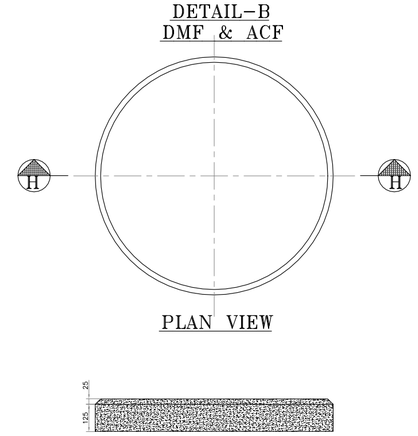


PLAN VIEW
DETAIL-A

(90GRS08-AP001), (90GRS09-AP001), (90GRS12-AP001) & (90GRS13-AP001)

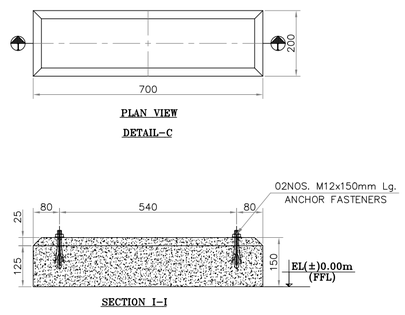
SECTION G-G



DETAIL-B
DMF & ACF

PLAN VIEW

SECTION H-H



PLAN VIEW
DETAIL-C

SECTION I-I

2	18.01.19	REVISED AS PER TANGEDCO COMMENTS	SSY	PSR	SSY
1	31.12.18	REVISED AS PER TANGEDCO COMMENTS	SSY	PSR	SSY
0	05.112018	REVISED AS PER BHEL COMMENTS	SSY	PSR	SSY
0-A	19.05.2018	ISSUSED FOR APPROVAL	PAK	MGAN	AJP
REV	DATE	DESCRIPTION	MECH.	DRAWN	CHK.

PROJECT:	2 X 660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI.
OWNER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT:	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
EPC CONTRACTOR:	BHARAT HEAVY ELECTRICALS LIMITED. (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
SUB CONTRACTOR :	PENNAR ENVIRO Water, Environment & Energy. Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad – 500 084

DEPT.	CODE		SCALE	WEIGHT (KG)	VENDOR DRAWING NO.	ITEM
--	--		AS SHOWN	–	A2-PEL-1037-GA-007	

TITLE Mech GA Drawings of all Sewage Sumps and Tanks for Sewage Treatment Plant (Part-3)

MECHANICAL GA DRAWING. FOR MCC, DCS, UPS, PANTRY ROOM & PUMP HOUSE

	NAME	SIGN	DATE
PREP	MGAN		19.05.2018
CHKD	AJP		19.05.2018
CHKD	SSY		19.05.2018
APPD	PAK		19.05.2018

DEPT.	CARD CODE	BHEL DRAWING NO.	REV
SIGN	–	PE-V0-412-673-A005C	4
DATE		NO. OF SHEETS – 3 OF 3	

APPROVED

PROJECT: 1X660MW ENNORE SEZ SSCTPP AT ASH DYKE OF NCTPS, CHENNAI
END USER : TAMILNADU GENERATION AND DISTRIBUTION COPORATION LTD
CONSULTANT : DESEIN PRIVATE LTD
CLIENT : BHARAT HEAVY ELECTRICALS LIMITED
BHEL DOC NO: PE-V0-412-673-A011
DOC NAME: TECHNICAL DATASHEET OF VERTICAL SUBMERSIBLE CENTRIFUGAL PUMPS

COMMENTS RESOLUTION SHEET

S.No.	TANGENDCO Comments	BHEL/PEL's Response
1	Indicate all Design Conditions and fill in details indicated as "As per approved vendor and specification"	Noted and Incoporated
2	Indicate maximum allowable size of solids in "Operating Conditions".	Noted and Incoporated
3	Indicate all Performance Data and fill in details indicated as "As per approved vendor and specification"	Noted and Incoporated
4	Indicate Nozzle Schedule, Sealing Flushing & Cooling Data and fill in details indicated as "As per approved vendor and specification"	Noted and Incoporated
5	In Construction Data indicate fill in details indicated as "As per approved vendor and specification	Noted and confirmed

REV.	DATE	DESCRIPTION	PREP.	CHK.	APPR.
1	27.11.2019	ISSUED FOR APPROVAL	PSR	SSY	SDK
0	04.09.2018	ISSUED FOR APPROVAL	MKK	SSY	PAK

PROJECT:	2 X 660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI.
OWNER:	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
OWNER'S CONSULTANT:	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
EPC CONTRACTOR:	BHARAT HEAVY ELECTRICALS LIMITED. (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
SUB CONTRACTOR :	**PENNAR INDUSTRIES LIMITED** ENVIRO BUSINESS UNIT Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad – 500 084
PACKAGE:	**75 KLD SEWAGE TRATMENT PLANT**

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

TITLE

Technical Datasheet Of Submersible Pumps

	NAME	SIGN	DATE
PREP	PSR		27.11.2019
CHKD	SSY		27.11.2019
APPD	SDK		27.11.2019

DEPT.							CARD CODE	BHEL DOC NO. PE-V0-412-673-A011	REV
SIGN				N.A.			–	PEL DOC NO. A4-PEL-1037-DS-P001 to 006	1
DATE								NO. OF SHEETS – 22 (EXCLUDING COVER SHEET)	

PENNAR INDUSTRIES LIMITED
ENVIRO BUSINESS UNIT

Project :	**2 x 660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS,CHENNAI**					**Date : 27-11-2019**
Customer :	**TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED**					**Rev No.: 0**
Owner Consultant :	**DESEIN PRIVATE LIMITED,DESEIN HOUSE,NEW DELHI**					**PEL/D & D- F 002**
EPC Contractor:	**BHARAT HEAVY ELECTRICALS LIMITED,PEM NOIDA**					
Package:	**75 KLD Sewage treatment plant**					
Document No:	**PE-V0-412-673-A011**	**PEL Doc. no:**	**A4-PEL-1037-DS-P001 to 006**			

Technical Datasheet For Vertical Submersible Centrifugal Pumps

	SEWAGE TRANSFER PUMPS-1	**SEWAGE TRANSFER PUMPS-2**	**SEWAGE TRANSFER PUMPS-3**	**SEWAGE TRANSFER PUMPS-4**	**COMMON COLLECTION SUMP PUMPS**	**MBBR FEED PUMPS**
GENERAL DATA						
Pump Designation	To Pump from Sewage sump-1 to common collection sump	To Pump from Sewage sump-2 to common collection sump	To Pump from Sewage sump-3 to common collection sump	To Pump from Sewage sump-4 to common collection sump	To pump from common collection sump to Screen chamber	To pump from Equalization tank to MBBR Aeration Tank
Pump Tag Number	GRS01-AP001/AP002	GRS02-AP001/AP002	GRS03-AP001/AP002	GRS04-AP001/AP002	GRS05-AP001/AP002	GRS06-AP001/AP002
Quantity (Total = W+S)	2 (1W+1S)	2 (1W+1S)	2 (1W+1S)	2 (1W+1S)	2 (1W+1S)	2 (1W+1S)
P & ID reference	PE-V0-412-673-A001	PE-V0-412-673-A001	PE-V0-412-673-A001	PE-V0-412-673-A001	PE-V0-412-673-A001	PE-V0-412-673-A001
Pump Location (Indoor/Outdoor)	Submerge in Sewage sump -1 (5m Depth)	Submerge in Sewage sump -2 (5m Depth)	Submerge in Sewage sump -3 (5m Depth)	Submerge in Sewage sump -4 (5m Depth)	Submerge in Common collectionsump (3.5m Depth)	Submerge in Equalization Tank(3.2m Depth)
Duty (Continuous/Intermittent)	Continious	Continuous	Continuous	Continuous	Continuous	Continuous
DESIGN CONDITIONS						
Pump Design Standard	IS 5120 /IS 5659/Equivalent	IS 5120 /IS 5659/Equivalent	IS 5120 /IS 5659/Equivalent	IS 5120 /IS 5659/Equivalent	IS 5120 /IS 5659/Equivalent	IS 5120 /IS 5659/Equivalent
Pump Testing Standard	HIS	HIS	HIS	HIS	HIS	HIS
Casing Design Pressure (Kg/cm2(g))	10	10	10	10	6	6
Casing Hydro test pressure (Kg/cm2(g))	6.9	8.1	5.85	5.85	2.4	2.4
Design Temp°C	50	50	50	50	50	50
OPERATING CONDITIONS						
Fluid Handled	Sewage	Sewage	Sewage	Sewage	Sewage	Sewage
Operating Temp°C [min/nor/max]	25/ 35 / 50	25/ 35 / 50	25/ 35 / 50	25/ 35 / 50	25/ 35 / 50	25/ 35 / 50
Specific Gravity at operating temp (nor/max)	1	1	1	1	1	1
Viscosity at operating temp (nor/max)	1.0 cp	1.0 cp	1.0 cp	1.0 cp	1.0 cp	1.0 cp
Solid particle size (mm)	20	20	20	20	20	20
Maximum allowable size of solids (mm)	25	20	25	25	25	25
pH of Fluid	7.0 - 8.0	7.0 - 8.0	7.0 - 8.0	7.0 - 8.0	7.0 - 8.0	7.0 - 8.0
Min/Max/Rated Flow (m3/hr)	8	8	8	8	4	4
Suction pressure (Kg/cm2(g))	Flooded	Flooded	Flooded	Flooded	Flooded	Flooded
Discharge head (Kg/cm2(g))	4	4.9	3.3	3.3	1.2	1.2
Total differential pressure (Kg/cm2(g))	4	4.9	3.3	3.3	1.2	1.2
Head in mWC	40	49	33	33	12	12.0
NPSH (A) (m)	Ample	Ample	Ample	Ample	Ample	Ample

PENNAR INDUSTRIES LIMITED
ENVIRO BUSINESS UNIT

Project :	**2 x 660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS,CHENNAI**		**Date : 27-11-2019**
Customer :	**TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED**		**Rev No.: 0**
Owner Consultant :	**DESEIN PRIVATE LIMITED,DESEIN HOUSE,NEW DELHI**		**PEL/D & D- F 002**
EPC Contractor:	**BHARAT HEAVY ELECTRICALS LIMITED,PEM NOIDA**		
Package:	**75 KLD Sewage treatment plant**		
Document No:	**PE-V0-412-673-A011**	**PEL Doc. no:**	**A4-PEL-1037-DS-P001 to 006**

Technical Datasheet For Vertical Submersible Centrifugal Pumps

	SEWAGE TRANSFER PUMPS-1	SEWAGE TRANSFER PUMPS-2	SEWAGE TRANSFER PUMPS-3	SEWAGE TRANSFER PUMPS-4	COMMON COLLECTION SUMP PUMPS	MBBR FEED PUMPS
PERFORMANCE						
Minimum Flow (m^3/ hr)	5	5	5	5	2	2
Speed of rotation (RPM)	2900	2900	2900	2900	2900	2900
Efficiency at duty point (%)	14	14	15.7	15.7	14	14
Power required at duty Point (kW)	6.22	7.63	4.58	4.58	0.93	0.93
Guaranteed power consumption at motor terminal (KW)	7.33	9.03	5.47	5.47	1.19	1.19
Motor Rating	7.5	9.3	5.5	5.5	1.1	1.1
NPSH (R) (m)	Flooded	Flooded	Flooded	Flooded	Flooded	Flooded
Shut off Head (mWC)	46	54	39	39	16	16
Maximum sound level (dB)	85 dBA at 1.0m Distance	85 dBA at 1.0m Distance	85 dBA at 1.0m Distance	85 dBA at 1.0m Distance	85 dBA at 1.0m Distance	85 dBA at 1.0m Distance
Operating Range	20 Mtr-43.5 Mtr	20 Mtr-51 Mtr	15 Mtr-36 Mtr	15 Mtr-36 Mtr	6 Mtr - 14 Mtr	6 Mtr-14 Mtr
CONSTRUCTION						
Pump Type	Non clog,Submersible Grinder Pump	Non clog,Submersible Grinder Pump	Non clog,Submersible Grinder Pump	Non clog,Submersible Grinder Pump	Non clog,Submersible Grinder Pump	Non clog,Submersible Grinder Pump
No. of Stages	Single	Single	Single	Single	Single	Single
Split type	Radial	Radial	Radial	Radial	Radial	Radial
Impeller type	Semiopen	Semiopen	Semiopen	Semiopen	Semiopen	Semiopen
Impeller Diameter (mm)	182	208	195	195	112	112
Max / Min Impeller dia.(mm)	200	235	200	200	124	124
Shaft sealing arrangement	Mechanical Seal	Mechanical Seal	Mechanical Seal	Mechanical Seal	Mechanical Seal	Mechanical Seal
Curve Number	14038-1	14038-2	14038-3	14038-4	14038-5	14038-6
Drive arrangement	Direct drive with flexible type coupling	Direct drive with flexible type coupling	Direct drive with flexible type coupling	Direct drive with flexible type coupling	Direct drive with flexible type coupling	Direct drive with flexible type coupling
Direction of Rotation of Pump from Drive End	Drive end	Drive end	Drive end	Drive end	Drive end	Drive end
Bearing Type	Deep Grove Ball Bearing	Deep Grove Ball Bearing	Deep Grove Ball Bearing	Deep Grove Ball Bearing	Deep Grove Ball Bearing	Deep Grove Ball Bearing
Protection class	IP 68	IP 68	IP 68	IP 68	IP 68	IP 68

PENNAR INDUSTRIES LIMITED
ENVIRO BUSINESS UNIT

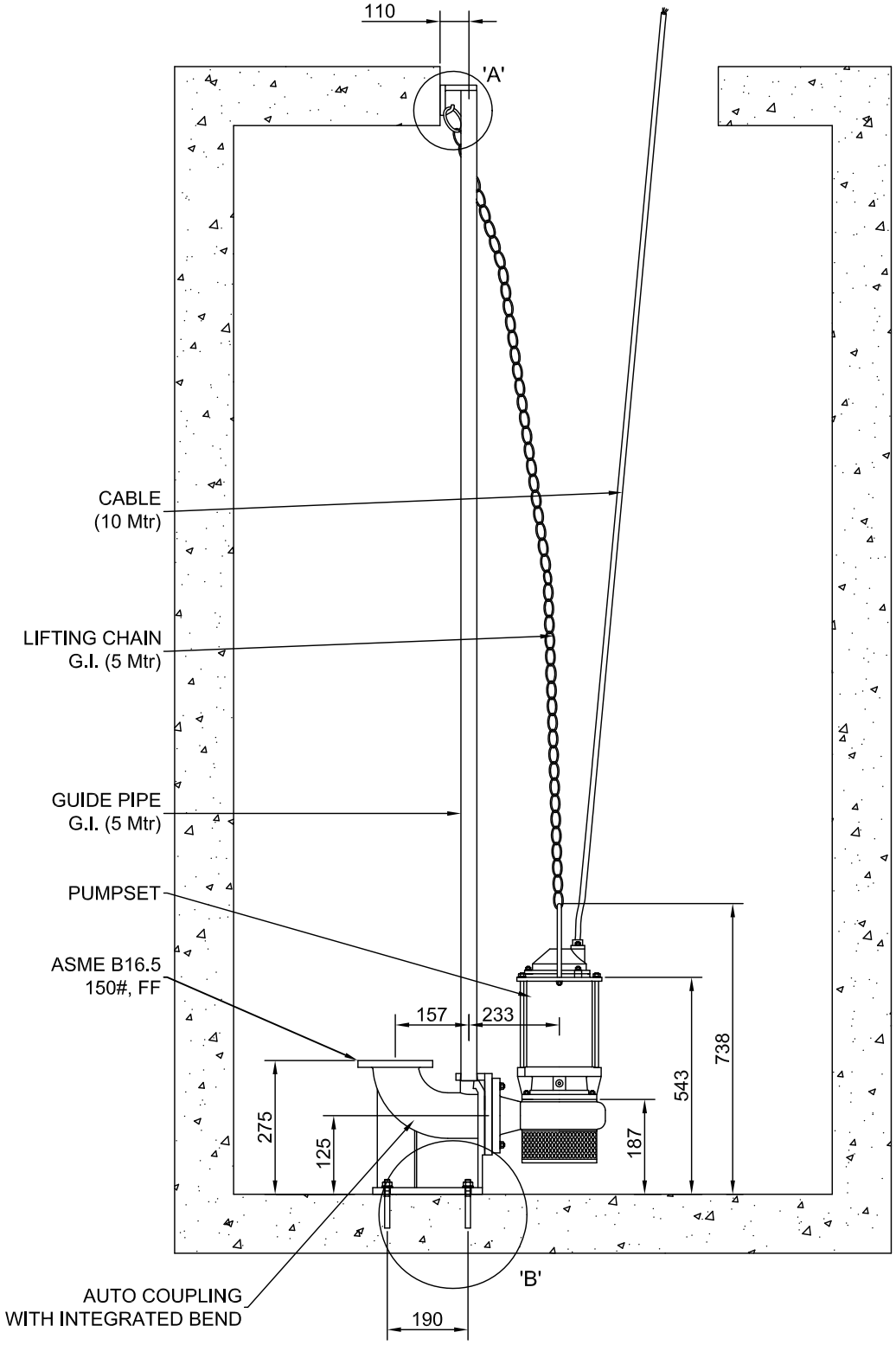
Project :	**2 x 660 MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS,CHENNAI**		**Date : 27-11-2019**
Customer :	**TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED**		**Rev No.: 0**
Owner Consultant :	**DESEIN PRIVATE LIMITED,DESEIN HOUSE,NEW DELHI**		**PEL/D & D- F 002**
EPC Contractor:	**BHARAT HEAVY ELECTRICALS LIMITED,PEM NOIDA**		
Package:	**75 KLD Sewage treatment plant**		
Document No:	**PE-V0-412-673-A011**	**PEL Doc. no:**	**A4-PEL-1037-DS-P001 to 006**

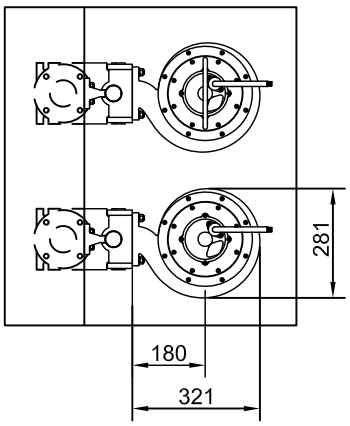
Technical Datasheet For Vertical Submersible Centrifugal Pumps

	SEWAGE TRANSFER PUMPS-1	SEWAGE TRANSFER PUMPS-2	SEWAGE TRANSFER PUMPS-3	SEWAGE TRANSFER PUMPS-4	COMMON COLLECTION SUMP PUMPS	MBBR FEED PUMPS
NOZZLE SCHEDULE						
Suction Size / Orientation	50/ Bottom	50/ Bottom	50/ Bottom	50/ Bottom	50/ Bottom	50/ Bottom
Discharge Size / Orientation / End connection	50 / side / Flanged,ASME B 16.5,150#,FF	50 / side / Flanged,ASME B 16.5,150#,FF	50 / side / Flanged,ASME B 16.5,150#,FF	50 / side / Flanged,ASME B 16.5,150#,FF	50 / side / Flanged,ASME B 16.5,150#,FF	50 / side / Flanged,ASME B 16.5,150#,FF
SEALING, FLUSHING & COOLING						
Mechanical Seal Type	Bellow type	Bellow type	Bellow type	Bellow type	Bellow type	Bellow type
Seal Manufacturer	Eagle Burgmann	Eagle Burgmann	Eagle Burgmann	Eagle Burgmann	Eagle Burgmann	Eagle Burgmann
Seal Face Materials	SiC/ SiC & C & SiC	SiC/ SiC & C & SiC	SiC/ SiC & C & SiC	SiC/ SiC & C & SiC	SiC/ SiC & C & SiC	SiC/ SiC & C & SiC
MATERIALS						
Casing Material	CI: IS 210 FG 260	CI: IS 210 FG 260	CI: IS 210 FG 260	CI: IS 210 FG 260	CI: IS 210 FG 260	CI: IS 210 FG 260
Impeller Material	A 351 Gr CF8 / SS 304	A 351 Gr CF8 / SS 304	A 351 Gr CF8 / SS 304	A 351 Gr CF8 / SS 304	A 351 Gr CF8 / SS 304	A 351 Gr CF8 / SS 304
Shaft Material/Shaft sleeve	SS 410 / SS 304	SS 410 / SS 304	SS 410 / SS 304	SS 410 / SS 304	SS 410 / SS 304	SS 410 / SS 304
Grinder	Two Blade Cutter SS 410	Two Blade Cutter SS 410	Two Blade Cutter SS 410	Two Blade Cutter SS 410	Two Blade Cutter SS 410	Two Blade Cutter SS 410
Casing & Impeller Wear Rings	C.I FG260	C.I FG260	C.I FG260	C.I FG260	C.I FG260	C.I FG260
Bolts and Nuts for Internal	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304
Bolts and Nuts for Casing	SS 304	SS 304	SS 304	SS 304	SS 304	SS 304
Gasket for Casing (O-Ring)	Nitrile rubber	Nitrile rubber	Nitrile rubber	Nitrile rubber	Nitrile rubber	Nitrile rubber
Base block material(Auto coupling stand)	CI: IS 210 FG 260	CI: IS 210 FG 260	CI: IS 210 FG 260	CI: IS 210 FG 260	CI: IS 210 FG 260	CI: IS 210 FG 260
WEIGHTS / DIMENSIONS						
Weight of pump(kg)	90	175	85	85	38	38
Dimensions (L x W x H mm)	As per GA drawing	As per GA drawing	As per GA drawing	As per GA drawing	As per GA drawing	As per GA drawing
Dynamic Load (Kg)	92	117	87	87	40	40

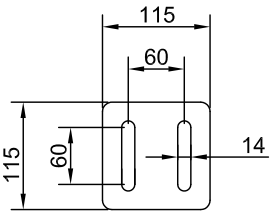
Rev	Date	Description	Made	chk.	Appd
0	27 November 2019	For Approval	PSR	SSY	SDK

SEWAGE TRANSFER PUMPS-3
GRS01-AP001 / AP002



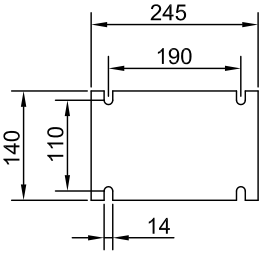


PLAN VIEW



FOUNDATION DETAIL 'A'

Anchor Fastener Details :
Size : M12x100
Material : G.I.
Qty : 2 Nos.



FOUNDATION DETAIL 'B'

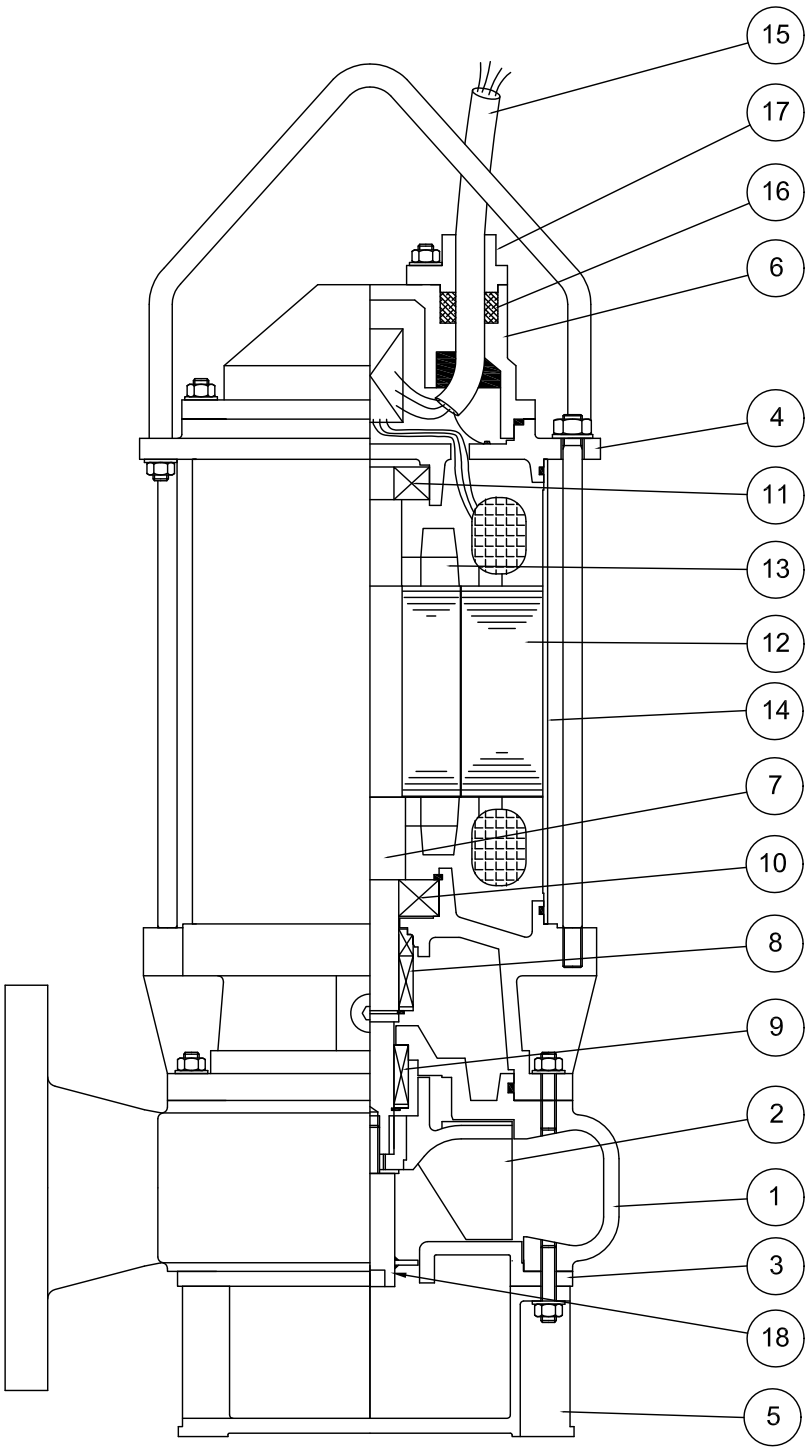
Anchor Fastener Details :
Size : M12x100
Material : G.I.
Qty : 4 Nos.

FLOWMORE LIMITED

NEW DELHI

			NAME	DATE
MODEL : FLAP 251510	Client : Tamilnadu Generation & Distribution Limited Project : 2x660 MW Innore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPC, Chennai Contractor : Bharat Heavy Electricals Ltd., PEM, Noida Job No. : 12141037	DRN BY	H.A.Trivedi	20.05.19
Capacity : 8 M³/Hr. Head : 40 Mtr. Motor : 7.5 kw Del. Size : 50 mm	DESCRIPTION : FIXED TYPE INSTALLATION Tag No. : GRS01-AP001/AP002	CHD BY	A.G.Patel	20.05.19
	QUANTITY : 2 Nos.	APPD BY	A.Y.Trivedi	20.05.19
SCALE- NTS	TITLE-: 259 GENERAL ARRANGEMENT DRAWING FOR PORTABLE SUBMERSIBLE PUMP	DRAWING No.- GA-SALE19054110 30		

SEWAGE TRANSFER PUMPS-3
GRS01-AP001 / AP002



BILLS OF MATERIAL

No.	DESCRIPTION	M.O.C.
1	Pump Casing	C.I.FG260
2	Impeller	S.S. CF8
3	Wear Plate	C.I.FG260
4	Top Cover	C.I.FG260
5	Stand	C.I.FG260
6	Terminal Box	C.I.FG260
7	Shaft	S.S. 410
8	Mech. Seal (Upper)	C vs SiC
9	Mech. Seal (Lower)	SiC vs SiC
10	Ball Bearing (DE)	SKF or Eq.
11	Ball Bearing (NDE)	SKF or Eq.
12	Stator Stamping	Si. Stamping
13	Rotor Die Cast	Aluminium
14	Motor Body	S.S.
15	Cable	PVC Insu.
16	Cable Grommet	Ni. Rubber
17	Cable Gland	C.I.FG260
18	Two Blade Cutter	S.S.410

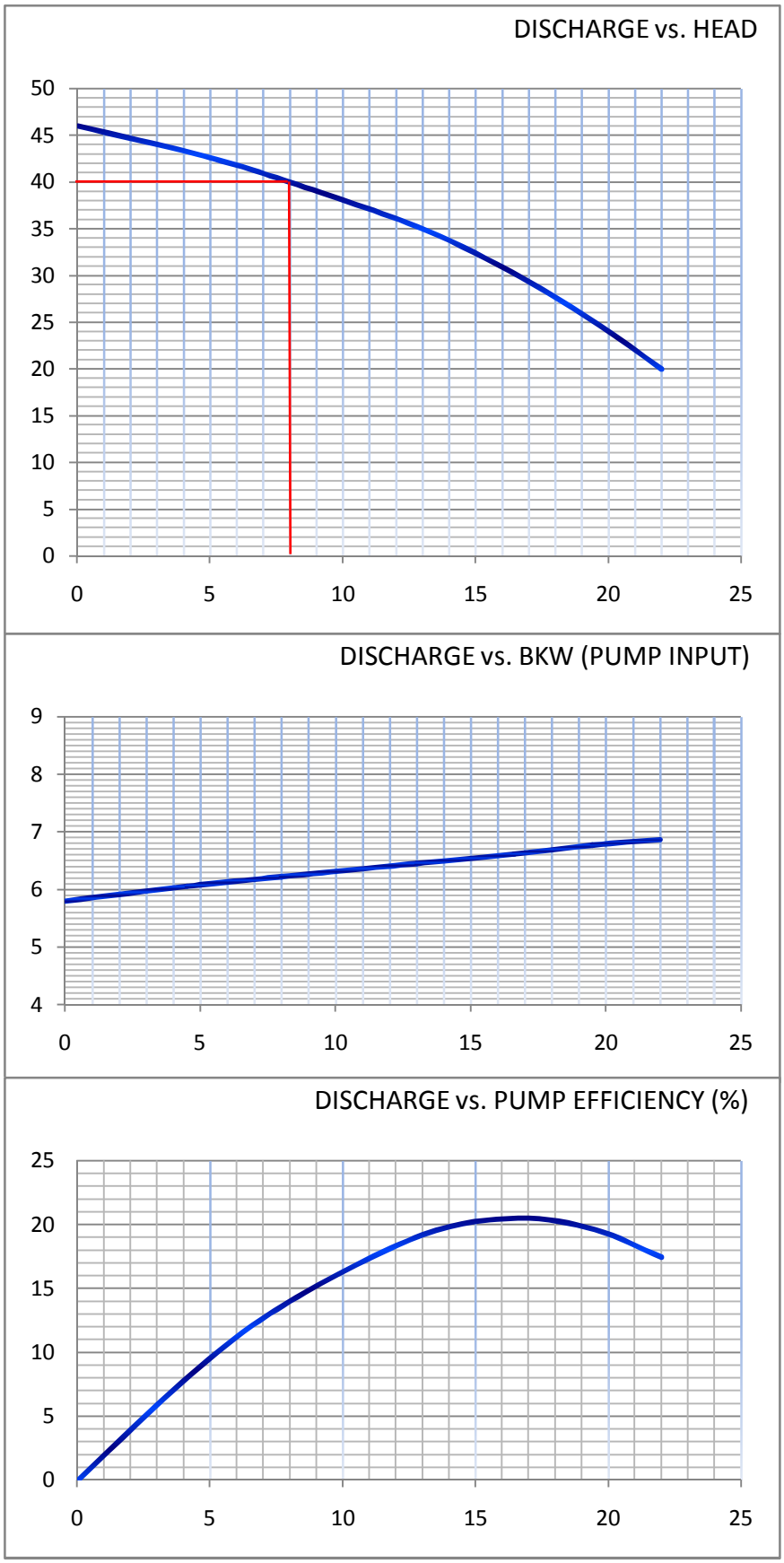
FLOWMORE LIMITED

NEW DELHI

			NAME	DATE
MODEL : FLAP 251510	Client : Tamilnadu Generation & Distribution Limited Project : 2x660 MW Innore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPC, Chennai Contractor : Bharat Heavy Electricals Ltd., PEM, Noida Job No. : 12141037	DRN BY	H.A.Trivedi	20.05.19
Capacity : 8 M³/Hr. Head : 40 Mtr. Motor : 7.5 kw Del. Size : 50 mm	DESCRIPTION : FIXED TYPE INSTALLATION Tag No. : GRS01-AP001/AP002	QUANTITY : 2 Nos.	CHD BY	A.G.Patel	20.05.19
			APPD BY	A.Y.Trivedi	20.05.19
SCALE- NTS	TITLE-: 260 CROSS SECTIONAL DRAWING FOR PORTABLE SUBMERSIBLE PUMP		DRAWING No.- CSD-SALE19054110 30		

FLOWMORE LIMITED

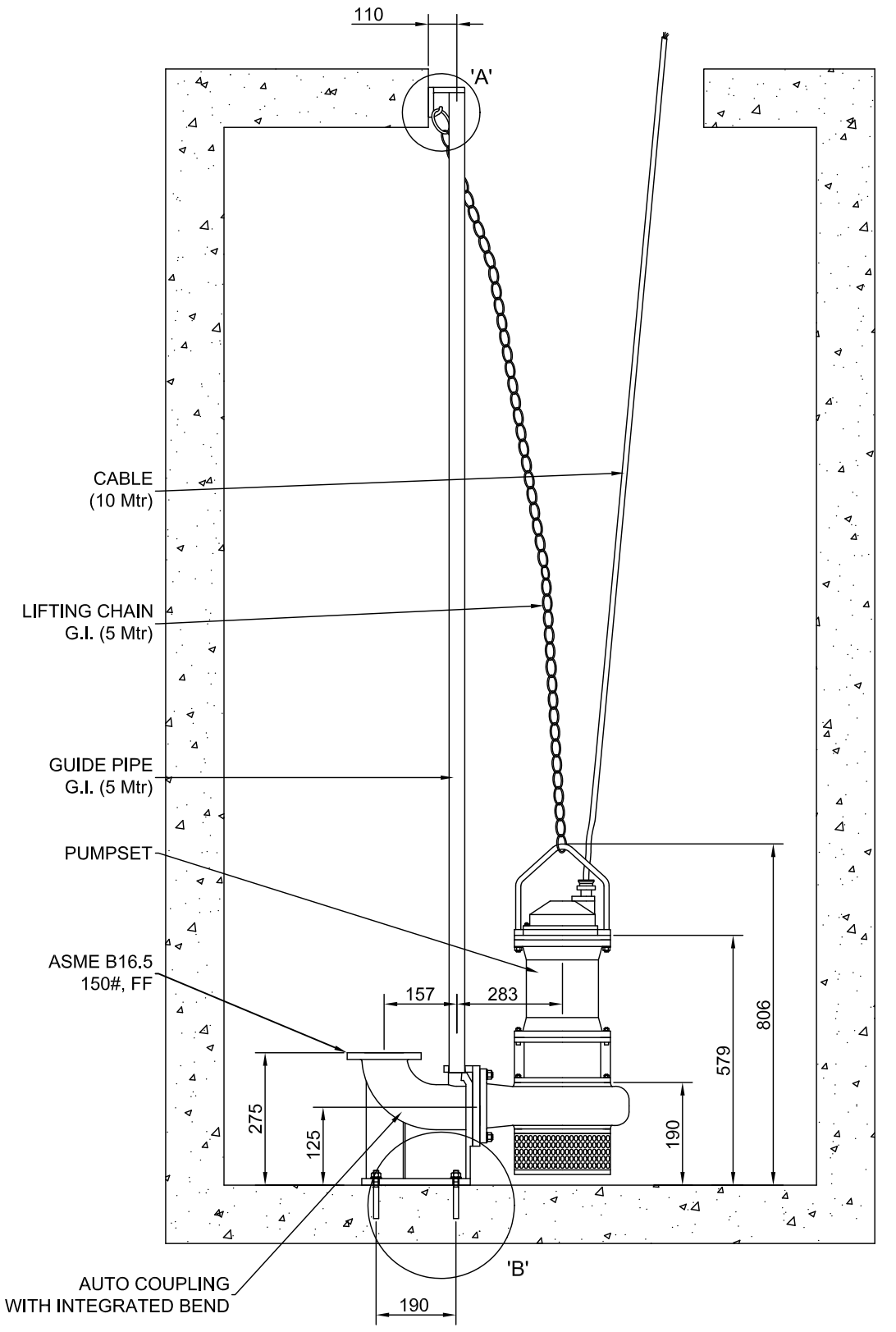
NEW DELHI

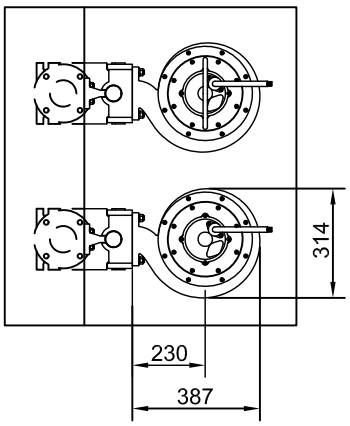


Discharge in M³/Hr.

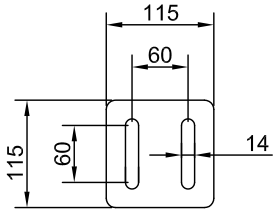
OFFER No.	14038-1
P□MP MODEL	**AP□□1□10**
H.P. / K.W.	10.0/7.5
TOTAL HEAD (Mtr.)	35
DISCHARGE (M³/Hr.)	13
PUMP EFFICIENCY (%)	19.20
BKW (PUMP INPUT kW)	6.45
DELIVERY SIZE (mm)	50
SPEED (RPM)	2900
FREE PASSEGE (mm)	25
TOTAL HEAD (Mtr.)	40 mtr.
DISCHARGE (M³/Hr.)	8 M3/Hr.
PUMP EFFICIENCY (%)	14.00
BKW (PUMP INPUT kW)	6.22

SEWAGE TRANSFER PUMPS-3
GRS02-AP001 / AP002



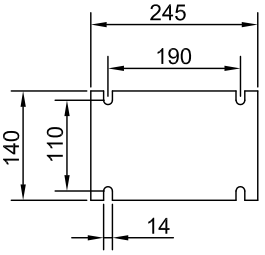


PLAN VIEW



FOUNDATION DETAIL 'A'

Anchor Fastener Details :
Size : M12x100
Material : G.I.
Qty : 2 Nos.



FOUNDATION DETAIL 'B'

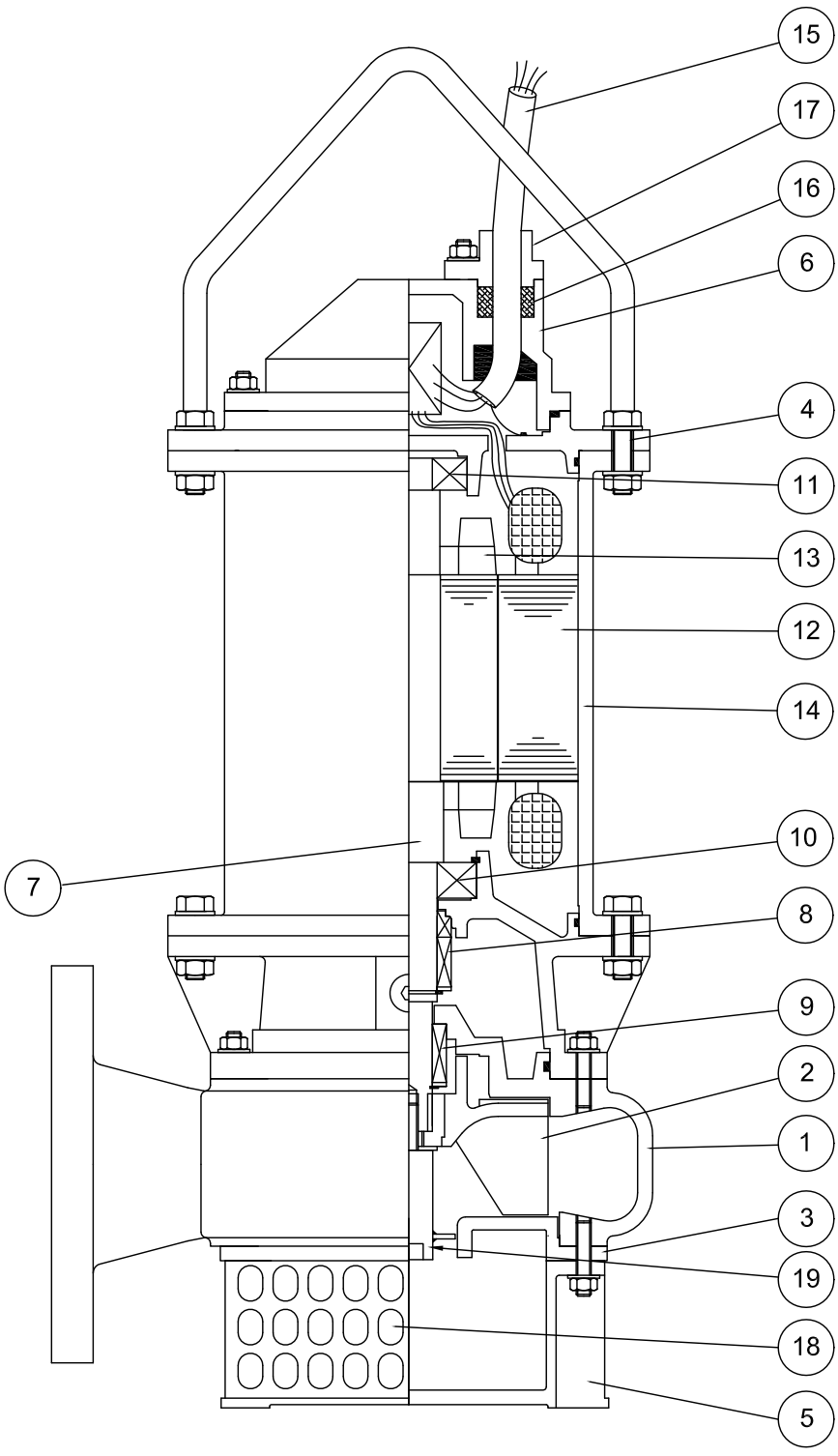
Anchor Fastener Details :
Size : M12x100
Material : G.I.
Qty : 4 Nos.

FLOWMORE LIMITED

NEW DELHI

			NAME	DATE
MODEL : FLAP 251512.5	Client : Tamilnadu Generation & Distribution Limited Project : 2x660 MW Innore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPC, Chennai Contractor : Bharat Heavy Electricals Ltd., PEM, Noida Job No. : 12141037	DRN BY	H.A.Trivedi	20.05.19
Capacity : 8 M³/Hr. Head : 49 Mtr. Motor : 9.3 kw Del. Size : 50 mm	DESCRIPTION : FIXED TYPE INSTALLATION Tag No. : GRS02-AP001/AP002	CHD BY	A.G.Patel	20.05.19
	QUANTITY : 2 Nos.	APPD BY	A.Y.Trivedi	20.05.19
SCALE- NTS	TITLE-: 262 GENERAL ARRANGEMENT DRAWING FOR PORTABLE SUBMERSIBLE PUMP	DRAWING No.- GA-SALE19054110 40		

SEWAGE TRANSFER PUMPS-3
GRS02-AP001 / AP002



BILLS OF MATERIAL

No.	DESCRIPTION	M.O.C.
1	Pump Casing	C.I.FG260
2	Impeller	S.S. CF8
3	Wear Plate	C.I.FG260
4	Top Cover	C.I.FG260
5	Stand	C.I.FG260
6	Terminal Box	C.I.FG260
7	Shaft	S.S. 410
8	Mech. Seal (Upper)	C vs SiC
9	Mech. Seal (Lower)	SiC vs SiC
10	Ball Bearing (DE)	SKF or Eq.
11	Ball Bearing (NDE)	SKF or Eq.
12	Stator Stamping	Si. Stamping
13	Rotor Die Cast	Aluminium
14	Motor Body	C.I.FG260
15	Cable	PVC Insu.
16	Cable Grommet	Ni. Rubber
17	Cable Gland	C.I.FG260
18	Strainer	S.S.
19	Two Blade Cutter	S.S.410

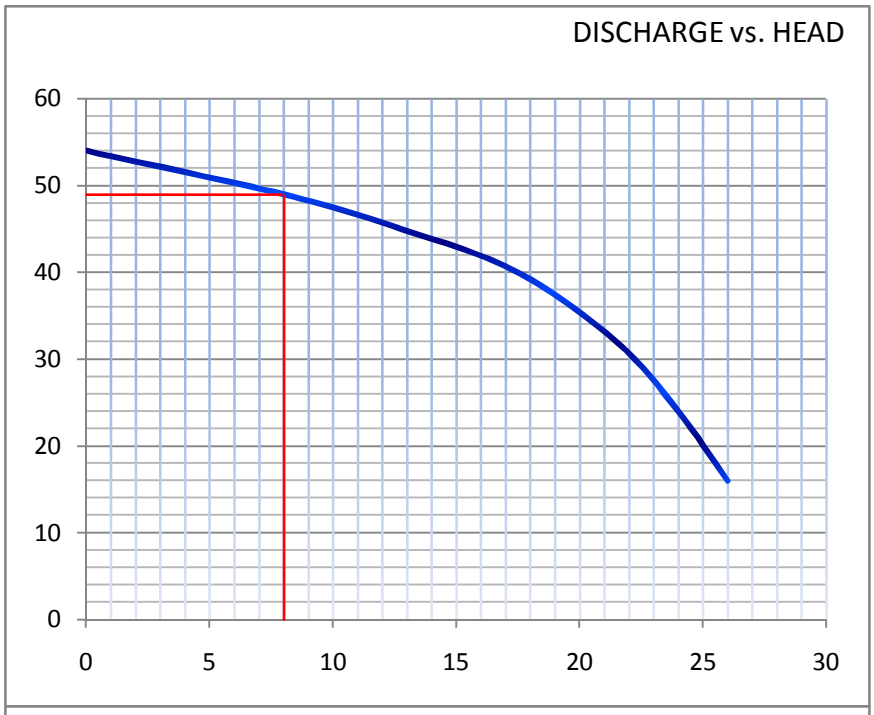
FLOWMORE LIMITED

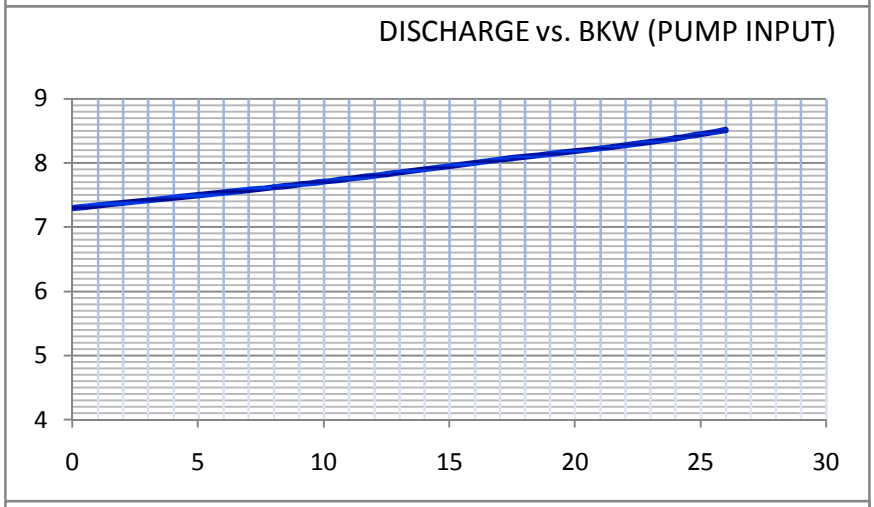
NEW DELHI

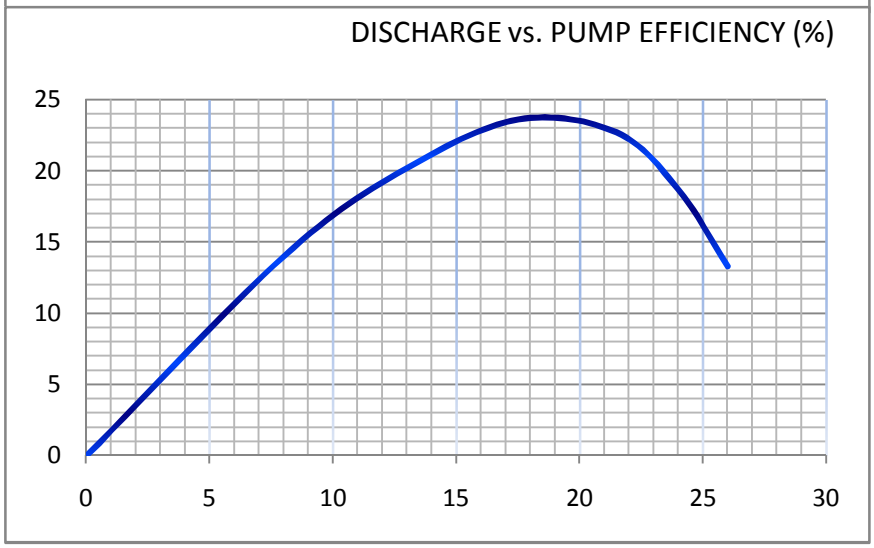
			NAME	DATE
MODEL : FLAP 251512.5	Client : Tamilnadu Generation & Distribution Limited Project : 2x660 MW Innore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPC, Chennai Contractor : Bharat Heavy Electricals Ltd., PEM, Noida Job No. : 12141037	DRN BY	H.A.Trivedi	20.05.19
Capacity : 8 M³/Hr. Head : 49 Mtr. Motor : 9.3 kw Del. Size : 50 mm	DESCRIPTION : FIXED TYPE INSTALLATION Tag No. : GRS02-AP001/AP002	QUANTITY : 2 Nos.	CHD BY	A.G.Patel	20.05.19
			APPD BY	A.Y.Trivedi	20.05.19
SCALE- NTS	TITLE-: 263 CROSS SECTIONAL DRAWING FOR PORTABLE SUBMERSIBLE PUMP		DRAWING No.- CSD-SALE19054110 40		

FLOWMORE LIMITED

NEW DELHI



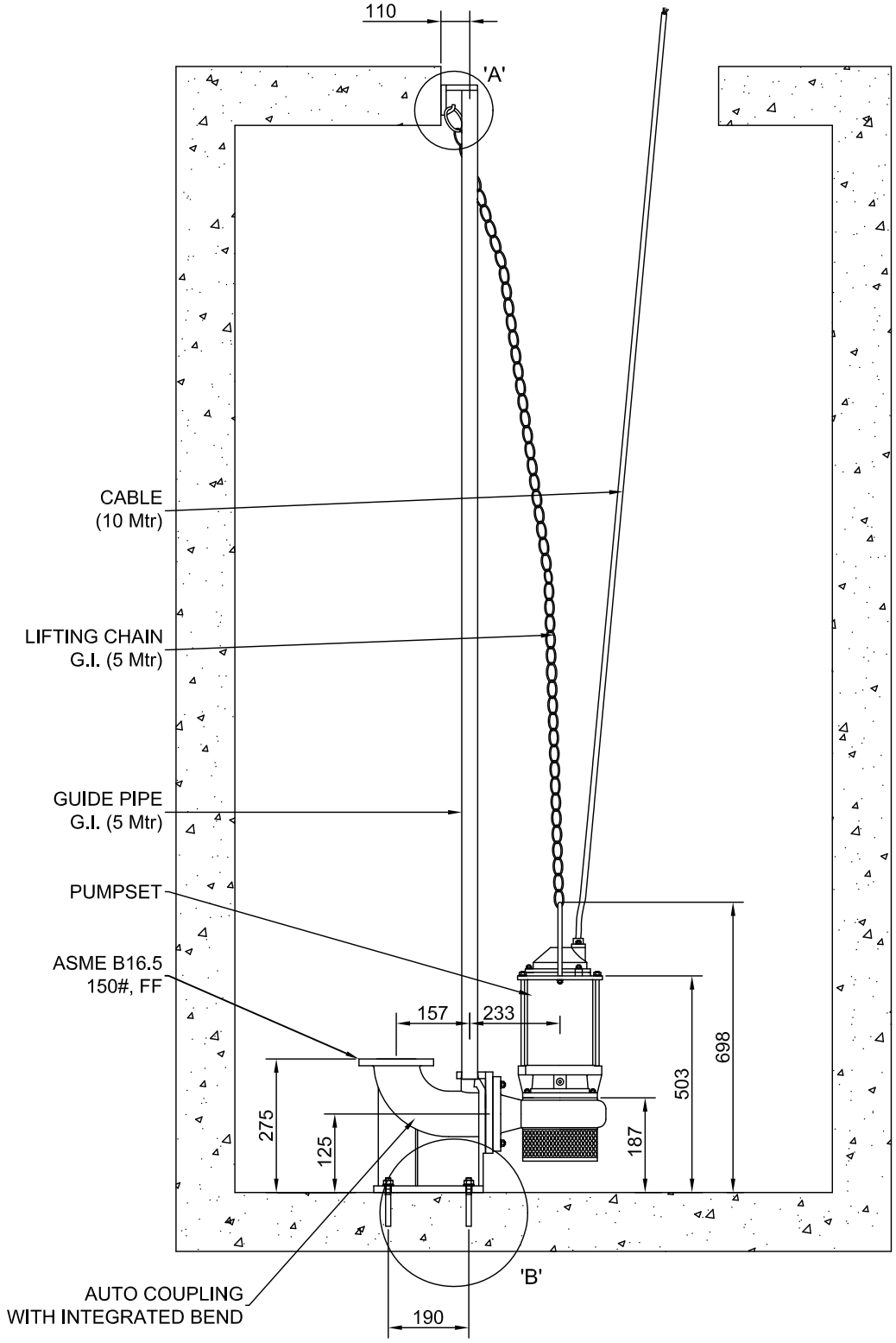


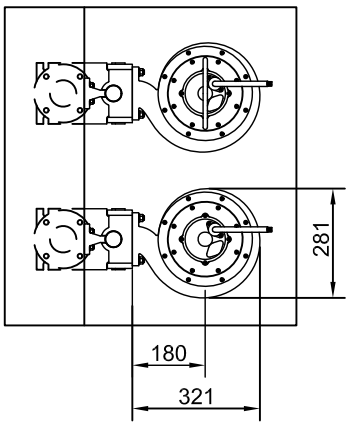


Discharge in M³/Hr.

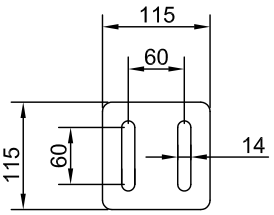
OFFER No.	14038-2
PUMP MODEL	**FLAP251512.5**
H.P. / K.W.	12.5/9.3
TOTAL HEAD (Mtr.)	40
DISCHARGE (M³/Hr.)	17.5
PUMP EFFICIENCY (%)	23.60
BKW (PUMP INPUT kW)	8.08
DELIVERY SIZE (mm)	50
SPEED (RPM)	2900
FREE PASSEGE (mm)	25
TOTAL HEAD (Mtr.)	49 mtr.
DISCHARGE (M³/Hr.)	8 M3/Hr.
PUMP EFFICIENCY (%)	14.30
BKW (PUMP INPUT kW)	7.63

SEWAGE TRANSFER PUMPS-3
GRS03-AP001 / AP002



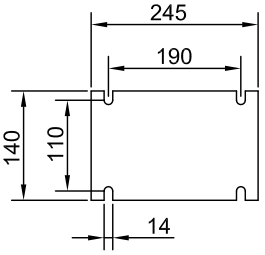


PLAN VIEW



FOUNDATION DETAIL 'A'

Anchor Fastener Details :
Size : M12x100
Material : G.I.
Qty : 2 Nos.



FOUNDATION DETAIL 'B'

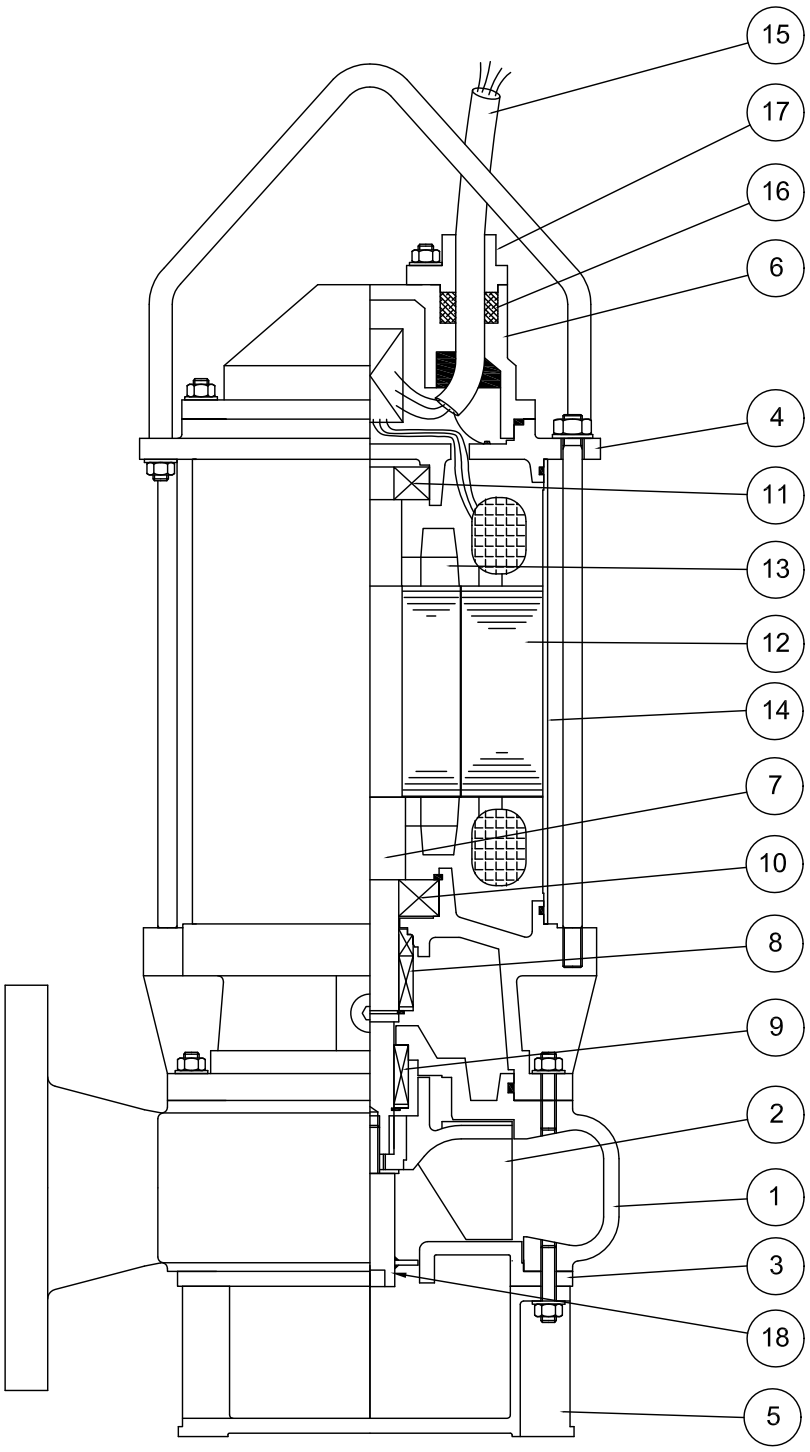
Anchor Fastener Details :
Size : M12x100
Material : G.I.
Qty : 4 Nos.

FLOWMORE LIMITED

NEW DELHI

			NAME	DATE
MODEL : FLAP 25157.5	Client : Tamilnadu Generation & Distribution Limited Project : 2x660 MW Innore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPC, Chennai Contractor : Bharat Heavy Electricals Ltd., PEM, Noida Job No. : 12141037	DRN BY	H.A.Trivedi	20.05.19
Capacity : 8 M³/Hr. Head : 33 Mtr. Motor : 5.5 kw Del. Size : 50 mm	DESCRIPTION : FIXED TYPE INSTALLATION Tag No. : GRS03-AP001/AP002	CHD BY	A.G.Patel	20.05.19
	QUANTITY : 2 Nos.	APPD BY	A.Y.Trivedi	20.05.19
SCALE- NTS	TITLE-: 265 GENERAL ARRANGEMENT DRAWING FOR PORTABLE SUBMERSIBLE PUMP	DRAWING No.- GA-SALE19054110 50		

SEWAGE TRANSFER PUMPS-3
GRS03-AP001 / AP002



BILLS OF MATERIAL

No.	DESCRIPTION	M.O.C.
1	Pump Casing	C.I.FG260
2	Impeller	S.S. CF8
3	Wear Plate	C.I.FG260
4	Top Cover	C.I.FG260
5	Stand	C.I.FG260
6	Terminal Box	C.I.FG260
7	Shaft	S.S. 410
8	Mech. Seal (Upper)	C vs SiC
9	Mech. Seal (Lower)	SiC vs SiC
10	Ball Bearing (DE)	SKF or Eq.
11	Ball Bearing (NDE)	SKF or Eq.
12	Stator Stamping	Si. Stamping
13	Rotor Die Cast	Aluminium
14	Motor Body	S.S.
15	Cable	PVC Insu.
16	Cable Grommet	Ni. Rubber
17	Cable Gland	C.I.FG260
18	Two Blade Cutter	S.S.410

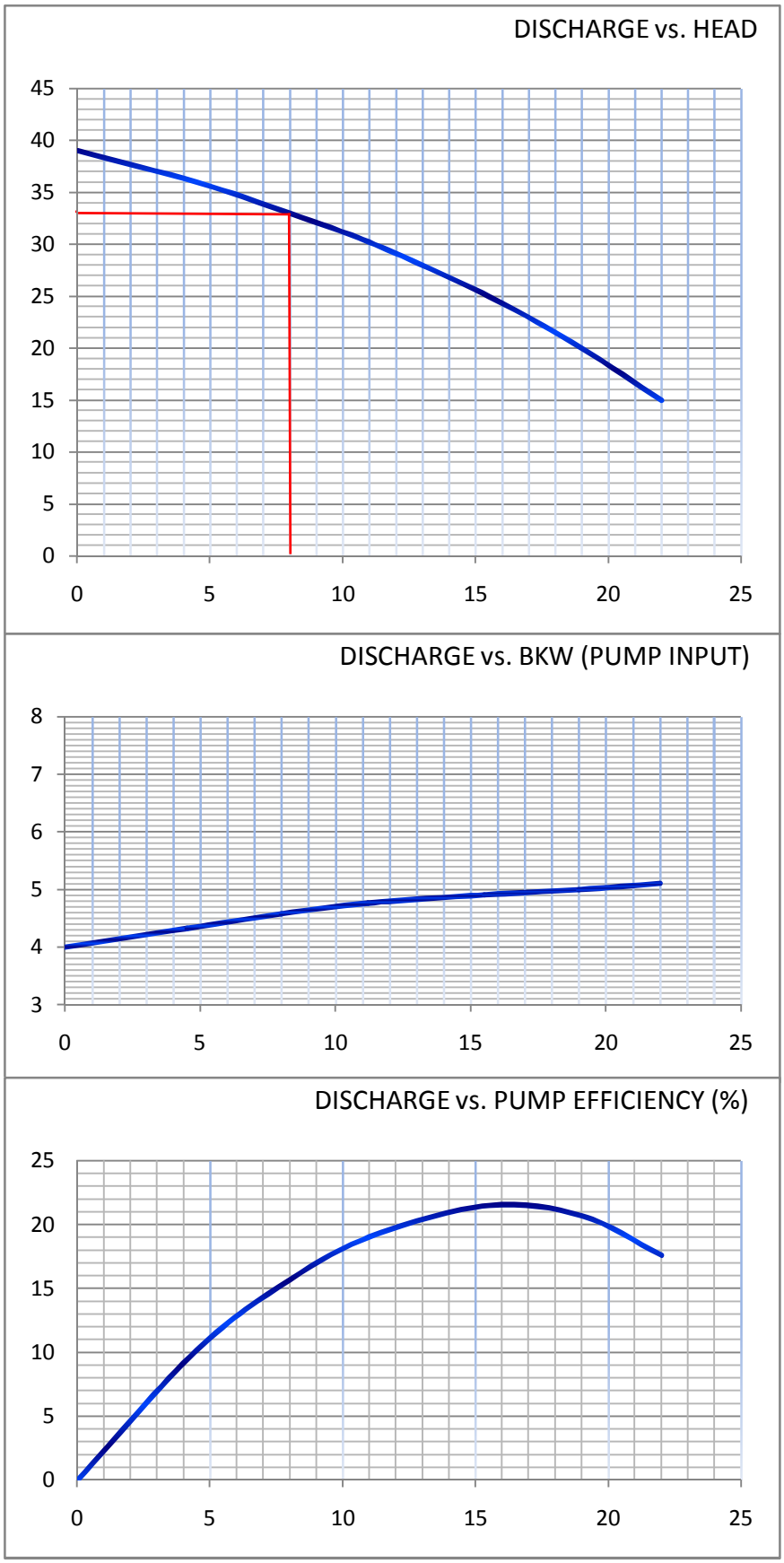
FLOWMORE LIMITED

NEW DELHI

			NAME	DATE
MODEL : FLAP 25157.5	Client : Tamilnadu Generation & Distribution Limited Project : 2x660 MW Innore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPC, Chennai Contractor : Bharat Heavy Electricals Ltd., PEM, Noida Job No. : 12141037	DRN BY	H.A.Trivedi	20.05.19
Capacity : 8 M³/Hr. Head : 33 Mtr. Motor : 5.5 kw Del. Size : 50 mm	DESCRIPTION : FIXED TYPE INSTALLATION Tag No. : GRS03-AP001/AP002	QUANTITY : 2 Nos.	CHD BY	A.G.Patel 20.05.19
			APPD BY	A.Y.Trivedi 20.05.19
SCALE- NTS	TITLE-: 266 CROSS SECTIONAL DRAWING FOR PORTABLE SUBMERSIBLE PUMP		DRAWING No.- CSD-SALE19054110 50	

FLOWMORE LIMITED

NEW DELHI

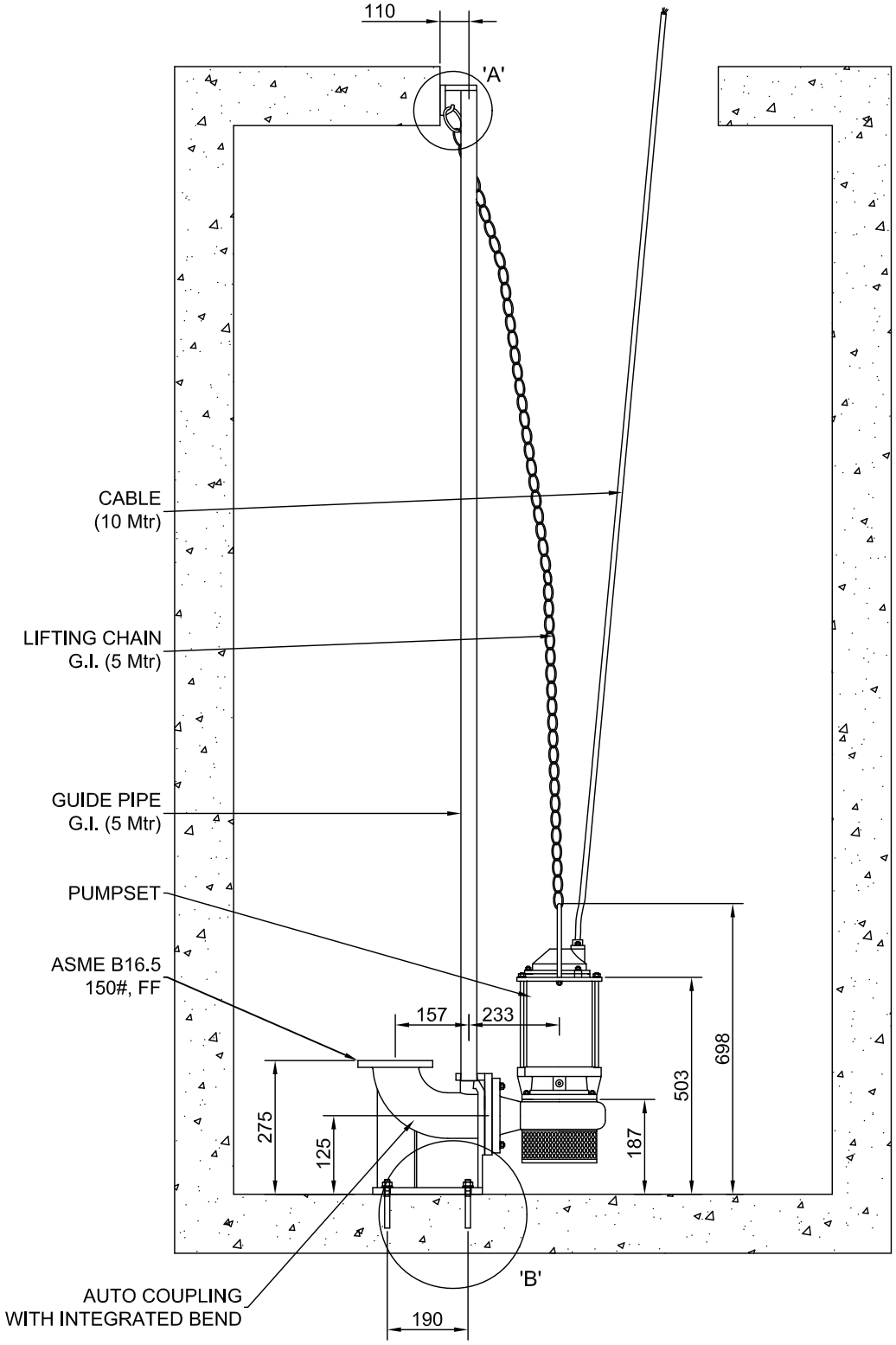


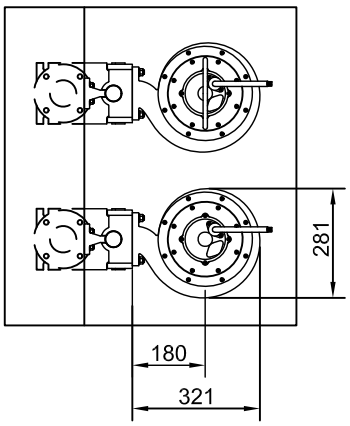
OFFER No.	14038-3
PUMP MODEL	**FLAP25157.5**
H.P. / K.W.	7.5/5.5
TOTAL HEAD (Mtr.)	30
DISCHARGE (M³/Hr.)	11.2
PUMP EFFICIENCY (%)	19.20
BKW (PUMP INPUT kW)	4.77
DELIVERY SIZE (mm)	50
SPEED (RPM)	2900
FREE PASSEGE (mm)	25
TOTAL HEAD (Mtr.)	33
DISCHARGE (M³/Hr.)	8
PUMP EFFICIENCY (%)	15.70
BKW (PUMP INPUT kW)	4.58

Discharge in M³/Hr.

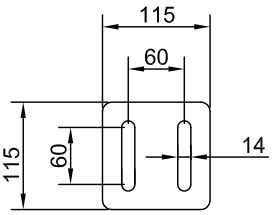
267

SEWAGE TRANSFER PUMPS-3
GRS04-AP001 / AP002



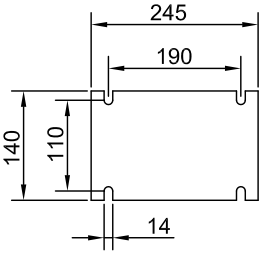


PLAN VIEW



FOUNDATION DETAIL 'A'

Anchor Fastener Details :
Size : M12x100
Material : G.I.
Qty : 2 Nos.



FOUNDATION DETAIL 'B'

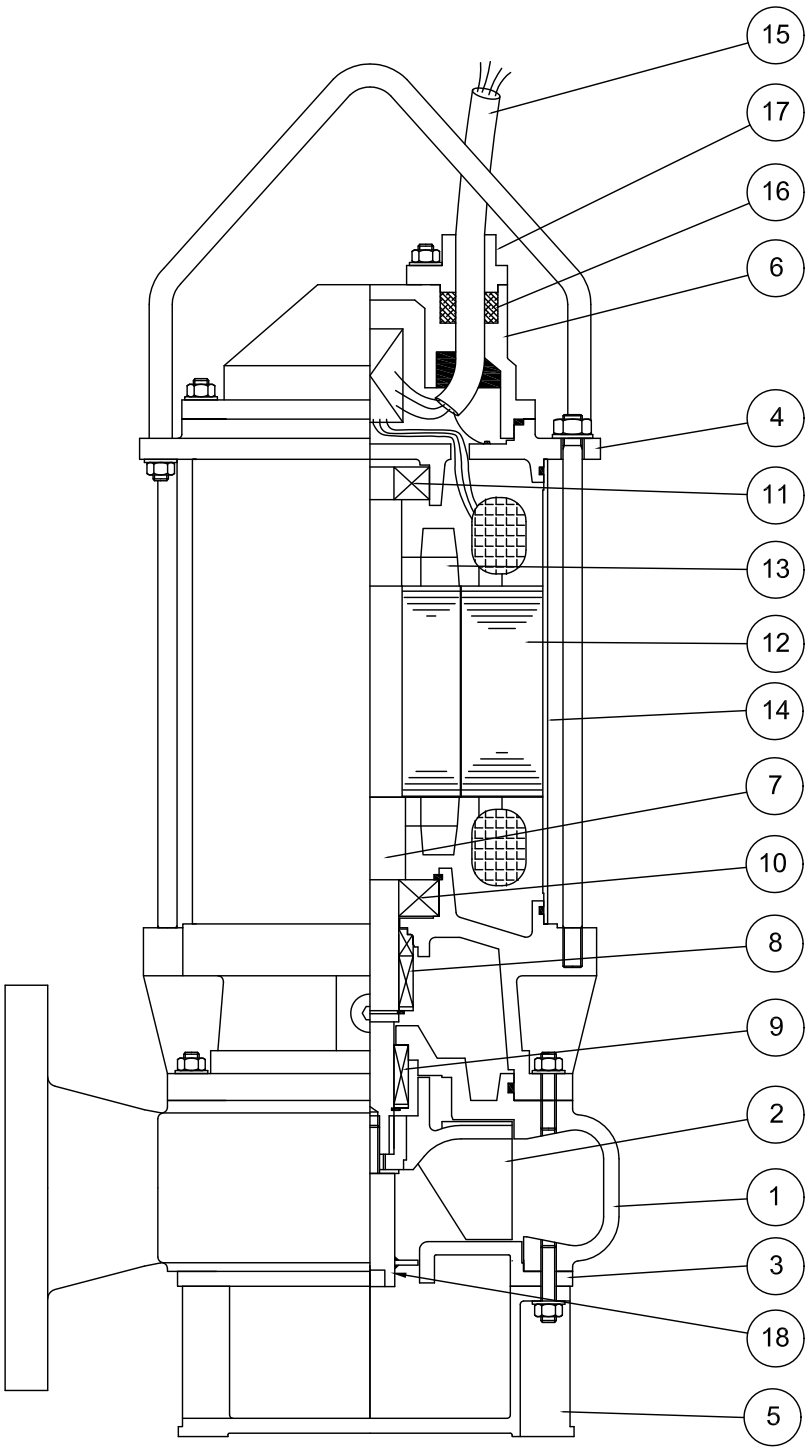
Anchor Fastener Details :
Size : M12x100
Material : G.I.
Qty : 4 Nos.

FLOWMORE LIMITED

NEW DELHI

			NAME	DATE
MODEL : FLAP 25157.5	Client : Tamilnadu Generation & Distribution Limited Project : 2x660 MW Innore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPC, Chennai Contractor : Bharat Heavy Electricals Ltd., PEM, Noida Job No. : 12141037	DRN BY	H.A.Trivedi	20.05.19
Capacity : 8 M³/Hr. Head : 33 Mtr. Motor : 5.5 kw Del. Size : 50 mm	DESCRIPTION : FIXED TYPE INSTALLATION Tag No. : GRS04-AP001/AP002	CHD BY	A.G.Patel	20.05.19
	QUANTITY : 2 Nos.	APPD BY	A.Y.Trivedi	20.05.19
SCALE- NTS	TITLE-: 268 GENERAL ARRANGEMENT DRAWING FOR PORTABLE SUBMERSIBLE PUMP	DRAWING No.- GA-SALE19054110 60		

SEWAGE TRANSFER PUMPS-3
GRS04-AP001 / AP002



BILLS OF MATERIAL

No.	DESCRIPTION	M.O.C.
1	Pump Casing	C.I.FG260
2	Impeller	S.S. CF8
3	Wear Plate	C.I.FG260
4	Top Cover	C.I.FG260
5	Stand	C.I.FG260
6	Terminal Box	C.I.FG260
7	Shaft	S.S. 410
8	Mech. Seal (Upper)	C vs SiC
9	Mech. Seal (Lower)	SiC vs SiC
10	Ball Bearing (DE)	SKF or Eq.
11	Ball Bearing (NDE)	SKF or Eq.
12	Stator Stamping	Si. Stamping
13	Rotor Die Cast	Aluminium
14	Motor Body	S.S.
15	Cable	PVC Insu.
16	Cable Grommet	Ni. Rubber
17	Cable Gland	C.I.FG260
18	Two Blade Cutter	S.S.410

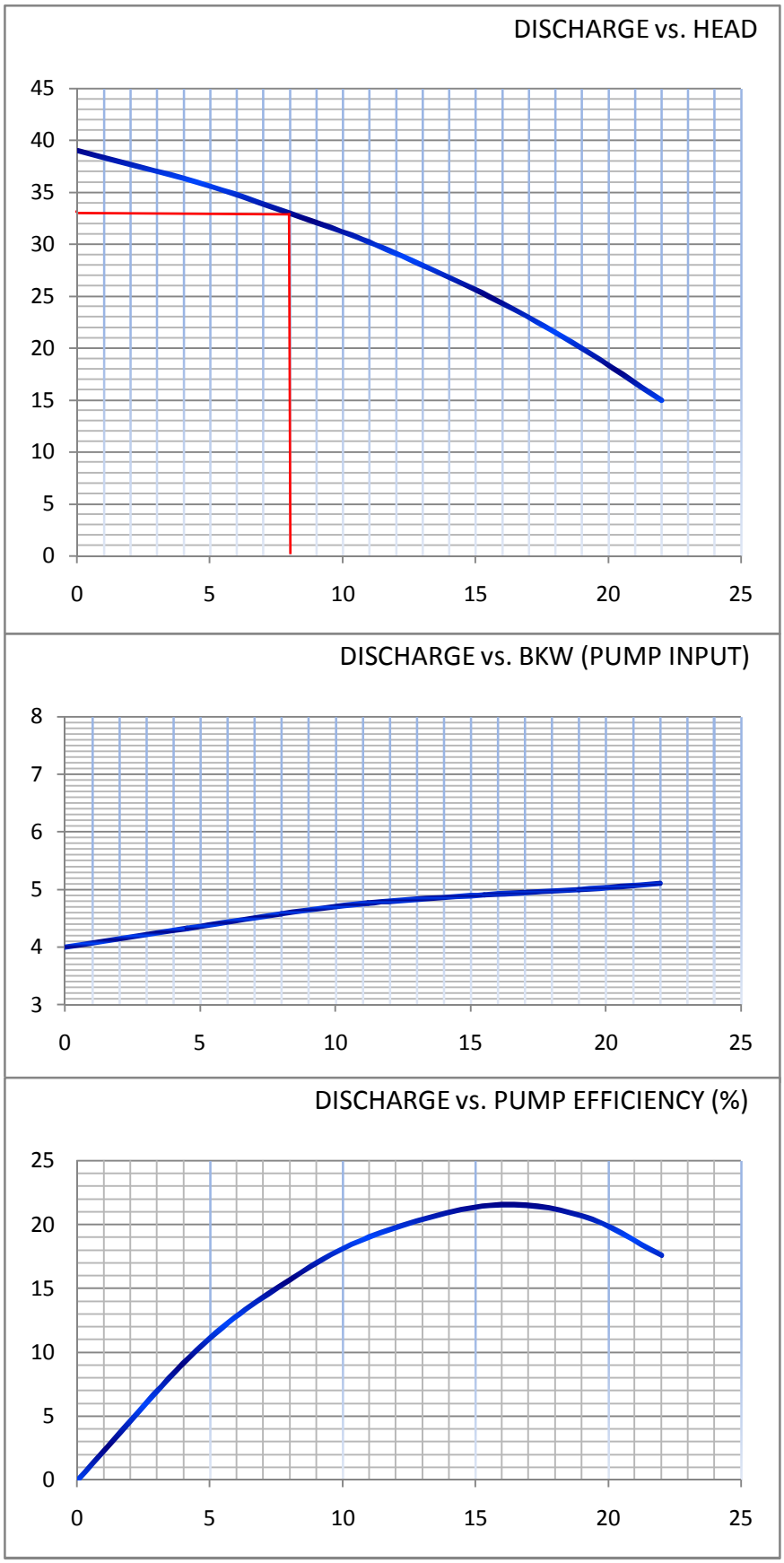
FLOWMORE LIMITED

NEW DELHI

				NAME	DATE
MODEL : FLAP 25157.5	Client : Tamilnadu Generation & Distribution Limited Project : 2x660 MW Innore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPC, Chennai Contractor : Bharat Heavy Electricals Ltd., PEM, Noida Job No. : 12141037		DRN BY	H.A.Trivedi	20.05.19
Capacity : 8 M³/Hr. Head : 33 Mtr. Motor : 5.5 kw Del. Size : 50 mm	DESCRIPTION : FIXED TYPE INSTALLATION Tag No. : GRS04-AP001/AP002	QUANTITY : 2 Nos.	CHD BY	A.G.Patel	20.05.19
			APPD BY	A.Y.Trivedi	20.05.19
SCALE- NTS	TITLE-: 269 CROSS SECTIONAL DRAWING FOR PORTABLE SUBMERSIBLE PUMP		DRAWING No.- CSD-SALE19054110 60		

FLOWMORE LIMITED

NEW DELHI

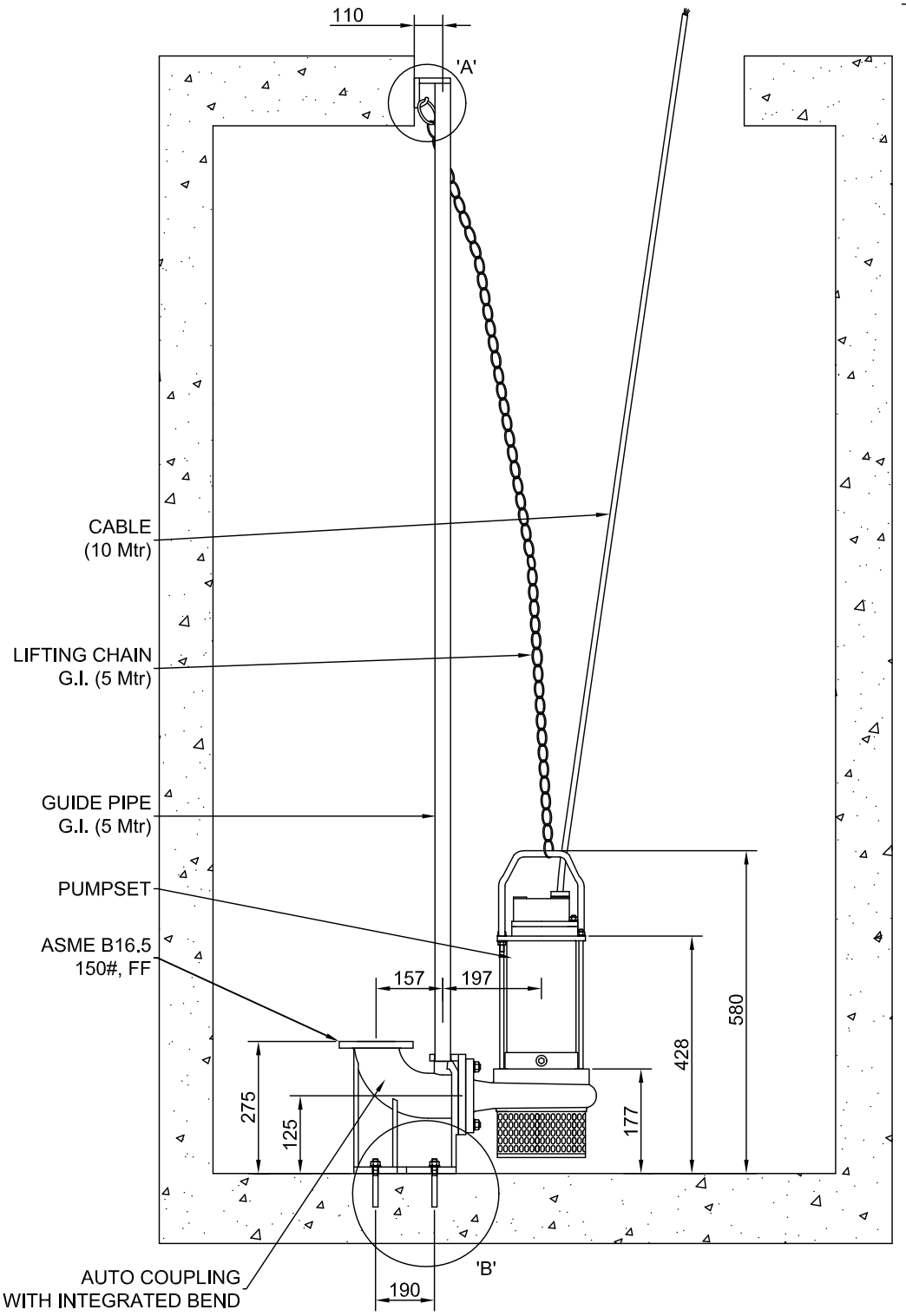


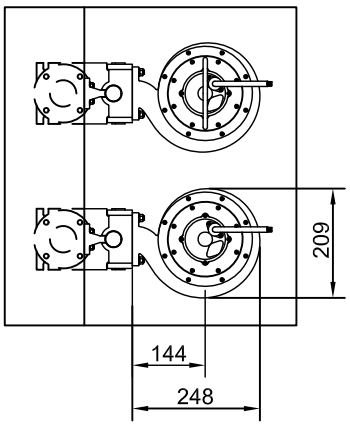
OFFER No.	14038-4
PUMP MODEL	**FLAP25157.5**
H.P. / K.W.	7.5/5.5
TOTAL HEAD (Mtr.)	30
DISCHARGE (M³/Hr.)	11.2
PUMP EFFICIENCY (%)	19.20
BKW (PUMP INPUT kW)	4.77
DELIVERY SIZE (mm)	50
SPEED (RPM)	2900
FREE PASSEGE (mm)	25
TOTAL HEAD (Mtr.)	33
DISCHARGE (M³/Hr.)	8
PUMP EFFICIENCY (%)	15.70
BKW (PUMP INPUT kW)	4.58

Discharge in M³/Hr.

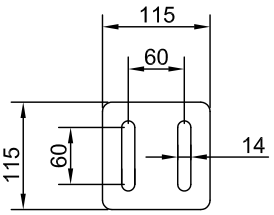
270

COMMON COLLECTION SUMP PUMPS
GRS05-AP001 / AP002



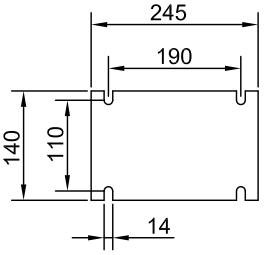


PLAN VIEW



FOUNDATION DETAIL 'A'

Anchor Fastener Details :
Size : M12x100
Material : G.I.
Qty : 2 Nos.



FOUNDATION DETAIL 'B'

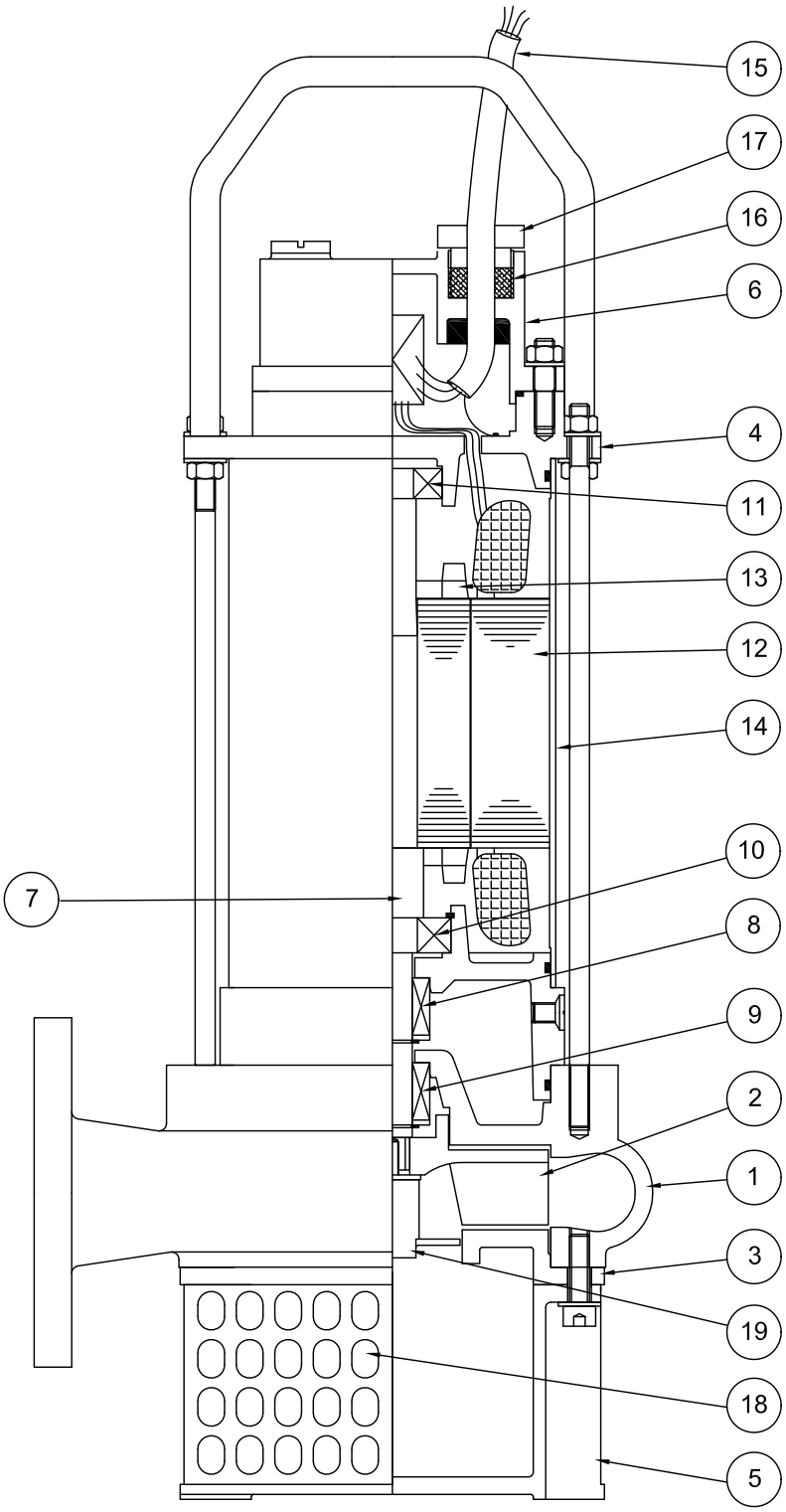
Anchor Fastener Details :
Size : M12x100
Material : G.I.
Qty : 4 Nos.

FLOWMORE LIMITED

NEW DELHI

			NAME	DATE
MODEL : FLAP 351.5	Client : Tamilnadu Generation & Distribution Limited Project : 2x660 MW Innore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPC, Chennai Contractor : Bharat Heavy Electricals Ltd., PEM, Noida Job No. : 12141037			
		DRN BY	H.A.Trivedi	20.05.19
Capacity : 4 M³/Hr. Head : 12 Mtr. Motor : 1.1 kw Del. Size : 50 mm	DESCRIPTION : FIXED TYPE INSTALLATION Tag No. : GRS05-AP001/AP002	QUANTITY : 2 Nos.	CHD BY	A.G.Patel 20.05.19
			APPD BY	A.Y.Trivedi 20.05.19
SCALE- NTS	TITLE-: 271 GENERAL ARRANGEMENT DRAWING FOR PORTABLE SUBMERSIBLE PUMP		DRAWING No.- GA-SALE19054110 70	

COMMON COLLECTION SUMP PUMPS
GRS05-AP001 / AP002



BILLS OF MATERIAL

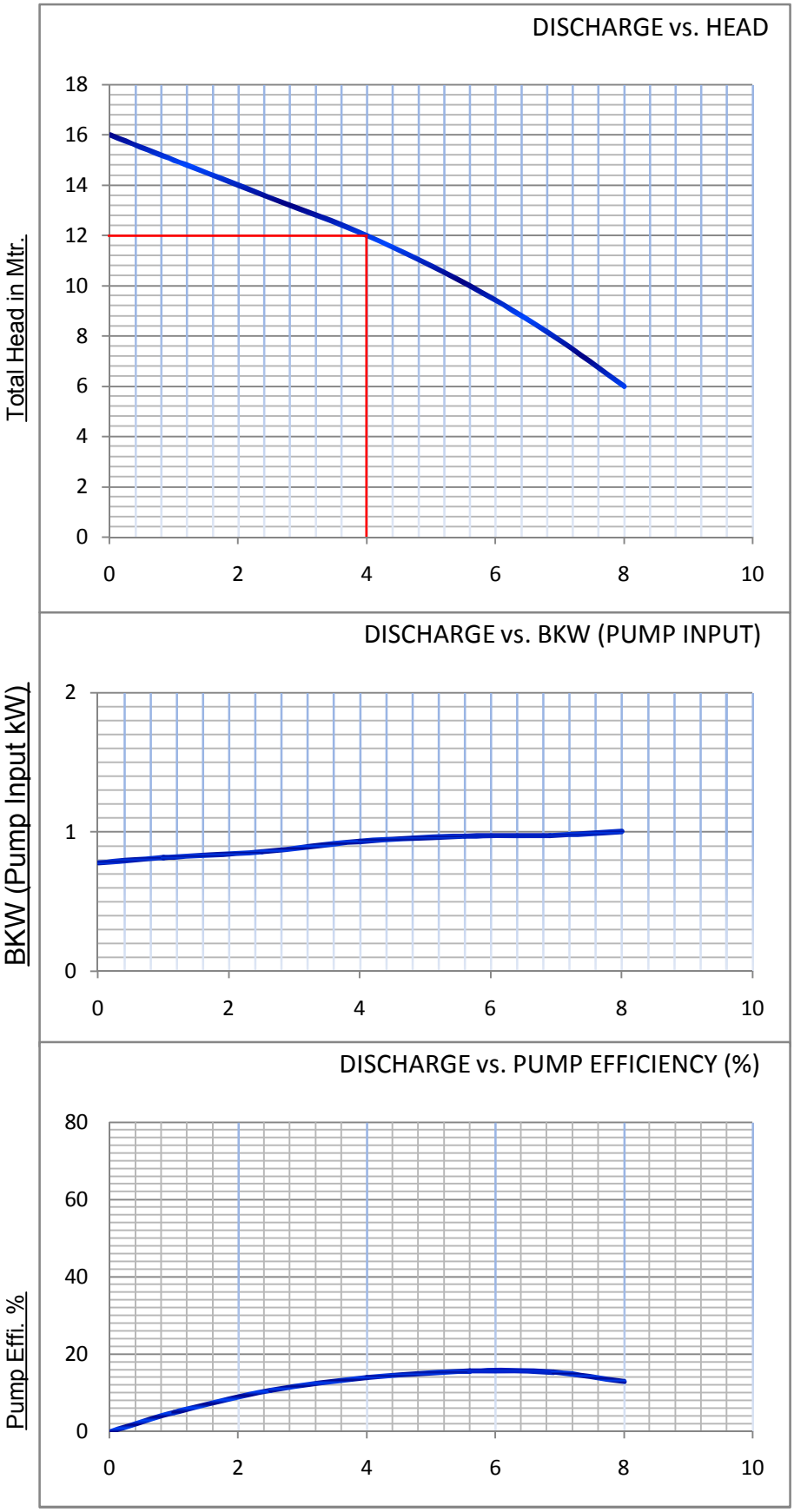
No.	DESCRIPTION	M.O.C.
1	Pump Casing	C.I.FG260
2	Impeller	S.S. CF8
3	Wear Plate	C.I.FG260
4	Top Cover	C.I.FG260
5	Stand	C.I.FG260
6	Terminal Box	C.I.FG260
7	Shaft	S.S. 410
8	Mech. Seal (Upper)	C vs SiC
9	Mech. Seal (Lower)	SiC vs SiC
10	Ball Bearing (DE)	SKF or Eq.
11	Ball Bearing (NDE)	SKF or Eq.
12	Stator Stamping	Si. Stamping
13	Rotor Die Cast	Aluminium
14	Motor Body	S.S.
15	Cable	PVC Insu.
16	Cable Grommet	Ni. Rubber
17	Cable Gland	Nylon
18	Strainer	S.S.
19	Two Blade Cutter	S.S.410

FLOWMORE LIMITED

NEW DELHI

			NAME	DATE
MODEL : FLAP 351.5	Client : Tamilnadu Generation & Distribution Limited Project : 2x660 MW Innore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPC, Chennai Contractor : Bharat Heavy Electricals Ltd., PEM, Noida Job No. : 12141037	DRN BY	H.A.Trivedi	20.05.19
Capacity : 4 M³/Hr. Head : 12 Mtr. Motor : 1.1 kw Del. Size : 50 mm	DESCRIPTION : FIXED TYPE INSTALLATION Tag No. : GRS05-AP001/AP002	CHD BY	A.G.Patel	20.05.19
	QUANTITY : 2 Nos.	APPD BY	A.Y.Trivedi	20.05.19
SCALE- NTS	TITLE-: 272 CROSS SECTIONAL DRAWING FOR PORTABLE SUBMERSIBLE PUMP	DRAWING No.- CSD-SALE19054110 70		

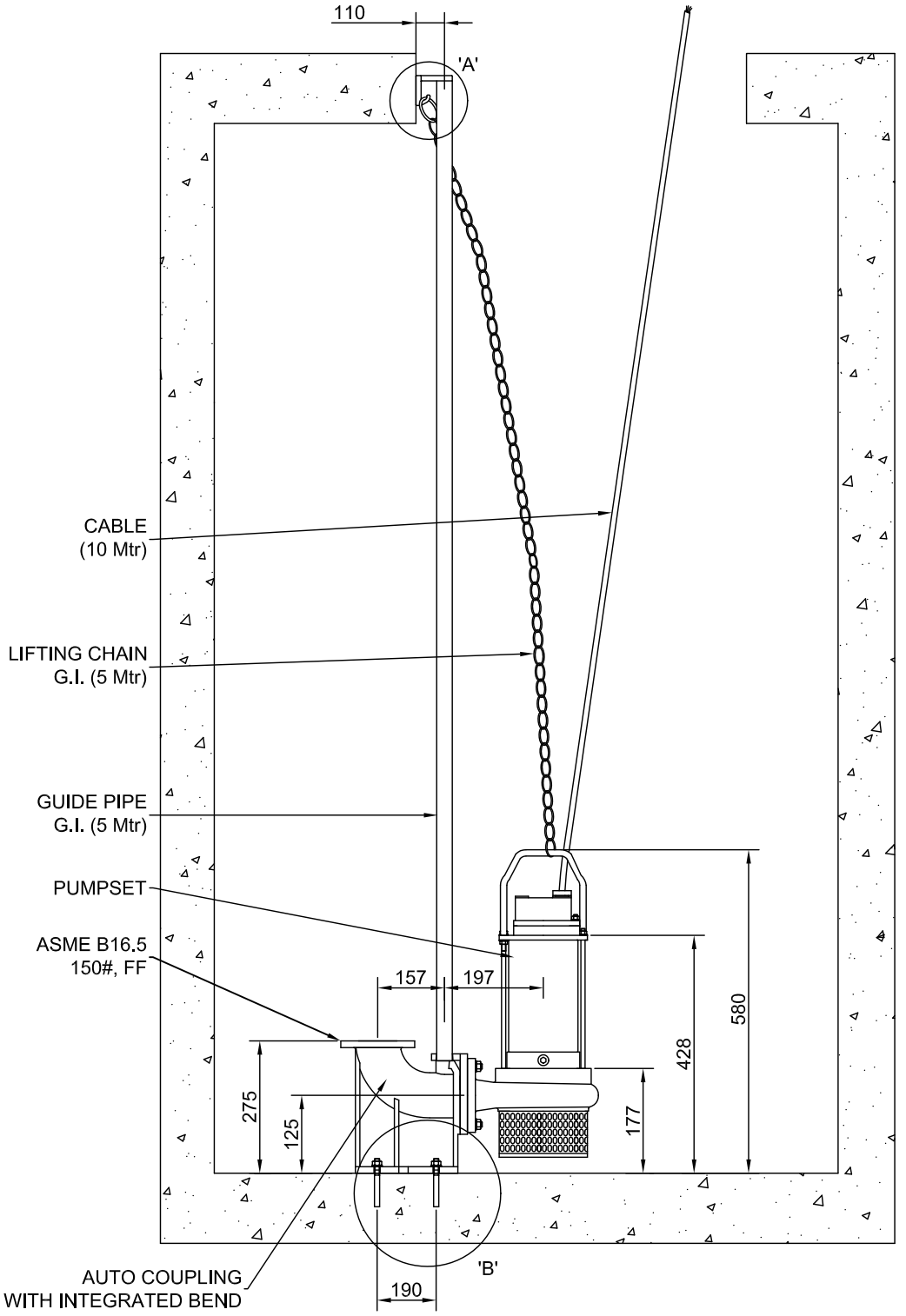
FLOWMORE LIMITED
NEW DELHI

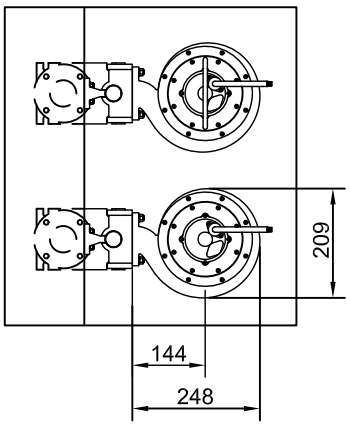


OFFER No.	14038-5
PUMP MODEL	**FLAP351.5**
H.P. / K.W.	1.5/1.1
TOTAL HEAD (Mtr.)	12
DISCHARGE (M³/Hr.)	4
PUMP EFFICIENCY (%)	14.00
BKW (PUMP INPUT kW)	0.93
DELIVERY SIZE (mm)	50
SPEED (RPM)	2900
FREE PASSEGE (mm)	25

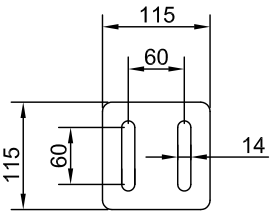
Discharge in M³/Hr. 273

MBBR FEED PUMPS
GRS06-AP001 / AP002



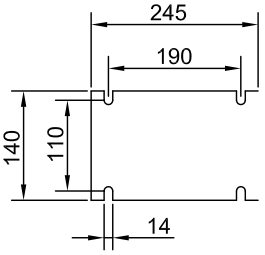


PLAN VIEW



FOUNDATION DETAIL 'A'

Anchor Fastener Details :
Size : M12x100
Material : G.I.
Qty : 2 Nos.



FOUNDATION DETAIL 'B'

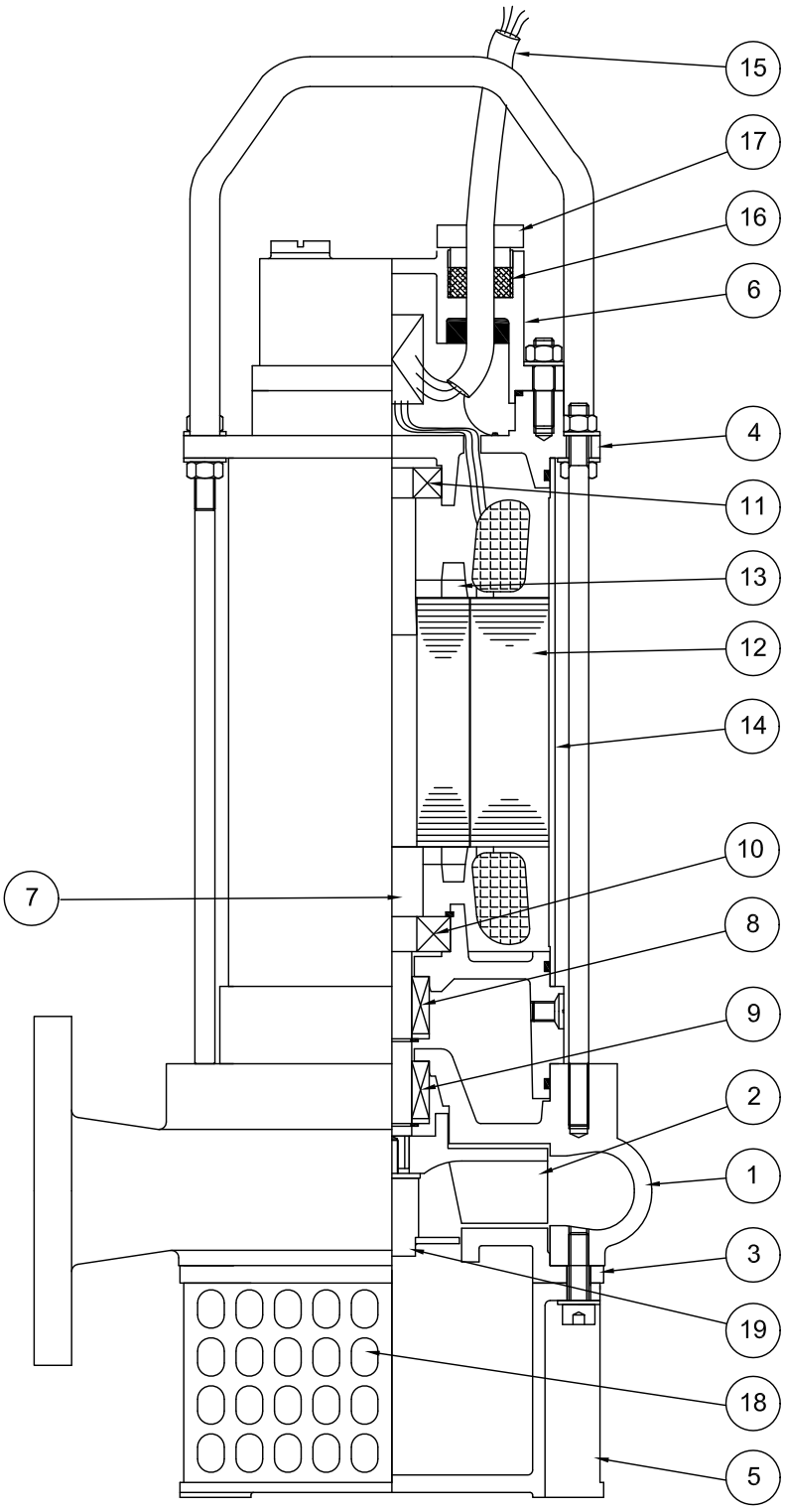
Anchor Fastener Details :
Size : M12x100
Material : G.I.
Qty : 4 Nos.

FLOWMORE LIMITED

NEW DELHI

			NAME	DATE
MODEL : FLAP 351.5	Client : Tamilnadu Generation & Distribution Limited Project : 2x660 MW Innore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPC, Chennai Contractor : Bharat Heavy Electricals Ltd., PEM, Noida Job No. : 12141037			
		DRN BY	H.A.Trivedi	20.05.19
Capacity : 4 M³/Hr. Head : 12 Mtr. Motor : 1.1 kw Del. Size : 50 mm	DESCRIPTION : FIXED TYPE INSTALLATION Tag No. : GRS06-AP001/AP002	QUANTITY : 2 Nos.	CHD BY	A.G.Patel 20.05.19
			APPD BY	A.Y.Trivedi 20.05.19
SCALE- NTS	TITLE-: 274 GENERAL ARRANGEMENT DRAWING FOR PORTABLE SUBMERSIBLE PUMP		DRAWING No.- GA-SALE19054110 80	

MBBR FEED PUMPS
GRS06-AP001 / AP002



BILLS OF MATERIAL

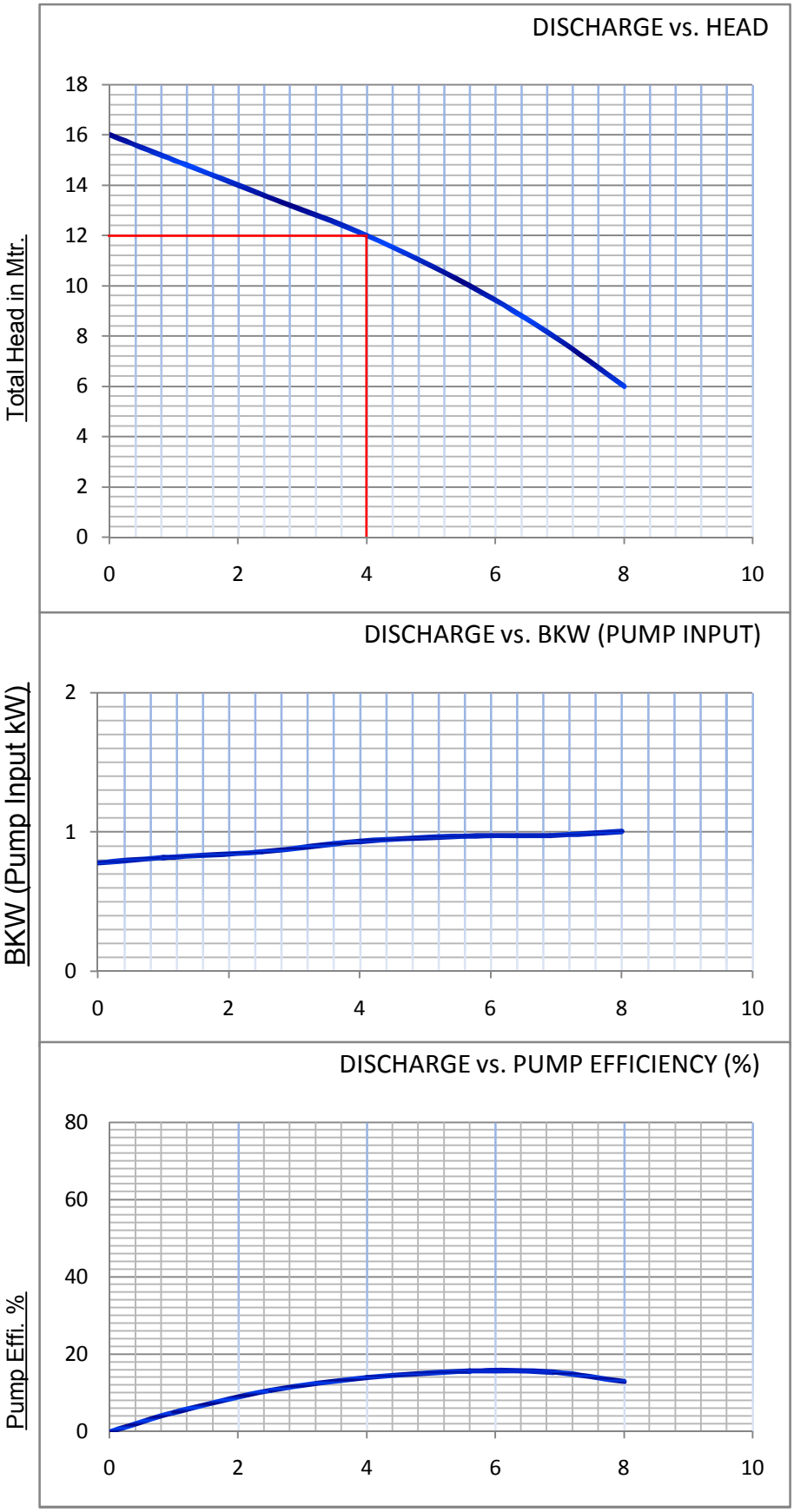
No.	DESCRIPTION	M.O.C.
1	Pump Casing	C.I.FG260
2	Impeller	S.S. CF8
3	Wear Plate	C.I.FG260
4	Top Cover	C.I.FG260
5	Stand	C.I.FG260
6	Terminal Box	C.I.FG260
7	Shaft	S.S. 410
8	Mech. Seal (Upper)	C vs SiC
9	Mech. Seal (Lower)	SiC vs SiC
10	Ball Bearing (DE)	SKF or Eq.
11	Ball Bearing (NDE)	SKF or Eq.
12	Stator Stamping	Si. Stamping
13	Rotor Die Cast	Aluminium
14	Motor Body	S.S.
15	Cable	PVC Insu.
16	Cable Grommet	Ni. Rubber
17	Cable Gland	Nylon
18	Strainer	S.S.
19	Two Blade Cutter	S.S.410

FLOWMORE LIMITED

NEW DELHI

			NAME	DATE
MODEL : FLAP 351.5	Client : Tamilnadu Generation & Distribution Limited Project : 2x660 MW Innore SEZ Supercritical Thermal Power Project at Ash Dyke of NCTPC, Chennai Contractor : Bharat Heavy Electricals Ltd., PEM, Noida Job No. : 12141037	DRN BY	H.A.Trivedi	20.05.19
Capacity : 4 M³/Hr. Head : 12 Mtr. Motor : 1.1 kw Del. Size : 50 mm	DESCRIPTION : FIXED TYPE INSTALLATION Tag No. : GRS06-AP001/AP002	CHD BY	A.G.Patel	20.05.19
	QUANTITY : 2 Nos.	APPD BY	A.Y.Trivedi	20.05.19
SCALE- NTS	TITLE- 275 CROSS SECTIONAL DRAWING FOR PORTABLE SUBMERSIBLE PUMP	DRAWING No - CSD-SALE19054110 80		

FLOWMORE LIMITED
NEW DELHI



OFFER No.	14038-6
P□MP MODEL	**FLAP351.5**
H.P. / K.W.	1.5/1.1
TOTAL HEAD (Mtr.)	12
DISCHARGE (M³/Hr.)	4
PUMP EFFICIENCY (%)	14.00
BKW (PUMP INPUT kW)	0.93
DELIVERY SIZE (mm)	50
SPEED (RPM)	2900
FREE PASSEGE (mm)	25

Discharge in M³/Hr. 276

APPROVED

REV.	DATE	DESCRIPTION	PREP.	CHK.	APPR.
1	02.01.2019	ISSUED FOR APPROVAL	PSR	SSY	PAK
0	04.09.2018	ISSUED FOR APPROVAL	MKK	SSY	PAK

PROJECT:		2 X 660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS, CHENNAI.
TANGEDCO	**OWNER:**	TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
DESEIN	**OWNER'S CONSULTANT:**	DESEIN PRIVATE LIMITED DESEIN HOUSE, NEW DELHI
BHEL	**EPC CONTRACTOR:**	BHARAT HEAVY ELECTRICALS LIMITED. (A GOVERNMENT OF INDIA ENTERPRISE) PROJECTS ENGINEERING MANAGEMENT, NOIDA
	SUB CONTRACTOR :	PENNAR ENVIRO Re-engineering Water, Environment & Energy Floor No. +3, DHFLVC Silicon Towers, Kondapur, Madhapur Road, Hyderabad – 500 084

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

TITLE Technical Datasheet Of Blowers

	NAME	SIGN	DATE
PREP	PSR		02.01.2019
CHKD	SSY		02.01.2019
APPD	PAK		02.01.2019

DEPT.							CARD CODE	BHEL DOC NO.	REV
SIGN				N.A.			–	PE-V0-412-673-A014	
DATE								PEL DOC NO. A4-PEL-1037-DS-B001 to B002	1
								NO. OF SHEETS – 10 (EXCLUDING COVER SHEET)	