BHARAT HEAVY ELECTRICALS LIMITED,
RANIPET- 632 406.

TECHNICAL SPECIFICATION

FOR

RO STAGE II PERMEATE STORAGE TANK

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1.0 SCOPE

This specification covers design, engineering, supply of material, fabrication at site & assembly, inspection and testing at site as well as at site erection, Hydro testing & commissioning and painting and handing over for a 1200 cu.m tank at site.

2.0 PROJECT INFORMATION

2.1	Owner	:	Tamilnadu generation and distribution corporation (TANGEDCO)
2.2	Project Title	:	Ennore, SEZ- 2 x 660 MW
2.3	Location	:	Vayalur Village, Chennai – 120
2.4	Nearest Railway Station	:	Athipattu Pudunagar (approx. 5 kms)
2.5	Nearest Road	:	5 KM road from Pattamandiri to Site on Thiruvottiyur – Ponneri district highway
2.6	Nearest Port	:	Kamarajar Port Ltd. (Formerly Ennore Port Ltd.)
2.7	Atmospheric Maximum / Minimum Mean Ambient Temperature	:	32 deg. C / 24 deg. C
2.8	Basic Wind speed	:	50 m/s

Wind Load : Calculations for wind effect shall be in accordance with IS: 875 – latest revision taking into account.

2.9	Seismic Zone	:	**Seismic Zone III as per IS:1893-2002** Importance factor (I) : 1.75

3.0 EQUIPMENT SPECIFICATION:

3.1 RO STAGE II PERMEATE STORAGE TANK:

1)	Application	: For storage of RO Stage-II Permeate
2)	No. of Tanks	: 1 No.
3)	Effective capacity of each Tank	: 1200 cu.m
4)	Size of the Tank	: 13 m Dia x 9.7 m Height (approx.)
5)	Type and Shape	: Vertical, Cylindrical
6)	Type of Roof	: Cone with self supporting roof structure to withstand the weight of O & .M persons (min 5 persons)
7)	Design Pressure	: Atmospheric Pressure + Full of water
8)	Design Temperature	: 60 Deg. C
9)	Sp. gr. Of Liquid	: 1.0
10)	Wind Pressure	: As per IS :875
11)	Earth Quake	: As per IS : 1893
12)	Applicable design codes	: IS: 803 / API 650
13)	Location of Installation	: Outdoor
	Corrosion allowance (mm)	: SHELL-3.0, ROOF-3.0 & BOTTOM 3.0 mm
14)	Material of Construction	: Mild Steel to IS:2062 Grade-B
	- Minimum thickness including Corrosion allowance	: 8 mm
	- minimum thickness for bottom most shell and bottom plate	: 10 mm
15)	Inside protection	: Refer Clause no:. 6.0
16)	External Painting	: Refer Clause no:. 6.0
17)	Inlet water pipe	: Perforated pipe shall be terminated up to a height of 500 mm from inside bottom and perforated groove shall be

at a distance of 500mm.

18) Overflow, drain and sample connection : Required

19) Overflow pipe size : one size higher than the inlet pipe size

20) Nozzle connections reqd./ end connections. : As per sketch,
< 50 NB Socket welded
≥ 50 NB Flanged.

21) Pipe / Nozzle material : SS304, Sch 40.

22) Pipe material for hand railing : Carbon steel, painted with marine grade epoxy paint

23) End connection of the valves : < 50 NB Socket welded
≥ 50 NB Flanged

24) Man Hole : 2 Nos. One No. on shell and the other on roof. Minimum 600 NB size to be provided with neoprene rubber gasket with SS 316 screws, Nuts & washers

25) Level Indicator : Required. Flange on the top of the tank shall be provided by vendor.
- Quantity : 1 No. for each Tank
- Type : Mechanical float type

26) Ultrasonic Type level Transmitter : **Provided by BHEL**. For mounting the level transmitter 2 nos. of DN 50 size flange with dummy shall be provided as indicated in drawing.
- Type : Microprocessor based 2 wire type, Hart protocol compatible
- Quantity : 2 Nos. for each Tank

27) Additional spare Nozzles : (Minimum) 2 Nos. at bottom and 2 Nos. at Top level in each tank

28) Instruments / Accessories required : a) Sampling connections with valves
b) Overflow & drain piping with drain valve
c) Stand pipe for mounting instruments (size not less than 100NB)
d) Drain vent & isolating valves for stand pipe
e) 8 Nos. tapping with 25 NB root

valves(gate) on stand pipe
f) Stair case and platform for external

approach
g) Ladder for access inside

29)

1) Testing standards (as Applicable) : API 598 for gate valve (40 NB and below)
API 598 for gate valve (50 NB and above)
API 598 for globe valve (40 NB and below)
BS 6755 for globe valve (50 NB and above)

2) MOC of gate valves : SS304(applicable standard)

3) Inspection : As per BHEL's approval check list

Note: The specification covers the entire requirement for the steel tank. However, if any other materials / components additionally required during the detailed engineering, the same shall be intimated to successful bidder by BHEL. Vendors are expected / required to care of such additional material / components in their offer itself based on their experience and no commercial implication shall be entertained by BHEL.

3.3 LEVEL INDICATOR:

1) Type : Mechanical Type (Float Operated)
2) Float Material : SS316 having 2 nos. Guide wires
3) Float Wire Pulley : Shall comprise of 2 nos. Cast Aluminum Pulley hosing Assembly with SS 304 pulley and pulley shaft. Steel ball bearings shall be provided in pulley housing for easier float movement. Float wire material shall be SS316L. Between 2 pulleys, 1" NB G.I. short pipe with tentative length
4) Guide wire Assembly : CS chamber with spring and adjuster having 1" Class 150 ANSI RF MS flange. Guide wire rope shall be SS316L.
5) Counter Weight : MS counter – weight with Aluminum Pointer and Brass assembly Pull Chain.
6) Scale : SS 316/Aluminum material in mm with 1 % accuracy.
7) Nozzle Details : For float wire pulley assembly, one tapping and for guide wire assembly two tapping at the top of the tank; Size 1" NB (Top Mounting Type)
8) Process Connection : Flanged as per ANSI B 16.5 to suit 1" NB nozzle (Nozzle length - 150 mm for float wire, 100 mm for guide wire)
9) Accessories (to be supplied with the instrument)
a) Counter flange : All mating Flanges, Nozzle
b) Mounting Accessories : All mounting accessories
c) Tag Plate : To be provided (material SS316)

10) Spring : SS-304
11) Cover : SS-316
12) Pointer and Graduations : Aluminum and SS
13) Accuracy : 1% of full scale
14) Range : Project Specific (will be intimated based on specific requirement)
15) Quantity : 1 No.

Note : For other components, the material shall be intimated to successful bidder by BHEL during detail engineering for which no commercial implication shall be entertained by BHEL.

4.0 Design Consideration

4.1 The steel tanks to be fabricated and supplied at site under this specification shall be generally as per enclosed tank drawing. Modifications may be made by the bidder to suit good engineering practice to the satisfaction of the customer. The customer, however, reserves the right to reject any modifications.

4.2

a) The connections and accessories which are required to be supplied with each tank by the bidder shall be as indicated in specification and enclosed drawing for tank and sketch.

b) The piping material inside the tank shall be supplied by the bidder. All inlet piping shall be extended up to the bottom of the tank and the clearance between the bottom of the tank and the edge of the inlet piping shall be kept as 500 mm (maximum).

c) The inside piping shall be adequately/properly supported with inside of tank and shall be provided with adequately sized vent connection at pipe top.

d) Weir plates of adequate thickness (minimum 8 mm) shall be provided for all inlet piping.

e) Pad plates on the tanks for supporting outside piping shall be provided by the bidder. Details of the pad plates (sizes, quantity etc.) shall be informed to bidder during detail engineering.

f) Fabrication and supply of all flanges and counter flanges for all nozzles of tank connections shall be included in the scope of work of the bidder. Necessary screws, nuts and gaskets for these connections shall also be supplied by the bidder.

g) The manhole shall be of hinged & screwed type with nuts, screws and gaskets in bidder's scope of supply. The size of the manhole shall be minimum 600 mm.

4.3 The scope of works shall also include supply and installation of special accessories as indicated in Equipment specification for storage tank and

drawing. The necessary fixtures and other accessories for mounting these special fittings shall be included in the scope of work of the bidder.

4.4 Level indicator for each tank shall be provided by the bidder along with all fittings & accessories as required for mounting indicator on the tanks. Float and arrow type level gauge / indicator shall be provided unless otherwise specified in specification and drawing for storage tanks.

4.5 Material of construction for standpipe shall be stainless steel (SS 316) and size shall not be less than NB 100 unless otherwise specified in drawing.

Standpipe along with the following isolation valves shall be supplied as a part of each tank: -

a) Drain, vent & isolating valves for standpipe shall be provided by the bidder. The size of the drain and vent valve of standpipes shall be 25 NB and size of the isolating valves for standpipe shall be 50 NB unless otherwise specified in equipment specification and drawing. Two (2) numbers of isolating valves for each stand-pipe shall be supplied by the bidder (volume details shall be furnished with calculation).

b) Required number of tapings with 25NB instrument root valves shall be provided by the bidder for mounting instruments like level switches, level transmitters etc. The number of tapping's shall be as indicated in the RO STAGE II PERMEATE STORAGE TANK and drawing.

4.6 The Nozzle & Valves shall be provided by the bidder as indicated in the drawing.

4.7 NaOH breather and seal pot shall be provided with necessary drain valve of size 25 NB with stainless steel construction unless otherwise specified in the equipment specification and drawing. Two (2) nos. NaOH breather shall be provided by the bidder for the tank, out of which one shall be used for in-breathing purpose and the other shall be used for out-breathing purpose.

4.8 Pipes, fittings, nozzles, flanges and counter flanges shall be supplied by the bidder. The minimum requirement like quantity, size, type etc. are indicated in the drawing and may undergo change during detail engineering stage and these shall be supplied by the bidder as per the approved drawings / documents for which no commercial implication shall be entertained by BHEL. Material of construction of all pipes, fittings, nozzles, flanges and counter flanges shall be as per specification and drawing.

4.9

a) Material of construction of all tanks shall be mild steel conforms to IS – 2062 grade – B.

b) All valves shall be of stainless steel (SS – 304) construction unless otherwise indicated.

4.10 NaOH breather and seal pot shall be located in the bottom / ground level and necessary connection from tank vent to NaOH breather shall be provided through SS304 pipe.

Vent size calculation shall be furnished by the bidder during detail engineering stage based on the tank filling / emptying rate for approval and increase in vent size from the minimum size requirement, if any, shall be provided by the bidder without any commercial implication.

The overflow pipe from overflow nozzle to seal pot shall also be in bidder's scope of work.

4.11 All anchor screws, nuts, washers including pad plates shall be provided by the bidder, if required for anchoring of tank as per approved design calculation during detail engineering stage and for which no commercial implication shall be entertained by BHEL.

4.12 Bidder shall provide adequate numbers of earthlings / grounding pads for each tank. Each pad shall be made of stainless steel or mild steel of required size, which will be informed to the successful bidder during detail engineering stage for which no commercial implication shall be entertained by BHEL. Further, grounding of tank with the earth mat shall be in BHEL scope.

4.13 Commissioning spares as required for commissioning of the tanks / NaOH breathers / seal pots are in bidder's scope.

4.14 Platforms, staircase, monkey ladder, hand railing, knee guard, toe guard (in stair case and all along the periphery of roof of the tank) etc. as per the relevant design code / good engineering practice shall be included in bidder's scope of work. All stair tread and platforms shall be made from 8mm thk. Chequered plate.

4.15 Suitable structural items like channels and saddle supports shall be provided for fixing the tank with foundation for each NAOH breather & Seal pot respectively.

4.16 Draw off sump shall be provided. Size and design of the same shall as per latest edition of IS 803/API 650.

4.2 The successful bidder shall furnish design calculations to BHEL during detailed engineering stage for approval along with the copies of relevant pages of authentic supporting literature e.g. Code, Hand book, National / international Standards etc. Calculation shall be necessarily done in **SI UNITS** only for the followings: -

a) The tanks shall be designed as per IS – 803 / API – 650 good engineering practice as applicable and referred code shall be of latest edition. However, requirement of codes and standards shall be as indicated in the specification.

b) Plate thickness calculation (different courses of shell plate, bottom plate and roof plate thickness), roof curb angle, top wind girder, intermediate wind girder, tank internal pressure vis –a-vis. allowable value.

c) Design of roof and roof structures for vertical storage tanks shall be designed based on standard guidelines given in the book titled “Process equipment design” by Brownell and Young.

d) Tank stability calculation (wind load / seismic / overturning stability) shall be done as per API – 650, latest edition. However, factors / coefficients as required for the design of tank shall be obtained from BHEL by the bidder after placement of order.

d) Vent sizing calculation shall be done as per API – 2000, latest edition

e) Sizing calculation for vent, NaOH breather, seal pot and breather valve.

f) Weight calculation of plates, appurtenances & structures separately shall be included in the Design calculation.

4.3 The successful bidder shall indicate references of all the clauses indicating their page number from respective standard in the design calculation during detail engineering stage. All calculations shall necessarily be done in SI units only. All steps including formulas and abbreviations shall be clearly shown in the calculation. All inputs / assumptions shall be indicated in the first sheet of the calculation.

4.4

a) Minimum 8 mm clear (excluding tolerance on plate as per relevant IS) thick plates including corrosion allowance shall be considered for bottom, roof and side / shell plates for all tanks. Calculation for the plate thickness shall be got approved from BHEL / Customer during detailed engineering stage. However, if the addition / summation of calculated value of plate thickness (excluding tolerance on plate as per relevant IS) / nominal minimum thickness specified in the relevant design code / standard and corrosion allowance of 2 mm comes out more than 8 mm then the nearest available (higher side) standard plate thickness in the market shall be provided for bottom, shell and roof plates without any commercial implication.

b) Negative tolerance on plate thickness shall not be considered in the plate thickness calculation and also shall not be provided in the tank. Only positive tolerance shall be considered.

4.5 All appurtenances and mountings shall also be designed as per relevant clauses of IS: 803 / API – 650 as per the design code indicated in drawing.

4.6 Tank shall be suitably constructed for safe, proper and continuous operation under all conditions that can be expected in a plant life without undue strain, corrosion or other operating difficulties.

4.7 In calculating the minimum plate thickness, the specific gravity of the liquid shall not be taken less than 1.

4.8 For cylindrical tanks, the plates shall be cold rolled through plate bending machine by several number of passes to true curvature. The flanges shall be made by V-die and the corners welded, provided no cracks are developed.

4.9 Vessels seams shall be so positioned that they do not pass though vessel connections. For cylindrical vessels consisting of more than two sections longitudinal seams shall be offset.

4.10 Wherever possible, the inside seam weld shall be ground smooth, suitable for application of corrosion resistant primer.

4.11 Due consideration shall be given by the supplier for wind load and earthquake effect in the design of tanks.

4.12 For the tanks being of diameter larger than 3.75 m added structural supports in the form of rafter shall be provided.

4.13 Reinforcement in tanks shall be provided as per design code. The reinforced connection shall be completely pre - assembled into shell plate.

4.14 The joint efficiency factor to be adopted for design calculation shall be in accordance with the specified design code.

4.15 All roofs and supporting structures shall be designed to support dead load plus a uniform live load of not less than 250 kg/m^2 of projected area.

4.16 Staircase / access ladder and hand railing shall be provided as per the relevant codes and standards.

4.17 Water draw off sump shall be provided as per the relevant design code, latest editions.

4.18 Code conformance for flanges / counter flanges shall be ANSI B 16.5. Code conformance for screws and nuts shall be SA 193 & 194 respectively.

4.19 The number & size of nozzles (including flanges, counter flanges and inside piping) indicated in the Drawings attached with the data sheets are tentative and bidder guidance purpose only and the same may undergo change during detail engineering stage for which no commercial implication shall be entertained by BHEL.

4.20 Bidder shall furnish the Standard calculation along with the roof structure calculation (if roof is designed on the basis of trusses) during detail engineering for checking the stability of roof.

4.21 Provision shall be made by the bidder to minimise the air ingress in the tank through float with arrow type level gauge and details of the same shall be furnished during detail engineering stage for BHEL's approval and approved arrangement shall be provided by the bidder without any commercial implication.

4.22 The tank shall be designed for filled water head / atmospheric pressure and design temperature for the tank shall be as specified in the equipment specification.

5.0 OTHER TECHNICAL REQUIREMENT

1. Data sheets of various items shall be prepared by the bidder for storage tanks and shall be submitted to BHEL / customer / consultant for approval after placement of order and any changes required by BHEL / customer / consultant for the same shall be incorporated and adhered by the bidder without any commercial implications.

2. GA drawing, nozzle schedule, design data, material of construction etc. shall be prepared by the bidder during detail engineering stage based on specification / contractual requirement and there should be no commercial implication on account of finalization of the drawings and documents.

3. O & M manual shall be furnished to BHEL for approval during detailed engineering stage. Final O&M manual 6 hard copies & one soft copy shall be supplied during hydro testing.

4. Field quality plan / quality assurance plan / check list shall be prepared by the bidder for storage tanks / each instrument / item and shall be submitted to BHEL / customer / consultant for approval after placement of order and any changes required by BHEL / customer / consultant for the same shall be incorporated and adhered by the bidder without any commercial implications.

5. All possible efforts shall be made by the bidder to get the approval of drawings and documents from BHEL / customer / consultant at the earliest and the documents prepared / generated by them or their sub-vendors shall be checked by their competent authority before submission to BHEL.

6. Revision made by the bidder in any drawings and documents shall be highlighted by indicating the no. of revisions in a triangle without fail so that the minimum time is required by BHEL to review the drawings and documents.

7. Any other drawings and documents in addition to the list of drawings and documents indicated in the NIT specification as required by BHEL for the

execution of the project shall be furnished by them during detailed engineering stage and no commercial implication shall be entertained by BHEL for the same.

8. Bidder to confirm that all the drawings shall be prepared in Auto Cad - 2010 version and required number of hardcopies and soft copies shall be furnished to BHEL during detailed engineering stage. Exact requirement of number of hard copies and soft copies of all drawings and documents as required by BHEL / customer / consultant shall be informed to the successful bidder during detail engineering stage and bidder to furnish the same for which no additional cost shall be entertained.

9. 15 days time is required by BHEL to offer their comments on the drawings and documents being submitted by the bidder (during detailed engineering stage in the event of L.O.I being placed) from the date of receipt.

10. Civil works will be provided by BHEL. Hence, bidder has to furnish the civil inputs in time. Bidder has to carry out the rectification in the civil works in the event of any changes in the civil input data furnished by them or delay in submission of input data by them. Bidder to furnish the civil foundation drawing of the tanks / seal pots /

NaOH breather along with the loading data for approval during detailed engineering stage showing / indicating the followings:-

a) **Scope of work by BHEL and bidder shall be indicated with different legend or in the form of note.**

b) Recommended locations of earthing pads.

c) Civil loads shall be furnished and the detailed calculation showing weights of roof, bottom, and shell plates, all accessories and nozzles etc.

d) Details of pockets as required for anchor screws.

11. Bidder to depute competent designer (s) at BHEL's office during detailed engineering stage to discuss drawings and other technical documents as and when required by BHEL. However, minimum 7 days notice shall be served for the same.

12. All the drawings which are required to be furnished to BHEL during detailed engineering stage shall include technical parameters, details of paints, BOQ / BOM etc in tabular form indicating all components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc. All the drawings in soft form (Auto cad format) shall also to be provided to BHEL.

13. All drawings and documents including general arrangement drawing, data sheet, calculation etc. shall be furnished to BHEL during detailed engineering

stage and shall include / indicate the following details for clarity w.r.t. inspection, construction, erection and maintenance etc.: -

a) All drawings and documents shall bear BHEL's title block and drawing / document number. However, BHEL's drawing / document numbering scheme shall be furnished to the successful bidder after the placement of L.O.I.

b) All drawings and documents shall indicate the list of all reference drawings including general arrangement.

c) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view, all major self manufactured and bought out items shall be labelled and included in BOQ / BOM in tabular form.

d) Specification / schedule of painting shall be made as a part of general arrangement drawing of each item indicating at least 3 make subjected to BHEL/Customer approval.

The probable paint supplier can be as follows

1. Asian paints (India) Ltd,
2. Bombay Paints.
3. Burger paints India Ltd.
4. Good lass Nerolac Paints Ltd.
5. Garware Paints
6. Johnson & Nicolson
7. Shalimar Paints.

14. Bidder to assess the capability of their sub-vendors in terms of preparation of drawings, calculations, documents, quality assurance, supply of material etc. as per project schedule before placing the order on them. No deviations shall be entertained.

15. Commercial implication includes price implication as well as delivery implication.

16. Size of hand rails on stairway and tank roof / top shall be minimum 32 NB and shall conform to IS 1239 (M).

17. Type of roof for vertical cylindrical storage tanks shall be either supported cone roof or self supporting cone roof as per latest edition of relevant design code.

18. Commissioning of tanks will consist of installation of all accessories of tanks as per approved drawing/specification, charging of tank, water-fill test (for minimum 24 hours after complete filling of tank), satisfactory functioning of all accessories, emptying of tank, subsequent painting of complete tanks and changing of gaskets as per specification requirement.

19. Bidder to furnish the weight of each tank (in empty condition and water filled condition) in Tonnes for BHEL's reference only. Bidder to note that the weight in water filled condition shall be considered from bottom of tank up to top of curb angle.

20. Bidder shall check that specifications of all the items are available in the NIT specification. However, in the event of absence of specification for any item, bidder will approach BHEL to furnish the specification of missing items and new specification will be adhered by the bidder for which no commercial implication shall be entertained by BHEL.

21. Bar chart, list of drawings and documents including data sheet, manual calculation, quality plan, field quality plan, PG test procedure, list of sub-vendors, technical specification and material of construction, painting specification / schedule, dispatch schedule etc. of various items as required by BHEL / customer / consultant shall be submitted to BHEL / customer / consultant during detail engineering stage for approval and the approved drawings / documents shall be adhered by the bidder without any commercial implication.

22. All tools and plants including welding machines, crane, hydra, fork lift, batching plant etc. and instruments as required for construction, erection and commissioning, trial run and PG test at site shall be arranged by the bidder only.

23. Bidder to furnish list of sub-vendors for various items during detail engineering stage for BHEL's review and approval.

6.0 PAINTING **

6.1 GENERAL

The following surface and material shall require painting:

a. All un-insulated carbon steel and alloy steel equipment like columns, vessels, storage tanks, pumps, heat exchangers etc.
b. All un-insulated carbon steel and low alloy piping, fitting and valves (including painting of identification marks).
c. All pipe structural steel supports, walkways, platforms, handrails, ladders etc.

The following surfaces and materials shall not require painting :
a. Non-ferrous materials
b. Austentic stainless steel
c. Plastic and / or plastic coated materials
d. Insulated surface of equipment and pipes except color coating wherever required.

6.2 STEEL STRUCTURES

(i) All steel structures shall receive two primer coats and two sandwich coat of MIO Epoxy paint and one finish coat of painting. First coat of primer shall be given in shop after fabrication before dispatch to erection site after surface preparation as described below. The second coat of primer shall be applied after erection and final alignment of the erected structures. Two intermediate coats and one finished coat shall also be applied after erection.

(ii) Steel surface which is to be painted shall be cleaned of dust and grease and the heavier layers of rust shall be removed by chipping prior to actual surface preparation. The surface shall be abrasive blasted as explained in clause 3.1 to Sa 2½ finish as per SIS05-5900. Primer paint shall be Zinc Silicate of approved brand. Dry film thickness of each primer shall be 60 microns.

(iii) Two intermediate MIO Epoxy paint, and one top polyurethane coating of approved brand shall be applied. Dry film thickness of each intermediate coat shall be 90 microns and top polyurethane coating shall be 30 microns. The under coat and finish coat shall be of different tint to distinguish the same from finish paint. The total dry film thickness shall be 330 microns. All paints shall be of approved brand and shade as per owner's requirement.

(iv) Joints to be site welded shall have weldable primer applied within 100 mm of welding zone. Similarly where friction grip fasteners are to be used removable anti corrosive coating shall be provided. On completion of the joint the surfaces shall receive the paint as specified.

(v) Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection including top surfaces of floor beams, supporting gratings or chequered plate shall receive one additional coat of finish paint over the above number of coats specified before erection. Portion of steel member embedded/ to be encased in concrete shall not be painted.

6.3 Painting of internal surface of steel tank:

Surface preparation : Blasting according to Sa 2½ and ISO 8501-1:1988.

Prime Coat

Two layers of Zinc phosphate epoxy primer, total dry fim thickness >75µm.

Pretreatment

Dersuting of all mechanical damages, according to standard Sa3 to ISO 8501-1:1988, touch up with 2 pack high build epoxy with volume solid content of more than 85%, 75µm.

Intermediate Coat

2 pack high build epoxy, dry film thickness 80 µm.

Finish Coat

2 pack silicon acrylic, dry film thickness of 150µm per coat.

The paint system shall confirm to regulations issued by Food & drug administration/ National Public Health service/ AWWA/ OSHA and comply with applicable laws, regulations, ordinances etc. of the local authority, state or the nation pertains to work.

6.4 Painting of underneath of bottom plate of steel tank:

Coal tar Epoxy Paint:

Surface preparation	: Sand blasting finish confirming to SA 2 1/2 as per Swedish standard SIS-05-5900
Primer	: Two(2) coats of high build coal tar epoxy suitably pigmented, DFT 80-100 microns per coat

Total DFT : 160-200 Microns

6.4 Painting of external surface of steel tank:

Surface Preparation: Blasting according to SIS 055900 grade Sa 2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.

Prime Coat
Two (2) layers of Zinc phosphate epoxy, total dry fim thickness 75µm.

Intermediate Coat
One (1) layer 2 pack high build epoxy polyamide MIO, DFT 100µm.

Finish Coat
Application of two (2) finishing coats of chlorinated rubber paint in approved shades at 50 microns DFT each coat in approved shades

SUGGESTED COLOUR CODES FOR PAINTING:

SL. NO.	ITEM/SERVICE	COLOUR	IS-5
1	Structures, platforms, galleries, ladders and handrails	Dark Admirality Grey	632
2	Tanks (outdoor)	Aluminium	-

**** : Any changes in Painting schedule shall be communicated by the customer during detailed engg. Bidder has to comply without any commercial implication.**

7.0 CODES & STANDARDS

The design, fabrication & assembly, erection & performance of steel tanks shall comply with all latest statutory regulations and safety codes applicable in the locality where the tanks are to be installed. Tanks shall conform to the latest applicable standards. The vendor shall not be construed to be relieved of his responsibility by virtue of this specification. The tank in general shall conform to the latest editions, as applicable, out of the following standards.

1) IS-803 Code of practice for design, fabrication and erection of vertical mild steel cylindrical welded oil storage tank.
2) BS-2654 Specification for vertical steel welded storage tanks with butt welded shells for the petroleum industry.
3) IS-2062 specification for weld able structural steel.
4) IS-816 Code of practice for metal arc welding for general construction in MS
5) IS-817 Code of practice for training and testing for metal arc welder
6) IS- 822 code of procedure for inspection of welds.

8.0 DESIGN REQUIREMENT

8.1 GENERAL REQUIREMENT

8.1.1 All tanks will be mild steel tanks. The tanks will be of welded construction and will be designed to withstand satisfactorily the internal forces due to the liquid which these tanks have to hold as specified and external forces due to wind and seismic forces without deformation or undue strain. The plates will be cold rolled through plate bending machines by several no. of passes to the curvature.

8.1.2 All tanks will be designed for the capacities, dimensions and working conditions as specified in EQUIPMENT SPECIFICATION. These tanks will be provided with all necessary connections as specified. The design of tanks will be such as to allow easy inspection, cleaning and repair. Due consideration will be given to wind loading and adequate stiffening will be provided to prevent failure of tank due to buckling when it is empty. 3.0 mm corrosion allowance for shells, bottom and roofs above and beyond the required thickness / calculated thickness / nominal thickness as specified in the design code shall be provided.

8.1.3 Vessel seams shall be so positioned that they do not pass through nozzle connections on vessel. For vessels consisting of more than two sections, longitudinal seams shall be offset.

8.1.4 The inside seam should be ground smooth, suitable for application of corrosion resistant primer. If the stiffening of shell, bottom and / or roof is necessary, tanks will be stiffened from outside.

8.1.5 Flange faces of all nozzles shall be machined and squared with the vessel centre line.

8.1.6 All roofs and supporting structures shall be designed to support dead load plus a uniform live load of not less than 250 Kg/m2 of projected area.

8.1.7 The tanks shall be designed to have all courses truly vertical. Adequate distance between vertical joints in adjacent courses shall be taken so that the distortion is reduced to minimum.

8.1.8 When removing temporary attachments from shell plates, care should be taken that parent plate is not damaged. Holes in plate work to assist in fabrication / erection should be avoided as far as possible. The location of holes and method of filling shall be indicted in the fabrication drawing. Any projection of metal shall be chipped and ground flush with the plate surface. The plate shall not be gouged or torn in process of removing lugs.

8.1.9 In the construction of shell, very care shall be taken to minimize distortion or lack of circularity due to welding or for any other reason.

8.1.10 Material of construction of all tanks shall be mild steel conforms to IS -2062 grade –B unless otherwise specified in the EQUIPMENT SPECIFICATION.

8.2.0 ALIGNMENT

- Plates to be joined by butt-welding shall be matched accurately. Misalignment in completed vertical joints shall not exceed 10% of the plate thickness or 1.5 mm for plates of 20 mm thick and under, whoever is larger.

- In completed horizontal butt joints, the upper plate shall not project beyond the face of the lower plate at any point by more than 20% of the upper plate thickness with a maximum of 3 mm for plate thickness exceeding 8 mm except that for plate thickness 8 mm and under, the maximum shall be 1.5 mm.

- Each tank shall be properly constructed ensuring perfect vertical alignment with 5 mm or as specified in the relevant code / standard and tank circularity within 5 mm on diameter or as specified in the relevant code / standard. Local bulging and / or depressions at any location of tank particularly shell shall not be permitted.

8.3.0 WELDING

- Tanks and other attachments shall be welded as per IS-816
- Welding sequence shall be adopted that distortion due to welding shrinkage shall be minimum. Welding procedure specification shall be submitted for approval of BHEL giving details of material, welding position, sequence, type of electrode used, pre-heat & post weld requirement etc as per the code of construction. Brand name of electrodes to be used with proper classification (e.g E 6013) shall be as per BHEL's approval.
- Welding shall not be carried out when the surface is wet and during periods of rain and high winds unless the welder and the work are properly shielded which should meet the approval of the purchaser.
- Inspection of all welds shall be carried out in accordance with the governing code of construction. All material used by the purchaser such as electrodes, gaskets, screws, nuts etc shall be conforming to relevant standards of repute and approved by the purchaser prior to use.

8.3.1 All openings in tank plate shall be well reinforced in approved manner by adding pad plates of adequate size and / or structural sections.

8.4.0 STAIRCASE / ACCESS LADDER AND HAND RAILING

All cylindrical vertical tanks shall be provided with spiral staircase , ladder and safety cage shall conform to the requirements specified in design codes / standards unless specified otherwise. All stair treads shall be 32 mm steel fabricated gratings. Each tread, if needed, shall be housed in individual steel fabricated frame which shall be adequately supported from the tank outer periphery. The staircase shall be adequately supported from the tank outer periphery. The staircase shall have minimum 750 mm clear width.

Access ladder, one (1) for each vertical cylindrical tank shall be provided for access to the tank roof. It shall be steel fabricated having minimum 450 mm width. Ladder stringers shall be heavy steel flats or angle section. All rungs shall be minimum 20 mm diameter rods spaced at not more than 300 mm center to center. All ladders shall have steel fabricated safety cage to the approved construction. Safety cage shall be provided about 2.5 m clear height of the ladder. Access ladder's stringers shall be widely space at top for free access to the tank roof.

All staircase and roofs of vertical cylindrical tanks shall be provided with pipe hand railings of effective height as indicated in the relevant code / standard throughout. Handrails shall be constructed out of 32 mm medium class galvanized steel pipe conforming to IS – 1239: 1968. Handrail posts shall be arranged at spacing not greater than 1850 mm. Two (2) sets of pipes horizontal runners all along the length shall be provided. All welds joints in the handrails shall be ground flush to protect any person getting injured. Steel toe plates of 100 mm flats shall be used. Hand railing shall be fabricated and installed in an approved manner as directed by purchaser in accordance with approved drawings.

8.4.1 Unless otherwise specified, for all flanged connections, vendor shall furnish suitable counter flanges and necessary SS316 screws, Nuts & washers and gaskets materials. All fasteners (for flanges, structural items etc) shall be of SS316 MOC.

8.4.2 Gaskets shall be 3 mm thick full-face rubber or CAF. On completion of hydraulic test / water till test, contractor shall replace the gaskets used during testing at his own cost.

8.4.3 Float level indicators other than float and arrow type level indicator, gauge glass shall be provided.

8.4.4 During erection of tank, shell plates shall be suitably supported both for outside and inside to avoid buckling / collapsing of tank due to high speed wind, gust or sever storm, if any occurring during erection.

9.0 VERTICAL CYLINDRICAL STORAGE TANKS

9.1 Construction and shall be designed in accordance with codes and standards as specified in the EQUIPMENT SPECIFICATION. The vertical cylindrical storage tanks shall have slightly sloping bottom towards an adequately sized sump inside the tank to enable complete draining of the tank. The tank shall be designed for a wind pressure and seismic coefficient as specified.

9.2 Conical roof shall be either self-supported or supporting. The roof shall have a slope as specified in the relevant design code to ensure drainage of rainwater. Needed roof rafters and purling adequately designed shall be provided.

9.3 All plates to be used for fabrication of tank shall be checked and all sides trimmed to make them square.

9.4 All bottom plates shall have lap weld joints on all sides with overlap not less than five times the plate thickness.

9.5 All shell course plates shall be taken during bending to prevent plate skewing. For butt weld joints, edges shall be prepared which shall be uniform and smooth throughout. To maintain needed root penetration gap at any butt weld joint, sufficient numbers of erection cleats shall be provided on all sides of outer periphery of each shell plate. Plates for tanks shall be straightened by pressing or by other non-injurious methods.

9.6 Each shell course shall be of uniform width throughout longitudinal weld in plates. Make up for the course width shall not be permitted. Shell plates in each course width shall be so arranged that all vertical joints be staggered having a minimum of 600 mm stagger. Shell thickness could be reduced in upper courses depending on design requirements but in no case the plate thickness shall be less than 6 mm.

9.7 The tank height shall be completed by the provision of top curb / angle which shall be butt-welded to the adjacent tank plate courses. The outstanding leg of the curb angle shall be kept outside the tank periphery. All butt weld joints shall

be full strength welds but for design of shell plate thickness adequate weld efficiency as recommended by applicable code(s) shall be used.

9.8 Tank roof shall be either self supported or supported over rafters / steel fabricated central column(s). Adequately sized and spaced rafters and purlins shall be provided. All rafters shall have sliding screwed connections at one end and preferably on the tank periphery side. The roof-supporting frame shall have needed tie rods or bracing sets.

9.9 Roof plates shall have lap joints with lap not less than 25 mm and lap weld over the top surface only. Roof plates shall have continuous fillet welds around the tank curb angle. No joint of roof plate over the supporting frame shall be made.

9.10 Needed openings for mounting various specified accessories shall be well reinforced in accordance with application codes and as approved. Manhole shall the screwed and hinged covers unless otherwise specified.

9.11 All inlet pipe nozzles located at the top of tanks shall be provided with internal piping up to 500 mm high above the tank's bottom inside with suitable weir plate at bottom. The inside piping shall be adequately supported and shall be provided with adequately sized vent connection at pipe top.

9.12 All spare nozzles shall be provided with dummy flange, Neoprene rubber gasket, SS 316 screws, nuts & washers.

10.0 TESTING AND INSPECTION AT MANUFCTURERER'S WORKS

10.1 GENERAL

- The supplier shall provide inspection to establish and maintain quality of workmanship in his works and that of his subcontractors to ensure the mechanical accuracy of components, compliance with drawings identity and acceptability of all materials, parts and equipment. He shall conduct all tests required to ensure that the equipment and material furnished shall conform to requirements of the acceptable codes. All tests and test procedure proposed by manufacturer shall be submitted to the purchaser for their prior approval.

- All materials used for manufacture of the equipment under this specification shall be of tested quality. Relevant test certificates shall be made available to the purchaser before the finals hop inspection. In case the relevant correlating test certificates are not available, the supplier shall arrange to carry out the necessary tests required by codes at his own cost.

- Cast steel / alloy cast iron components shall be tested for both physical and chemical properties. Test bears shall be either integral or taken from the same ladle of material as the casting they represent.

- All materials including valves, instruments, piping, flanges, counter flanges etc. shall be procured from BHEL approved manufactures only.

10.2 TESTING AND INSPECTION FOR TANKS

10.2.1 NON - PRESSURE TANKS

The scope of testing and inspection for non-pressure tanks covered in this specification will comprise of the following

1) Identification of materials to manufacturer's test certificates
2) Inspection of plate edges after edge preparation and checking curvature against templates if shell plates sent after rolling
3) Checking of dimension and match marking.
4) Inspection during fabrication at appropriate stages including fit ups.
5) Bottom testing
   - After all the bottom and bottom course of shell plates have been welded, the bottom shall be tested by pumping air beneath the bottom plates to a pressure just sufficient to lift them off the foundation and in any case not less than 100 mm water gauge. The pressure shall be held by construction of a temporary dam of clay or other suitable material around the tank periphery. Soap suds or other suitable material around the tank periphery. Soap suds or other suitable material shall be applied to all joints for detection of leaks.
   - Fuel oil may be used instead of air and soap suds to test for leaks, subject to prior agreement and approval of the purchaser. The vacuum box used shall comply with IS-803, 1976 (figure 24)
   - Alternatively, the bottom seems may be tested by vacuum box method subject to prior agreement and approval of the purchaser. The vacuum box used shall comply with IS-803. 1976 (figure 24)

5) Shell testing
   - The shell of fixed roof non-pressure tanks shall be tested after completion of roof. Testing shall be done by filling the tank with water to the level of the top leg of the top curb angle and noting any leaks as required by the code.

6) Roof testing
   - The roof of the tank shall be tested by pumping air under the roof plates while the tank is still full of water. In the non – pressure tank, the roof shall be tested to a pressure of 75 mm of water gauge and in case of

pressure roof tanks, to a pressure of one and a quarter times the pressure at which the pressure sides of the pressure / vacuum relief valve is designed to open. Soap suds or other suitable material shall be applied to all joints for detection of leaks.

7) Examination of Radiographs including radiographic techniques, supervision of other non-destructive tests and heat treatment procedure as required by codes and specifications.
8) The tanks under this specification shall be tested as per the relevant design and testing code / standard. Supplier shall submit the detailed testing procedure for tanks during detail engineering stage for BHEL/ Customer/ Consultant's approval and approved document shall be adhered by them and testing shall be done accordingly without any commercial implication.

All field – testing shall be performed prior to any painting or coating application

All the tools, tackle, equipments, fasteners and consumables required for site inspection & Testing etc. are in Bidder's scope.

10.2.2 REPAIR OF LEAKS

1) All leaks detected during testing shall be repaired to the satisfaction of the purchaser and on completion retested for leakage as per approved procedure.

2) In the joints between roof plates only, pin hole leaks may be repaired by mechanical caulking. However, where there is any indication of considerable porosity, the leaks shall be sealed by laying down an additional layer of weld over the porous sections.

3) In all other joints, whether between shell plates or bottom plates or both, leak shall be repaired only welding and if necessary, after first cutting out the defective part.

4) When the tank is filled with water for testing, defects in the shell joints shall be repaired with the water level at least 300 mm below the joint being repaired.

5) No welding shall be done on any tank unless all lines connecting thereto have been completely blanked off.

11.0 TECHNICAL DETAILS FOR CIVIL WORKS:

Complete foundation details required for this tank shall be provided by the vendor well in advance. However, design of the foundation and construction will be taken care by BHEL / BHEL's agencies.

12.0 SPARES

12.1 Commissioning Spares:

The bidder should take care of this requirement since commissioning is under bidder's scope if required. The commissioning spares List and the individual price shall be indicated and included in the main supply. Any unutilized startup spares shall be handed over to the purchaser. The commissioning spares shall be delivered well in time before the start-up & commissioning of the plant.

13.0 ERECTION, HYDRO TEST, COMMISSIONING & HANDING OVER:

Successful bidder has to manufacture the equipment as per approved drawing and dispatch the materials sequentially required for erection of the RO STAGE II PERMEATE STORAGE TANK. Scope includes receipt of materials at site, its unloading, handling storage, erection (site fabricated) to 2 x 660 MW Ennore SEZ, site testing and hydro test & commissioning as per approved quality plans and handing over of RO STAGE II PERMEATE STORAGE TANK. All loose components shall be preferably packed in wooden boxes and shall be kept in safe custody of BHEL stores. Space for raw material storage will be given by BHEL/PSSR at site and necessary material handling equipment shall be arranged by successful bidder for all the handling.

Erection of equipment shall be commenced upon readiness of the civil works and appropriate stage checks shall be offered for inspection to BHEL / customer. Upon completion of erection, bidders to commission the tank and shall carryout the performance guarantee test stipulated elsewhere. The plant shall be handed over to BHEL/Customer upon successful completion and acceptance of PG test.

The required power supply and water will be provided free of charge by BHEL at one point. All other requirements are to be taken care of by the vendor.

14.0 DRAWINGS AND DOCUMENTS REQUIRED:

14.01 ALONG WITH BID

Sl. No	Description
1	GA Drawing of the tank (incl. Nozzle Orientation)
2	Filled up data sheet (Annexure – 1)
3	Design calculation of the Tank.
4	Typical Manufacturing Quality Plan.
5	Typical Field Quality Plan
6	Activity /Bar chart schedule.
7	Reference list of Tanks provide by you the customer/plant
8	Deviation schedule duly filled if any (Annexure – 2)
9	Preliminary civil requirements – Foundation details.
10	Un-priced commercial offer on the scope of supply.

14.02 AFTER RECEIPT OF ORDER

Sl. No	Description
	PHASE –I (for approval) within 10 days from the date of ordering
1	GA Drawing of the tank (incl. Nozzle Orientation and elevation)
2	Filled up data sheet (Annexure – 1)
3	Foundation and loading details of the tank
4	Design calculation of the Tank
5	Tank Fabrication drawings
6	Manufacturing Quality Plan.
7	Field Quality Plan including stage checks
8	Activity /Bar chart schedule.
9	Hydro Test Procedure (PG test)
	PHASE –I I (for information)
1	Details of bottom, roof & shell plates cutting plan
2	Details of roof structure
3	Details of Breather arrangement
4	Details of stairway, grating and hand railing
5	Erection Manual
6	Welding quality plan and stage inspection reports
7	Test certificates & reports
8	As Built Drawings
9	Analysis report of Equipments / Piping / Structures / Systems employing software package as detailed in specification
	- Input
	- Output
	- Drawing / Sketches
10	Operations and Maintenance Manual
11	Vendor details in respect of proposed vendors including contract evaluation report of the previous executed contracts.

16. IMPORTANT POINTS TO THE VENDORS:

i) Tanks shall be fabricated as per the dimensions, details of nozzles, instrumentation etc in line with the sketch enclosed. Location and orientations of various nozzles will be confirmed during detailed engineering's.

ii) Final Quality plan shall be submitted for the approval of BHEL by the successful bidder.

iii) Stage inspection and final inspection at vendor's works and at site by BHEL/Customer and approved inspection agency as applicable.

17. ATTACHMENT:

1. RO STAGE II PERMEATE STORAGE TANK

   Drawing No: 2-WT-220-00347 Rev.01

Annexure - 1

EQUIPMENT DATA SHEET FOR RO STAGE II PERMEATE STORAGE TANK WITH VALVES & ACCESSORIES

1.0 RO STAGE II PERMEATE STORAGE TANK:

1)	Application		: For storage of RO Stage-II(BWRO) Permeate
2)	No. of Tanks		:
3)	Gross capacity of each Tank	m^3	:
4)	Effective capacity of each Tank	m^3	:
5)	Size of the Tank		:
6)	Type and Shape		:
7)	Design Pressure		:
8)	Design Temperature		:
9)	Design codes / Statutory regulations		:
10)	Location		:
11)	Material of Construction		:
12)	Corrosion allowances		:
13)	Minimum plate thickness (without Corrosion allowance)		:
	- Shell		:
	- Bottom		:
	- Roof		:
14)	Inside protection		:
15)	External Painting		:
16)	Permeate Inlet pipe		:
17)	Overflow, drain and sample connection		:
18)	Overflow pipe size		:
19)	Nozzle connections reqd./end connections		:< 50 NB ≥ 50 NB
20)	Pipe / Nozzle material		: ≤ 50 NB ≥ 65 NB
21)	Pipe material for hand railing		:
22)	Valves for stand pipe		:
	- Drain Valve		:
	- Vent Valve		:
	- Isolating Valve		:
23)	Drain Valve for Tank		:
24)	End connection of the valves		: < 50 NB

25) Valve Material : ≥ 50 NB
< 50 NB
> 65 NB

26) No. of Man Holes provided :
- Type & size :
- Location :
- Type of cover plate :

27) Level Indicator :
- Quantity :
- Type :

28) Level switch :
- Quantity :
- Function :

29) Additional spare Nozzles :

30) Instruments / Accessories required :
- Sampling connections with valves :
- Overflow & drain piping with drain valve :
- Stand pipe for mounting instruments : (size not less than 100NB)
- Drain vent & isolating valves for stand pipe
- For mounting of transmitter & Level switches: (No. of tapping with root valves & size on stand pipe)
- Stair case & platform for external approach :
- Ladder for access inside :

31) Weight of completely fabricated tank including all supports and fittings etc. in empty condition :

32) Weight of completely fabricated tank including all supports and fittings etc. in flooded condition :

33) All counter flanges with nuts and screws, washers & gaskets included in scope of supply : Yes / No

2.0 VALVES:

1)	Body and Bonnet	For 40 NB and below	:
		For 50 NB and above	:
2)	Wedge and Seat Ring	For 40 NB and below	:
		For 50 NB and above	:
3)	Trim		:
4)	Screws and Nuts		:
5)	Rating	For 40 NB and below	:
		For 50 NB and above	:
6)	Ends	For 40 NB and below	:
		For 50 NB and above	:
7)	Design standards	For gate valve ≤ 40 NB	:

		For gate valve ≥ 50 NB	:
		For globe valves ≤ 40 NB	:
		For globe valves ≥ 50 NB	:
8)	Testing standards	For gate valve ≤ 40 NB	:
		For gate valve ≥ 50 NB	:
		For globe valves ≤ 40 NB	:
		For globe valves ≥ 50 NB	:

3.0 LEVEL INDICATOR:

1)	Type	:
2)	Float Material	:
3)	Float Size	:
4)	Guide cable MOC / Size	:
5)	Float Cable MOC / Size	:
6)	Spring MOC	:
7)	Cover MOC	:
8)	Roller / Pulley MOC	:
9)	Scale Board MOC / construction	:
10)	Pointer and Graduations MO	:
11)	Accuracy	:
12)	Range	:
13)	Quantity	:

ANNEXURE -2

TECHNICAL DEVIATIONS

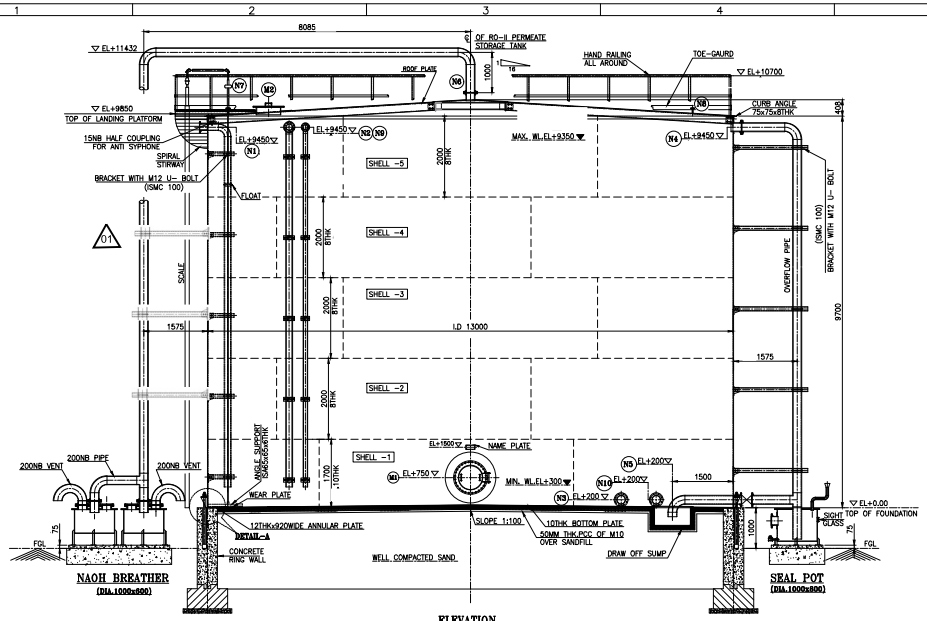
Sl. No	*Section no.*	*Clause No.*	*Page / No.*	*Specification*	*Statement of Deviations/variations*	*Reason for Deviation*	*cost of withdrawal*

01	03.05.22	BBS	IMRL	MSM	Revised based on comments
00	25.02.19	BBS	IMRL	GR	Fresh issue
Rev.No	Date	Prepared	Checked	Approved	Remarks

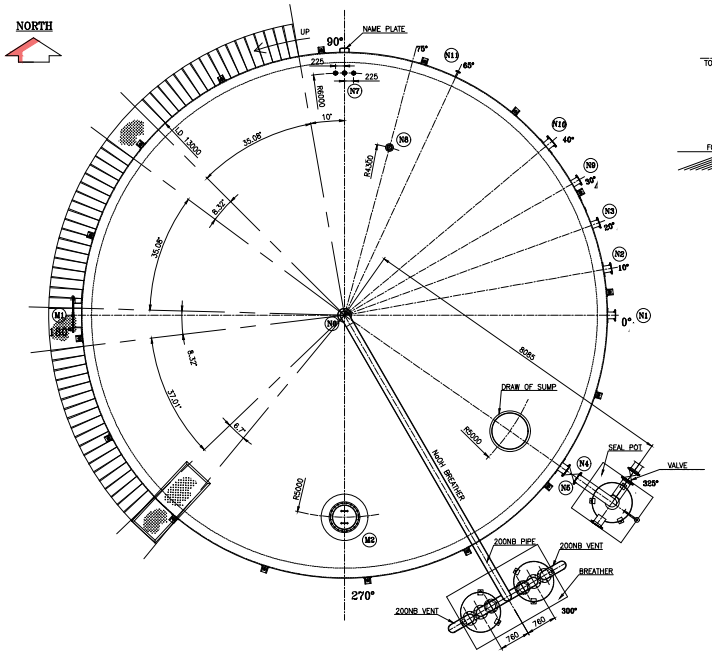
TANGEDCO	**TAMIL NADU GENERATION AND DISTRIBUTION CORPORATION LIMITED ENNORE -2 X 660 MW** CONSULTANT **DESEIN**
	BHARAT HEAVY ELECTRICALS LTD **BOILER AUXILIARIES PLANT** **RANIPET – 632 406.**

DEPT CODE		NAME	SIGN	DATE
876	DESN	BBS		25.02.19
	CHD	IMRL		25.02.19
	APPD	GR		25.02.19

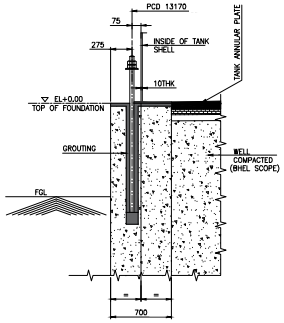
TITLE	DOCUMENT NO.	REV.NO
GA FOR RO STG II PERMEATE TANK	**2-WT-220-00347**	01



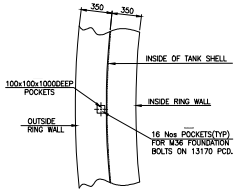
ELEVATION
(All Nozzles are not in one plan)
(SCALE 1:1)



PLAN
(Ref.plan view for exact orientation of nozzle)
(SCALE 1:1)



DETAIL-A
(SCALE 1:2)



SECTION B-B
(SCALE 1:2)

NOZZLE SCHEDULE:

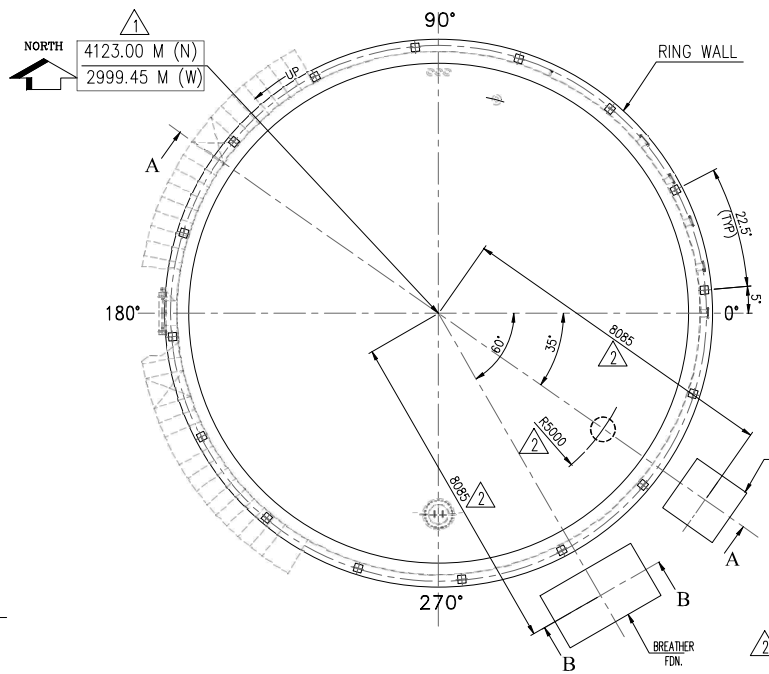
SHELL & ROOF APPURTENSANCES								
MARK	SIZE (NB)	SERVICE	SCH/ THK	RATING	TYPE	QTY	PROJ (MM)-G	NOZZLE HEIGHT. (BOTTOM OF BOTTOM PLATE)
N1	200	DEGASSED WATER INLET	SCH. 10S	150#	SORF	1	200	9450
N2	150	DM WATER(OFF-SPEC)INLET	SCH. 10S	150#	SORF	1	200	9450
N3	200	OUTLET TC RO-II PREM.SUPPLY PUMPS	SCH. 10S	150#	SORF	1	200	200
N4	200	OVERFLOW	SCH. 10S	150#	SORF	1	200	9450
N5	200	DRAIN	SCH. 10S	150#	SORF	1	200	200
N6	200	AIR VENT	SCH. 10S	150#	SORF	1	200	TANK ROOF UP
N7	25	LEVEL INDICATOR	SCH. 40S	150#	SORF	3	200	TANK ROOF UP
N8	80	LEVEL TRANSMITTER (HOLD)	SCH. 10S	150#	SORF	1	200	TANK ROOF UP
N9	100	DM WATER/ I/L FOR INTIAL COMEING	SCH. 10S	150#	SORF	1	200	9450
N10	200	SPARE OUTLET	SCH. 10S	150#	SORF	1	200	200
N11	25	SAMPLE	SCH. 40S	150#	SORF	1	150	150
M1	600	SHELL MANHOLE	12 THK	150#	SORF	1	200	750
M2	600	ROOF MANHOLE	12 THK	150#	SORF	1	200	TANK ROOF UP

DESIGN DATA:

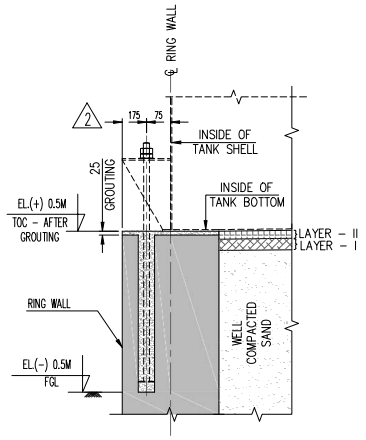
TYPE : CYLINDRICAL VERTICAL STORAGE TANK	
DESIGN CODE : IS 803 / API 650	
QTY : 1 No.	
DESIGN PRSSURE kg/cm2g	ATM + FULL HEIGHT OF WATER
DESIGN TEMPERATURE °C	60
WORKING PRESSURE kg/cm2g	ATM
WORKING TEMPERATURE °C	AMBIENT
HYDRO TEST PRESSURE	FULL OF WATER
STRESS RELIEF	AS PER CODE
CORROSION ALLOWANCE mm (Shell/Bottom/Top)	3 / 3 / 3
RADIOGRAPHY	10 %
JOINT EFFICIENCY %	0.85
SERVICE	WATER STORAGE
INSULATION	NA
FLUID DENSITY Kg/M3	1000
CAPACITY (WORKING) m3	1200
WIND DESIGN	IS 875
EARTHQUAKE DESIGN	IS 1893
EMPTY WEIGHT IN Kgs	~58500
HYDRO TEST WEIGHT IN Kgs	~1345500

MATERIAL OF CONSTRUCTION:

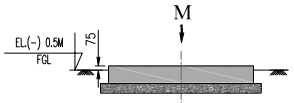
S.No	DESCRIPTION	MATERIALS	REMARKS
1	SHELL, ROOF & BOTTOM PLATE	IS 2062 Gr.B	
2	NOZZLE NECK	SA 312 TP 304	
3	NOZZLE FLANGE / BLIND FLANGE	ASTM A182 F 304	
4	MANWAY NECKS, SUMP	IS 2062 Gr.B	
5	MANWAY FLANGES & COVERS	IS 2062 Gr.B	
6	REINFORCEMENT PADS	IS 2062 Gr.B	
7	BOLTS & NUTS FOR MANWAY/NOZZLE	ASTM A 193 Gr.B7/A 194 Gr.2H	
8	GASKET	RUBBER/CAF	3 THK
9	NAME PLATE BRACKET	IS 2062 Gr.B	
10	CURB ANGLE	IS 2062 GR.A	
11	NAME PLATE	SS 304	
12	COVER HANDLE & EARTHING BOSS	IS 2062	
13	ANCHOR CHAIR	IS 2062 Gr.B	
14	CHEQUERED PLATE FOR LANDING PLATFORM	IS 3502	
15	ANGLES & PLATES FOR SPIRAL STAIRWAY	IS 2062 Gr.A /IS 2062 Gr.B	
16	GRATINGS FOR STEPS	IS 2062 Gr.B	
17	ANGLE & PLATES FOR HANDRAIL	IS 1239	GALVANISED
18	BOLT & NUT FOR FLANGES	ASTM A 193 Gr.B8/A 194 Gr.B8 & SS 316	
19	NOZZLE STIFFENERS	IS 2062 Gr.B	
20	GUSSET PLATE FOR ROOF SUPPORT	IS 2062 Gr.B	
21	PIPE FITTINGS	ASTM A 403 WP304	
22	HINGE PLATE,ROD,PIN FOR MANHOLES	IS 2062 Gr.B	
23	ANNULAR PLATE	IS 2062 Gr.B	
24	PAD FOR ANCHOR CHAIRS	IS 2062 Gr.B	
25	WASHERS	SS 304	



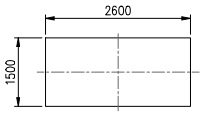
RO-II PERM. STORAGE TANK
FOUNDATION PLAN



DETAIL -X

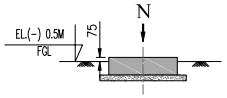


SECTION B-B

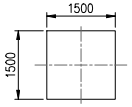


VIEW - M

BREATHER FDN. DETAILS

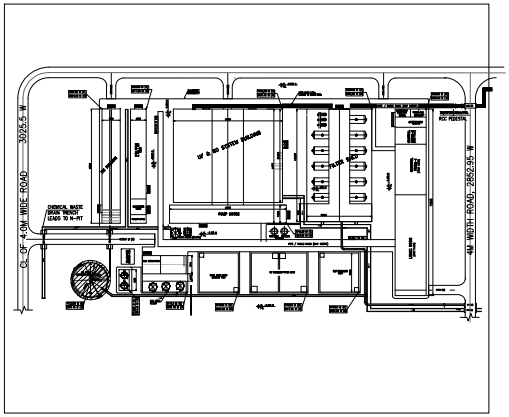


DETAIL - Y

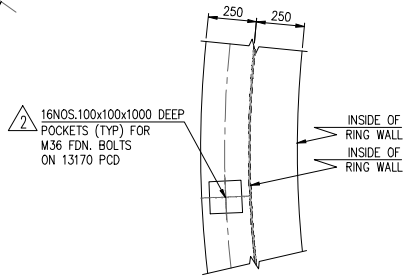


VIEW - N

SEAL POT FDN. DETAILS



KEY PLAN



SECTION P-P

NOTES :

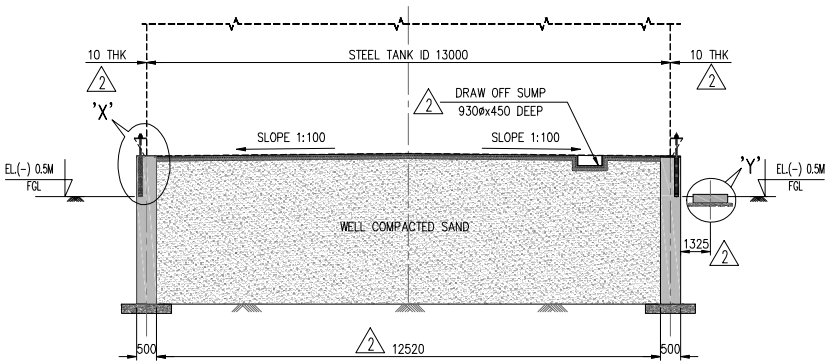
1. FINISHED GRADED LEVEL OF THIS AREA IS -0.500 M WHICH CORRESPONDS TO RL. 9.5 M w.r.t. MSL.
2. FOUNDATION POCKETS SHALL BE PERPENDICULAR TO THE SURFACE OF FOUNDATION.
3. LAYER-I : 75 THK OF COMPACTED STONES, SCREENINGS, FINE GRAVEL, CLEAN SAND OR SIMILAR MATERIAL MIXED IN HOT ASPHALT.
   LAYER-II : 50 THK OF ANTI CORROSIVE LAYER OF SCREENED COARSE SAND WITH 8-10% OF BITUMEN.
4. ~~FOUNDATION DETAILS OF NaOH BREATHER AND SEAL POT SHALL BE PROVIDED LATER~~

TANK DETAILS :

1.	MOC OF SHELL AND BOTTOM PL.	: IS2062 GR.B
2.	CAPACITY	: 1200 M^3
3.	QTY	: 1 NO.
4.	ID OF TANK	: 13000 MM
5.	HEIGHT OF TANK	: 9500MM CYL.+1700 MM CON.
6.	EMPTY WEIGHT	: 58.500 Tonn
7.	OPERATING WEIGHT	: 1345.500 Tonn.

SEAL POT & BREATHER DETAILS :

1.	NO. OF SEAL POT	: 01
2.	WORKING WT. OF SEAL POT	: 1000 Kg.
3.	NOS. OF BREATHER	: 02
4.	WORKING WT. OF BREATHER	: 2000 Kg.
5.	TYPE OF FDN. BOLT	: GRIP TYPE



SECTION A-A

Size A2

Painting specification

As per contract Vol II General & Schedules: Painting

6.3 Painting of internal surface of steel tank:

Surface preparation : Blasting according to Sa 2½ and ISO 8501-1:1988.

Prime Coat

Two layers of Zinc phosphate epoxy primer, total dry fim thickness >75µm.

Pretreatment

Derusting of all mechanical damages, according to standard Sa3 to ISO 8501-1:1988, touch up with 2 pack high build epoxy with volume solid content of more than 85%, 75µm.

Intermediate Coat

2 **pack high build epoxy, dry film thickness 80 µm.**

Finish Coat

2 pack silicon acrylic, dry film thickness of 150µm per coat.

The paint system shall confirm to regulations issued by Food & drug administration/ National Public Health service/ AWWA/ OSHA and comply with applicable laws, regulations, ordinances etc. of the local authority, state or the nation pertains to work.

6.4 Painting of underneath of bottom plate of steel tank:

Coal tar Epoxy Paint:

Surface preparation : Sand blasting finish confirming to SA 2 1/2 as

per Swedish standard SIS-05-5900

Primer : Two(2) coats of high build coal tar epoxy suitably pigmented, DFT 80-100 microns per coat

Total DFT : 160-200 Microns

6.4 Painting of external surface of steel tank:

Surface Preparation: **Blasting according to SIS 055900 grade Sa 2½. Depending on production flow, a weldable, inorganic ethyl zinc silicate shop primer of minimum dry film thickness 15-25 µm may be used.**

Prime Coat

Two (2) layers of Zinc phosphate epoxy, total dry fim thickness 75µm.

Intermediate Coat

One (1) layer 2 pack high build epoxy polyamide MIO, DFT 100µm.

Finish Coat

Application of two (2) finishing coats of chlorinated rubber paint in approved shades at 50 microns DFT each coat in approved shades

The Qualification requirements for RO STAGE II PERMEATE STORAGE TANK are detailed below and Bidders should meet the same. Offers of bidders who do not meet qualification requirement will not be considered.

1. Bidder should have Designed, Engineered, Fabricated, Erected & Commissioned at least one (1) no. Steel Tank of Capacity minimum 200 Cubic Meter (Site Fabricated) and fulfill the following requirement.

Sl. No.	Description	Unit	Values
a.	Minimum diameter of the Cylindrical Tank	Meter	6 (Minimum)
b.	Minimum straight length of the Tank	Meter	7 (Minimum)
c.	Tank Orientation		Vertical / Horizontal

2. The Steel Tank (referred by the bidder under Sl. No. 1) should have been supplied, Erected & Commissioned minimum one year prior to the date of techno-commercial bid opening.

3. Bidder shall furnish necessary documentary evidence [Approved GA Drawing/ P.O. Copy / LR Copy/ End User Certificate of Work Completion/Hydro test Certificate etc.] as a proof of meeting the qualifying criteria for the review by BHEL. Acceptance of documentary evidence shall be at the discretion of BHEL.

4. Bidder shall fill up all relevant information of the plant already executed by them (refer to Sl. No. 1) in the enclosed format (Annexure- I) and submit the signed format.

5. Bidders who defaulted, in any of the previous tenders floated by BHEL shall not be considered.

6. After receipt of offers, during scrutiny any bidder found to be banned by BHEL, then their offer will be summarily rejected at any stage.

Prepared by	Checked by	Approved by
Susanta Bisoi Dy. Engineer/WS	Abhinav Kumar Dy. Manager/WS	IMRL Rao Sr. Manager/WS

Annexure-I
Qualification
Datasheet

A. Steel Tank Details: -

Date of Supply : **Date of E&C:**

Sl. No.	Parameters	Unit	Design	Actual
01	Diameter of the Tank	m		
02	Straight length of the Tank	m		
03	Vessel orientation (Horizontal / Vertical)			
04	Capacity of Tank	Cu.M.		
05	Thickness	mm		
06	Approx. weight of the Tank	Kg		
07	End use			

B. Customer details: -

a. Name :
b. Designation :
c. Mobile :
d. Land line :
e. Fax :
f. Email id :
g. Postal address :

Signature of the Bidder with seal