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Safe & Efficient Installation Manual for Zincalume Water Storege Tank: Best Practice-Jjm

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ABSTRACT

Installation of Zinc alum tank requires careful planning and execution to ensure structural integrity and durability. This involves site preparation, tank fabrication, installation and testing and commissioning. Proper installation with High skilled team & ensures safe storage of water and minimizes the risk of leaks or structural failures. Zinc alum tank are made from a corrosion resistant material such as Galvanized coating or we can say zinc alum is a type of coated steel material that provides corrosion resistance. Zinc alum tanks are commonly used for storing of water, chemical or liquid.

In this tank we are using Liner is inner side to protect water from direct touch with the tank and liner is also prevent water from contamination, algae, foreign particle and any type bird and insect etc.

INTRODUCTION

The object of JAL JEEVAN MISSION-- HAR GHAR JAL is to provide drinking water all the house as well as to provide pure drinking water in many public places like SCHOOL, ANGANWADI, HEALTH & WELLNESS CENTRE, COMMUNITY SANITATION & TOILET COMPLEX, CATTLE POND etc. under Jal Jeevan mission, Gram panchayat have been entrusted with the responsibility of preparing implementation and maintaining the village action plan.

The Jal Jeevan mission in India has taken a revolutionary step in water conservation by incorporating Zinc alum, tank which are made from a corrosion -resistant alloy (Galvanized iron) of Zinc aluminum and silicon-coated steel. These tanks provide a sustainable solution for water storage, ensuring clean water access for rural communities.

Overall, Zinc alum tanks with liners are crucial component of the JAL JEEVAN MISSION in INDIA for providing a sustainable and reliable solution for water and contributing to the mission's objective of ensuring clean water access for all rural areas in India.

Zinc alum tanks prevent waterborne diseases by storing clean water, promoting health, education, economic opportunities and Empower communities to focus on growth and holistic development.

Zinc Alum Tank Sheet Detail

What are zinc alum Tanks-?

It is crafted with an innovative alloy of zinc and aluminum; Zinc alum tank offer enhanced durability and performance. This makes the product exceptionally strong and resistant to corrosion. The unique combination of the two metals ensures strong and it is suitable for storage of liquid with proper stiffeners (C-Chanel) And Wind Ring etc.

Zinc alum tanks are storage solutions constructed using Zinc alum steel, a coated steel product composed of approximately 55 % aluminum, 43.5 % Zinc and 1.5 % Silicon. This unique coating provides exceptional protection against corrosion.

KEY FEATURES AND BENEFITS OF ZINC ALUM TANKS	
• Corrosion resistance--Galvanized steel	• Agricultural storage
• Fire protection	• Fuel storage
• Environmental sustainability	• Rain water harvesting
• Variety of capacities	• Extended lifespan / Durability --Longer service life
• Drinking Water storage	• Industrial water use
• Leak prevention--liner create a seamless internal layer, preventing leaks and ensuring the integrity of the storage contents.	
• High Strength -to -weight ratio--Lightweight, simplifying transportation and installation.	
• Cost-Effective solution--Great performance compare to other corrosion -resistant materials.	
• Customizable Designs-- We can tailor tank sizes and configurations to meet your specific project requirements.	
• Liner for Enhanced Protection--These tanks include a range of high quality liners to provide additional protection against corrosion ,leaks, and chemical reaction .The liners are specifically designed for compatibility with various stored liquids and offer enhanced durability but In JAL JEEVAN MISSION we are using for storage of drinking water.	

TECHNICAL SPECIFICATIONS OF ZINCALUME STORAGE TANK	
• Seismic zone---As per IS:1893	• Truss---600 GSM coating thickness 275 GSM
• Specific gravity---1	• Nozzle as per IS:4759
• Sudden bursting	• Nut-Bolt & washer as per ISO 898/IS1367
• Hydrodynamic force	• Grade-10.9 ,M10-M16
• Eccentricity /alignment of tank	• Rope ladder with polypropylene /aluminum steps / food grade
• Horizontal and Vertical overlapping	• Verticality and bulging
• Temperature span -20 °C to +50 °C	• Spring mass model for seismic Analysis
• Wind flow Empty tank- IS:875, wind speed 50 m/sec	• Base moment

• Coating Thickness---150 GSM or as per Design	• Impulsive Hydrodynamic pressure
• Grade-AZ-150 /AZ-200	• Convective Hydrodynamic Pressure
• Wall Thickness 0.8 mm (single sheet) or multiple sheets as per load factor	• Pressure due to wall inertia
• Color---Natural zinc	• Effect of Vertical Ground Acceleration
• Cathode protection--To protect from Moisture and corrosion	• Maximum Hydrodynamic Pressure
• Other accessories --- lighting arrester , Water level indicator , ladders ,cutout to enter in tank Anchor fastener---Hilti / wurth /Fits her / Remax (By use of chemical & Expansion)	• Steel grade G-300 coating thickness 150 GSM for wall and G-550 Coating thickness 150 GSM for Roof
• IS:800 Indian Standard (Type of steel Grades and Their Mechanical Properties)	• Sloshing Wave height
• Non-uniform orthotropic tank	

LINER	
• Both side PVC coated	• Type of yarn---High tenacity polyester filament
• pH Range 5-10	• Geotextile--- 3 mm or as per requirement Non-woven fabric ,
• Australian standard --- As 4020:1999	• UV resistant ,Algae proof ,Non-pollution ,Antimicrobial
• Liner with reinforcement-760/890/900 GSM	• Food Grade Multi-layer
• Internal woven scrim reinforcement	

CODES					
Sl No.	**Parameter**		**Unit**	**Test Method**	**Specification**
1	Product weight		Gsm	IS 7016 Part I - 1982	760
2	Thickness		mm	IS 7016 Part I - 1982	0.55
3	Breaking Strength	Warp	Kg/5cm	IS 7016 Part II - 1981	240
		Weft	Kg/5cm	IS 7016 Part II - 1981	220
4	Tear Strength Warp	Warp	Kg	IS 7016 Part III - 1981	35
		Weft	Kg	IS 7016 Part III - 1981	30
5	Adhesion Strength		Kg/5 cm	IS 7016 Part V - 1987	7.0
6	Water Proofness @ 220 psi			IS 7016 Part VII - 1986	No Leak

Bulging & Bulging Calculation:- Bulging refers to the outward deformation of the tank wall panels due to water pressure or any other reason may be such as Inadequate design, Material defect, insufficient

support, overloading. Overpressure, vacuum, Incorrect installation, Inclined base. Mechanical damage, Human error, Lack of Technical knowledge etc.
Bulging can be estimated using Mechanics of Material and fluid pressure.

PART – 1. How to calculate bulging
Hydrostatic pressure (P) P=ρ· g· h, Density of water = 1000 kg/m³
Acceleration due to gravity= 9.81 m/s², =depth of water at the measured point (m)
A-Bulging displacement formula (Approximate)
If panels are considered as simply supported plates, the maximum deflection (bulging) can be roughly estimated by:
= Where maximum bulge / deflection (M)| = Constant based on support conditions (0.01 - 0.05)
=pressure (Pa) | = width of panel (m) | =Thickness of panel (m) |
= young's modulus of Zinc alum steel (200 GPA or Pa)
For Tank: - say
Panel thickness
Water height = 3.0 m
So pressure at bottom:
P = density1000\cdot9.81\cdot3=**29430 (pa)**
Note- Panel width a must be known for accurate calculation usually between 1.0 to 1.2 m

PART-2. Allowed bulging in zinc tank
According to industry standards e.g., AS/NZS 4766 IS: 15961:2022
Typical allowable bulge=1% to 1.5 % of the tank diameter
For visual inspection and safety field guidelines often says:
(i) Bulging >10 mm for small tank acceptable
(ii) Bulging <20 mm for large tanks is acceptable, if evenly disturbed and not due to damage
For 9.0 m diameter
(Max allowed bulge0\approx. 1% (of 9.0)
=90\ (mm)

SUMMARY
Parameter value
Max pressure (at 3.0 m) 29.43 kpa
Typical safe bulge limit 1% of diameter = (90 mm)
Preferred bulge >2% or fast -growing bulges

RECOMMENDATIONS: -
Measure bulging with a straight edge and depth gauge If bulging exceeds 20 to 30 mm consult the tank manufacturer or structural engineer.
Check for loose bolts, deformed panels or foundation bolt issue & used stiffeners.
The team should have all the necessary tools and equipment to perform their repairing & installation task efficiently and effectively.

TOOLS & TACKLES FOR INSTALLATION	
• Torque wrench set	• Ladder and safety belt
• Sockets set	• Tank jacks set
• Wrenches	• Chain pulley
• Rope	• Toolbox
• Nut and bolt tightening machine	• Screwdriver set
• TNT sharp edge rod diameter -10 mm	• Centre pole and clamps
• Level gauge	• Welding machine
• Hand drill machine	• PPE
• Hammer drill & hammer sets-6-20 mm	• Vernier calipers & screw gauge
• Extension cable with board	• Miscellaneous tools and tackles as per site requirements
• Cutting and grinding tools	• Rust proof paint

BULGING: - A visible deformation or swelling of the tanks surface, often caused by internal pressure corrosion or material defects.

CAUSES OF BULGING	
• Liquid pressure	• Incorrect installation
• Thermal expansion	• Uneven or inclined base
• Nozzle mounting issues	• External impact e.g. Squall
• Inadequate design	• Mechanical damage
• Material defects	• Lack of technical knowledge
• Temperature variation	• Careless installation
• Overloading / overpressure / vacuum	• Human error
• Improper maintenance	

HOW TO PREVENT BULGING IN TANK	
• Proper design	• Material compatibility
• Correct installation of all pipe and nozzle	• Cathodic protection
• Regular inspection & Maintenance	• Regular testing
• Cleaning and protection	• Avoid over pumping
• Coating maintenance	• Use stiffeners and air wind ring
• Pressure monitoring	• Avoid direct load or stress on tank wall
• Temperature controlling	• Incorporate flexible coupling or Expansion joint at nozzle connection

ZINC ALUME TANK INSTALLATION: - Zinc alum tank installation refers to the process of setting up a tank made from zinc alum, a type of coated steel that combines zinc and aluminum for correction resistance.

The composition in which steel sheets are dipped consists of 55% aluminum, 43.5% zinc, and 1.5% silicon, with the coating applied at a temperature of 550–600 °C.

KEY CONSIDERATIONS	
• Site preparation	• Corrosion monitoring
• Foundation / flat slab	• Liner fixing and cleaning
• Leveling of base	• DI pipe grouting in slab to avoid torque
• Avoid eccentric fixing	• Fusion of sheets or uniform sheet thickness
• Maintain verticality by using spirit level and plumb	• Vertical support (stiffeners / C- channel)
• Tank assembly	• Carefully Fixing of hold down bracket
• Use Bell mouth to avoid direct hit on slab	• Piping and fittings
• Use mechanical joint to adjust pipe length	• Bottom sheet 300 painted by Black Japan paint
• Use flexible coupling or Expansion joints	• Manufacturer's instructions
• Restraining wall surrounding the tank over slab	• Hire qualified personnel
• Anchor fasting (Mechanical /Chemical)	• Inspect the tank
• Thrust block to neutralized load	• Hydro-testing as per protocol
• DI pipe clamping	• Proper installation
• Carefully fixing of trusses and bracings	• Efficient operation
• Carefully nozzle fixing	• Safety protocol with height permit form safety in charge at the time of installation with tool box talk (TBT).

FUSION IN GI SHEET--

Fusion in GI sheet refers to the process of joining or Bonding two or More GI sheet together using various methods such as-

The Goal of fusion is to create a strong, durable, and often watertight joint between the GI sheets, suitable for various applications like Roofing, cladding, or structural fabrication e.g-Zinc alum tank.

A-MECHANICAL FUSION / FASTENING: - Riveting, Clinching, flow drill screw

A process that joins two zinc alum sheets through mechanical deformation, without the use of heat or adhesives.

Mechanical deformation: - The sheets are deformed mechanically, creating a strong bond between sheets, by using mechanical fusion we can create strong and reliable joints in zinc sheets while preserving the integrity of the coating.

No heat: - No heat is applied preserving the zinc alum coating.

No thermal distortion: - the process avoids thermal distortion, ensuring precise fit.

Preserve coating: - The zinc alum coating remains intact, maintaining its corrosion resistance.

B- CHEMICAL FUSION / ADHESIVE BONDING: - Using specialized adhesives

The chemical used in chemical fusion or bonding processes for zinc alum sheets depend on the specific application and requirements.

Before using chemical for fusion it's essential to consult with manufacturer to determine the best chemicals for specific needs. Some common chemicals and materials used.

- Epoxy Adhesives
- Acrylics adhesives
- Polyurethanes adhesive

Surface Preparation

Solvents--Acetone Isopropyl alcohol is used to clean the surface

Etchants / Primers / coupling agents --To improve adhesion between surfaces

C- WELDING FUSION: - Spot welding, Seam Welding

The process of joining two zinc alum sheets by melting and fusing the Metal together.

Key considerations: -

- Heat control
- Shielding / Fluxes
- Welding Technique

Challenges: -

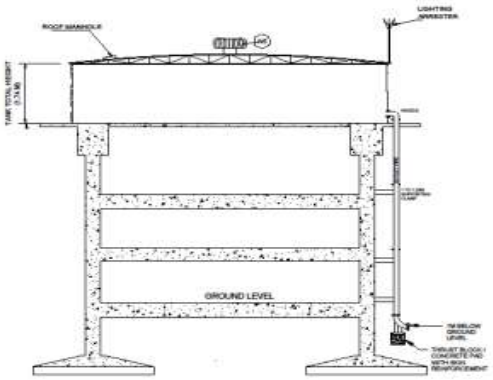
- Coating damage
- Porosity

PVC liner cleaning in zinc alum tank involves many steps to ensure liner integrity and prevent damage with hygiene process.

LINER CLEANING METHODOLOGY	
• Empty the tank after regular supply	• Scrub liner by sponge / soft brush as per requirement
• Left empty to remove chlorinated gases	• Wash with clean water
• Check nylon ladder before alight in tank	• Inspect if any damaged
• Remove debris or any foreign substance	• Disinfection by chlorine based (hypo chloride solutions)
• Use pressure water jet / spray	• Removal of Rinse after cleaning & Disinfection
• Use vacuum cleaner	• Tank refilling
• Use long handle brush	• Water filling under observations
• Use cleaning solution -- Non-toxic	• Final inspection of tank after water filling about safety
• Regularized supply again	

DRAWING FOR INSTALLATION

ELEVATIONAL PLAN FOR PIPE, CLAMP & THRUST BLOCK ARRANGEMENT 1



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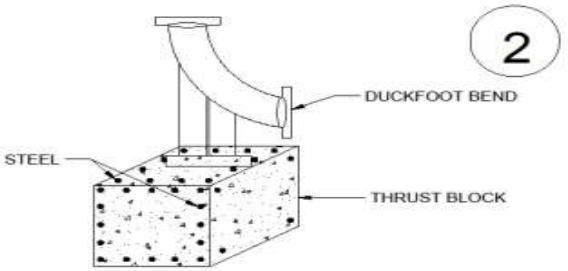
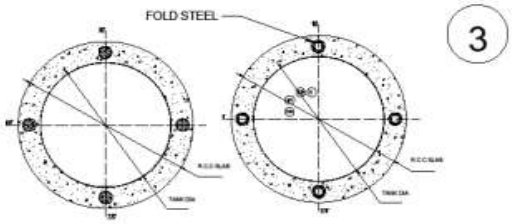


THRUST BLOCK

1. Steel as per CPHEEO manual for thrust block 5kg/msq.
2. As per site condition construct thrust block by using SKIN reinforcement.
3. Thrust Block should be below 1m from GL as per water supply manual.



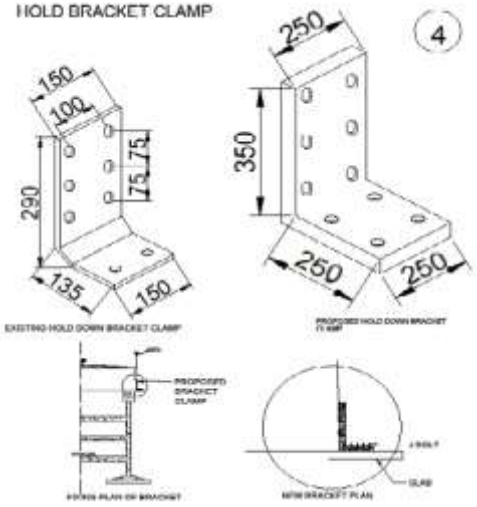
3

PROCEDURE FOR RCC SLAB OPENING & POURING

1.Do not cut steel from the side of the opening.
2.Cut steel only from the middle of the opening.
3.Fold steel to the opposite side.
4.Insert the DI pipe.
5.Fold the steel back into the hole.
6.Put a ring on the top and bottom of the slab to hold pipe and bind it with the existing steel.
7.Push the pipe slightly in an upward direction before grouting to neutralize the dead load.
8.Concrete done by area using Nitobond, Dr. Fixit 301 Pidicrete, or Dr. Fixit 211 epoxy bond agent.

HOLD BRACKET CLAMP

4



PLAN FOR INSTALLATION OF BELL MOUTH

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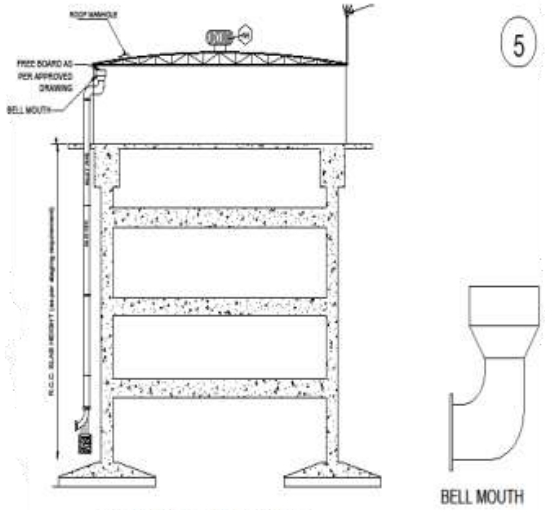
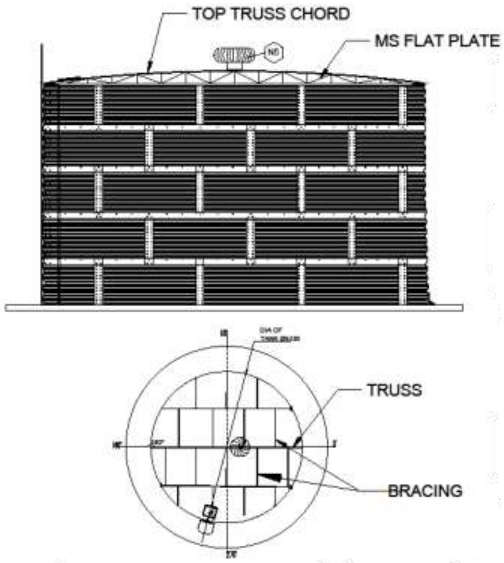
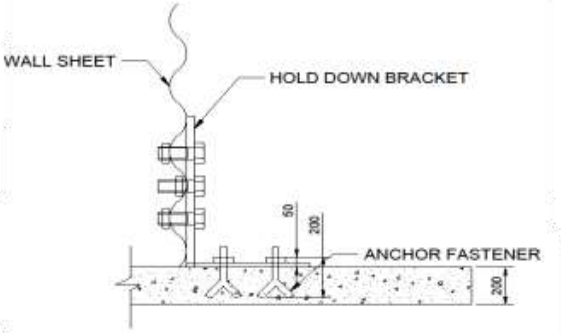


INSTALLATION OF BELL MOUTH TO PROTECT DIRECT HIT TO GEO TEXTILE & SLAB

TRUSS AND TRUSS BRACING 6



ANCHOR FASTENER MOUNTING DETAILS 7



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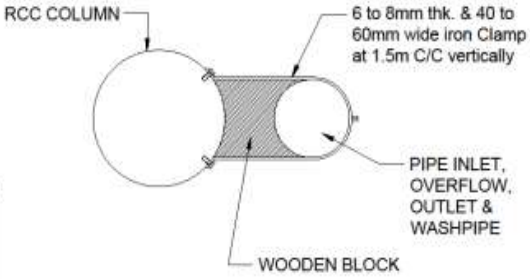

DETAILS OF CLAMP WITH COLUMN

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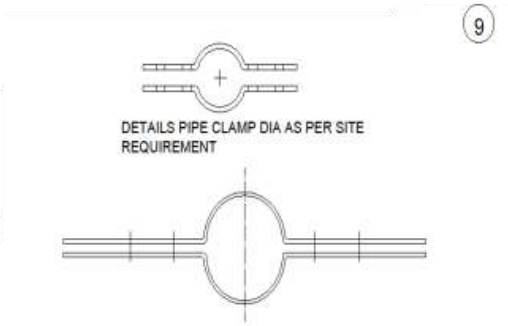
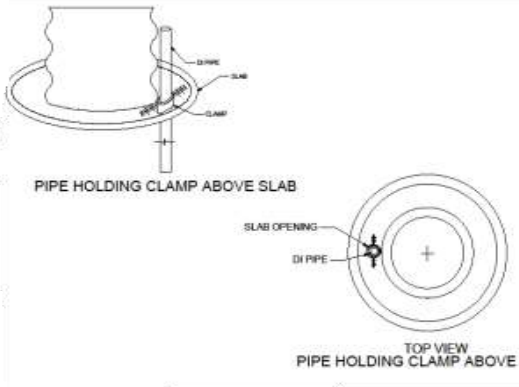
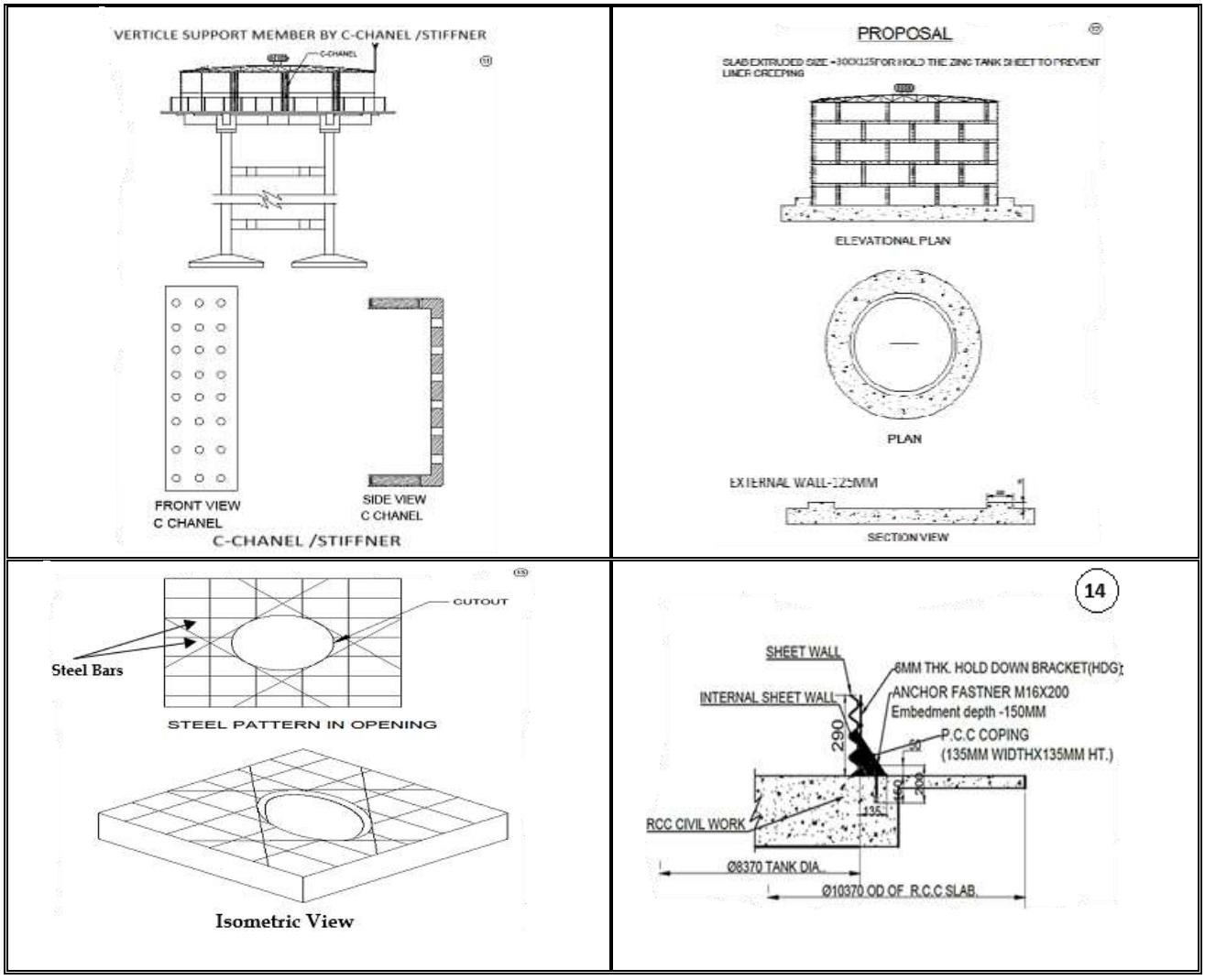


DETAILS OF CLAMP DIA AS PER SITE REQUIREMENT

10





CHECKLIST

TANK RESTING FLOOR CHECKS

- Verify tank elevation with respect to FGL.
- Check slab thickness.
- Ensure floor concrete levelness. And Layout will be checked by vendor /Engineer and Zinc Installation Team.

ANCHORS/FOUNDATION BOLTS

- Confirm all foundation bolts are erected as per drawings, Fixed properly, and of the required length.
- Ensure bolts are from reputed brands (e.g., Hilti/Fitsher/Wurth/Remax etc), clean, and free from rust.
- Washers must be used for all bolts.
- No missing or broken bolts.
- Ensure all anchor fasteners are in position as per the drawing.
- Bolts must be installed to full depth; partial insertion and cutting from top is not allowed.
- Verify nut and bolt length after fixing brackets.
- Perform grouting between slab and Hold-down bracket and final tightening.

SIDEWALL

- Ensure tank is vertical (check verticality).
- Tank shape must be round—no bulging should be visible.
- Tank sheet overlapping connection must comply with approved drawings (spacing, number, size, and grade of bolts with washers).
- All bolts at sheet joints must be tightened properly.
- Check for rusted sheets (interior and exterior).
- Ensure mounting brackets are securely fixed.
- Remove damaged or dented wall sheets.
- Ladder is installed properly as per drawing and should not be hang on tank, it should rested on slab.
- Hunching should be provided surrounding of the tank to ensure stability and prevent water seepage as per previous circular(ref.)

NOZZLE

- All nozzles (inlet, outlet, overflow, drain) are installed as per drawings.
- Nozzles are placed at correct elevations, Angle & Middle of the Sheet.
- Elbow and bell mouth for inlet/overflow installed correctly.
- Nozzle orientation & Size is as per site layout and should not be inserted through any part of the structure except designated cut-outs.
- Nozzle components (support plate, gasket, flanges) installed as per drawing.
- Pipe load should not be directly applied on nozzles; ensure all pipe supports are in place as per piping drawing.
- Check liner at nozzle connections for airtightness and avoid punctures.
- DI pipe proper clamping to hold the pipe weight properly.

TANK STRUCTURE

- Roof rafters installed properly.
- Bracing hardware tight and complete.
- Dome and ring dome installed properly and sealed.
- Stiffeners and splice joints properly installed as per drawing.
- No fabricated stiffener items allowed; thickness as per drawing.
- Repaint any areas showing rust.
- Ladder splices or wall connections secure.
- Ladder cages and straps installed as per drawing.
- Valve in chamber properly installed and operational & should not be height.

LINER

- Liner installed properly.
- Check liner joints as per manufacturer's standards.
- Ensure all hardware is tight and spaced per specification.
- Check liner for punctures or cuts.

- Inspect liner at nozzle joints for cuts or leaks. And use U clamp to hold the Liner at top.

ROOF (TRUSS)

- All hardware tight and spaced correctly as per drawing.
- Roof panels secure and tight.
- Roof accessories (level indicator, manhole, vents, and railing, level transmitter nozzle) installed as per drawings.
- Ensure air vents are not blocked or closed.
- Truss members installed per approved drawings & all supporting member are fixed and tighten properly -like supporting members. (Span, Bottom & top chord, bracing, joint nods anchor bolts, over hanging Etc.)

LIGHTNING ARRESTER

- Lightning arrester installed on the roof.
- Earthing pit constructed 3 meters deep.
- Earthings strip/cable connected between arrester, and used proper insulation till earthing pit.

BOTTOM ACCESSORIES / MISCELLANEOUS

- Duck foot bend placed upon CC blocks at bottom and properly supported.
- Chamber constructed and accessible.
- Maintain logbook, instruction book, and complaint register.

HYDROTESTING

- Stage 1: Fill the tank up to 1-meter height, hold for 24 hours, mark the water level, and monitor for any leakage or drop.
- Stage 2: Increase the water level to 2 meters, hold for 24 hours, remark the level, and observe for any changes or seepage.
- Stage 3: Raise the water level to 3 meters, hold for 24 hours, mark the level again, and inspect for any abnormalities.
- Stage 4: Fill the tank to the maximum level of 4 meters, hold for 24 hours, mark the final level, and conduct thorough observation for leakage, settlement, or level variation.

SUGGESTIONS	
• Material selection should be as per specification	• Use Mild cleaning agent
• For Proper installation use skilled crew	• Epoxy paint compulsory in inner side
• Customization as per requirement	• Liner should be reinforced
• Cost effectiveness but don't compromise by quality	• Use Flap for liner protection.
• Monitor tank condition	• Don't keep empty

• Prompt repairs	• Cleaning always should be by water jet / Spray
• Regular inspections are compulsory	• Depute skilled operator
• Maintain Cleaning schedule	• All electro Mechanical equipment should functional
• Weight of trusses should not be imposed directly over zinc sheet	• Stiffeners is useful to prevent bulging
• Full height stiffeners should be used to take Tresses component load	• Used automatic valves
• Used one or Two number air wind pipe surrounding the zinc alum tank	• Water filling alarming bell (Ghanti-As used in home) in the condition of non-functional Radar level sensor

CONCLUSION:

Zinc alum water tank stand as a testament to the evolution of water storage technology, offering durability, Longevity and Environmental sustainability. Their versatility and low maintenance requirements make them an attractive choice for a wide array of users, from homeowners to industrial enterprises along with Government in Jal Jeevan mission for rural water supply projects.

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