

Powell

Fabrication & Manufacturing Inc

Last Updated: April 21, 2000

Sodium Hypochlorite Fiberglass Reinforced Plastic (FRP) Storage Tanks

Part 1 General

1.01 Section includes

- A. Design and furnishing of FRP storage tanks for the purpose of storing a maximum of 16.5% by weight sodium hypochlorite solution.

1.02 FRP Tank Specifications

1. The sodium hypochlorite storage tank(s) shall be circular, fabricated from FRP, and sized to hold _____ gallons of sodium hypochlorite (16.5% by weight max concentration). The storage tanks shall be orthowound using Derakane 411 premium grade vinyl ester resins. The storage tank supplier shall have at least ten years experience in the installation of similar FRP tanks. The storage tank manufacturer shall be ASME certified to RTP-1, for fiberglass reinforced plastic fabrication. The storage tank supplier shall be Powell Fabrication & Manufacturing, Inc. of St. Louis, Michigan.
2. The tank wall thickness shall consist of the following four components:
 - a. A resin rich corrosion resistant surface layer containing 2 layers of 10 mil Nexus 1012 surfacing veil for a minimum thickness of 0.020".
 - b. An anti-wicking layer consisting of three layers of random chopped strand glass fiber reinforcing, 0.040" each (minimum). It shall consist of not less than 20% and not more than 30% glass fiber by weight. It shall have a minimum thickness of 0.120 inches.

Together these two layers represent a corrosion liner of 0.140 inches (minimum). The corrosion liner shall be considered a corrosion allowance and shall not be included in the structural design.
 - c. A structural layer consisting of chopped strand mat & woven roving, or continuous circumferential roving, and unidirectional roving. Nominal resin content shall be 45% to 70%. Reinforcing sequence and laminate thickness shall be as required by design.
 - d. A resin rich non-process side (exterior) surface layer reinforced with type C glass veil.
3. The non-process side layer shall be finished with two top (white) coats containing UV inhibitors. The outer layer of paraffin wax to promote completes curing of resin.
4. The structural layers shall start with a layer of chopped strand mat. A layer of chopped strand mat except at an overlap shall always separate two layers of woven roving.

5. Internal components, which are immersed on both sides, shall be reinforced only with chopped strand mat.
6. Vessel shell laminates shall comply with part 2 of ASME RTP1 (1b 1997).
7. The following manufacturing processes are not allowed: helical filament winding, spray up, pultrusion, press molding, resin injection and/or vacuum bagging.
8. The equipment supplier shall be responsible for the vessel design including the specific seismic design.
9. The equipment supplier shall provide the design calculations for the Engineer's review at the time of submission of fabricated drawings.
10. The design shall be rechecked with the corrosion liner included in the thickness to ensure that stress and strain levels are within acceptable levels in the corrosion liner.
11. Thickness shall be as required by design. For contact molded vessels, the minimum structural thickness shall be as required by the National Bureau of Standards NBS PS15-69. This required thickness should be in addition to the corrosion allowance of 0.140 inches.
12. The corrosion liner shall be cured using BPO-DMA catalyst cure system, followed by a four-hour post cure to provide a Barcol hardness of the minimum recommended by the resin manufacturer.
13. The nozzle sizes and locations shall be as shown on the contract drawings. A side manway shall also be provided as shown on the contract drawings. All nozzles shall be flat faced, 150 pound drilling. Minimum flange thickness shall be that shown in figure 4.6 ASME RTP1 1995 with addition of the corrosion liner thickness. All nozzles 12" diameter and smaller shall have a minimum of 3 gussets.
14. Quality control for visual defects shall be as the following table: Corrosion liners requiring rework in excess of 1% of the surface area of the component shall be cause for rejection.
15. A ladder and handrail (if required) shall be meet OSHA requirements.
16. A 3-stage inspection process shall be performed on the tank during various stages in the construction process. The first inspection shall be performed at the completion of the corrosion barrier and before structural winding occurs. The second inspection will be performed after the tank is removed from the mandrel and before any nozzles are attached. The third inspection shall be a final inspection prior to shipment of the tank. These inspections shall be performed by an independent inspector with at least 5 years of experience with FRP vessels.
17. Where the tank is RTP1 certified, the tank supplier must provide the appropriate documentation.

Table 1
Maximum Allowable Visual Defects
Quality Level 1

Visual Defect	Corrosion Liner	Structural & Finish Layers
Air Bubbles - Bubbles trapped within, on, or between plies. (0.015" dia. and larger) Not to be confused with froth.	None allowed between veil and anti-wicking barrier. (Test with pencil point) Max. 1/16" dia., 2 per in ² , averaged over 1 ft ² area. In no case, more than 4 per in ²	Practically achievable but not larger than 1/4" dia. Total combined area of all air bubbles not to exceed 10 in ² per yd ² for laminates up to 1/2" thick, and increased proportionately for thicker laminates. In no case more than 4 bubbles per in ² .
Blisters - Rounded surface elevations resembling a human skin blister.	None allowed	3/16" dia 1/16" height 1 per yd ²
Burned Areas - Dark discoloration and distortion of the laminate from excessive curing temperature.	None allowed	None allowed
Chips - Small pieces broken off an edge or surface of the laminate.	None allowed	1/8" dia. 1 per yd ² 1/16" deep
Cracks - Material separation or fracture.	None allowed	None allowed
Crazing - Fine cracks at or under the surface of the laminate.	None allowed	1" dia. 1 per yd ² 1/64" deep
Delaminations - Separation of the layers of material in a laminate.	None allowed	None allowed
Dry Spots - Area of surface where the reinforcement has not been wetted with resin. Not to be confused with glinting.	None allowed	None allowed
Edge Delamination - Separation of the reinforcement layers at the edge of the laminate.	None allowed	None allowed
Foreign Inclusions - Anything other than raw material components (visible with naked eye)	None exposed to surface. (must be covered with resin)	Practically achievable, but not more than 1/4" dia. and 3 per yd ² .
Pits - Small craters in the surface of the laminate.	1/16" dia. 2 per yd ² 1/32" deep	1/8" dia. 4 per yd ² 1/16" deep
Surface Pinholes - Numerous visible pinholes in the surface of the laminate.	No exposed surfacing veil.	Not applicable
Scratches - Shallow marks or grooves caused by mishandling the laminate.	None allowed	1/32" deep 6" long
Wrinkles - Linear, abrupt change in surface plane due to overlap in reinforcing layer, irregular mold surface, or wrinkled release film,	1/8" but must not decrease the laminate thickness below allowable.	Not applicable

Table 1
Maximum Allowable Visual Defects
Quality Level 1

Visual Defect	Corrosion Liner	Structural & Finish Layers
resulting in a resin rich area that could be easily chipped. Waviness is allowed provided it does not result in resin rich area.		

1.03 Warranty

1. The tank supplier shall warrant the tank(s) to the owner against defects in workmanship and materials at minimum for 2 years from the date of delivery.

Part 2 Execution

2.01 Examination and Preparation

- a. The contractor shall inspect all equipment immediately upon delivery to site. All internal surfaces of FRP equipment shall be smooth and free of cracks and chips. All visible damage shall be reported and repaired.
- b. Damaged equipment shall not be installed until repairs have been made in accordance with manufacturer's written instructions and approved by the Engineer. Damaged items shall be sent to factory for repair or replacement, unless otherwise approved by the Engineer.

2.02 Equipment Installation

- a. Install storage tanks in complete conformance with manufacturer's written instructions and requirements and Engineer approved shop drawings.
- b. Tank shall be installed on a level and smooth concrete base. The concrete base shall be covered with a 1" thick layer of dry Portland cement (no sand, gravel, or water added) to occupy irregularities between base and tank bottom. Do not grout between knuckle radius and concrete base. Grouting will not allow tank to expand and contract as required.

Powell

Fabrication & Manufacturing Inc
740 East Monroe Road, St. Louis, MI 48880
Phone 989.681.2158 Fax 989.681.5013
e-mail info@powellfab.com www.powellfab.com