SECTION 43 40 02

FIBERGLASS REINFORCED PLASTIC TANK
04/08

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASME INTERNATIONAL (ASME)

ASME B16.5	(2009) Standard for Pipe Flanges and Flanged Fittings: NPS 1/2 Through NPS 24

ASTM INTERNATIONAL (ASTM)

ASTM C 582	(2002) Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment
ASTM D 2583	(2007) Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
ASTM D 2584	(2008) Standard Test Method for Ignition Loss of Cured Reinforced Resins
ASTM D 3299	(2000) Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks
ASTM E 84	(2007b) Standard Test Method for Surface Burning Characteristics of Building Materials

1.2 DEFINITIONS

FRP: Fiberglass reinforced plastic.

1.3 DESIGN REQUIREMENTS

a. Design Loads: In accordance with Section 13 48 00.00 10, SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT.

b. Design tank, including resin selection (unless specified), wall thickness, methods and locations of support, and stiffener requirements. Design shall be prepared and sealed by designer meeting requirements of Article Quality Assurance.

c. Provide shop drawings and design data in Article Submittals. Design information as required under.

d. Coordinate with manufacturer of heater (see Section 43 32 56, REVERSE OSMOSIS (RO) SYSTEM and Chiller (see Section 44 44 20, AQUEOUS

AMMONIA SYSTEM) to be installed in tanks to ensure tank design and support design are suitable for use with heater and chiller actually being supplied. Secure the following:

1. Manufacturer drawings of required heater and chiller supports.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Shop Drawings; G

a. Fabricators catalog information, descriptive literature, specifications, and identification of materials of construction, including complete resin system information.

b. Letter from resin manufacturer stating that selected resin is suitable for intended service.

c. Detailed fabrication drawings.

d. Tank data indicating equipment number, pressure rating, diameter, straight shell lengths, overall lengths, wall thickness, corrosion barrier thickness, and details of nozzle designs.

e. Fabricator's detailed requirements for tank foundations.

f. Recommended bolt torque for bolted FRP connections.

g. Seismic anchorage and bracing drawings and cut sheets, as required by Section 13 48 00.00 10, SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT.

h. Samples: Laminate sample representative of production quality of surface finish and visual imperfections.

SD-05 Design Data

Design Data; G

1. Complete structural design calculations for tanks, supports and appropriate accessories. Calculations shall be stamped and signed by a registered Civil or Structural Engineer currently licensed in the State of California.

2. Seismic anchorage and bracing calculations as required by Section 13 48 00.00 10, SEISMIC PROTECTION FOR MECHANICAL EQUIPMENT.

3. Fabricator's Certificate of Compliance with fabrication requirements.

4. Qualifications of Fabricator's Quality Assurance Supervisor.

5. Copy of fabricator's Quality Assurance Program.

6. Quality Assurance Inspection:

a. Qualifications of Independent FRP Quality Assurance Inspector.

b. Initial QA Inspection Report.

c. Certification of Factory Testing.

7. Certification that heater or chiller and access nozzles have been coordinated with actual equipment being furnished.

8. Special shipping, storage and protection, and handling instructions.

9. Fabricator's printed installation and tank support instructions.

10. Manufacturer's Certificate of Proper Installation.

Contract Closeout Submittals: Service records for repairs performed during construction.

1.5 QUALITY ASSURANCE

a. Fabricator's Quality Assurance Supervisor: Minimum of 5 years' experience in fabrication of fiberglass structures.

b. Designer: Registered Civil or Structural Engineer currently licensed in California.

c. Independent FRP Quality Assurance Inspector:

1. Minimum 5 years' experience as FRP inspector.

2. Representing a corporately and financially independent organization that can function as an unbiased inspection authority.

3. Professionally independent of manufacturers, suppliers, and installers of systems being inspected.

1.6 DELIVERY, STORAGE, AND HANDLING

a. Shop Drawings Prepare and protect tank for shipment as follows:

1. Mount tank on padded cradles if shipped horizontally or on a suitable skid if shipped vertically.

2. Protect flanged nozzles with wooden blinds bolted to flange and having a diameter of 2 inches greater than outside diameter of flange.

3. Provide either rigid plugs inside ends to prevent deflection or wooden boxes for unflanged components. Brace open end of tank with suitable stiffening member to prevent deflection.

4. Do not ship components or other pieces loose inside tank.

5. Load tank with at least 2 inches of clearance between tank (including fittings) and bulkheads, or bed of vehicle.

6. Regardless of mode of transportation, firmly fasten and pad components to prevent shifting of load or flexing of components while in transit.

1.7 SEQUENCING AND SCHEDULING

Do not ship tank from factory until Engineer's review of Certification of Factory Testing is completed.

PART 2 PRODUCTS

2.1 SUPPLEMENTS

Some specific requirements relative to this section are included in Volume Standard Details of the Contract Documents.

2.2 SERVICE CONDITIONS

Operating Pressure: Atmospheric.

2.3 MATERIALS

a. Filament-Wound: Fabricate in accordance with ASTM D 3299, Type I, Grade I.

b. Resin:

1. Suitable for intended service.

2. Premium grade and corrosion resistant, such as chlorendic polyester, vinyl ester, or bisphenol A fumarate polyester.

3. Use same resin throughout entire tank shell.

4. Add ultraviolet absorbers to surfacing resin to improve weather resistance.

5. No dyes, pigments, or colorants, except in exterior gel coat.

6. No fillers or thixotropic agents.

7. Additives may be added to achieve fire retardancy. The Flame-Spread Rating of finish laminate shall be less than 25, as determined by ASTM E 84. Additives shall not be added to interior layer, unless specifically required.

8. Curing System:

a. As recommended by resin manufacturer or as specified herein.

b. Cure products as specified in ASTM D 3299.

c. Measure Barcol hardness according to ASTM D 2583.

9. Post-cure tank and appurtenances in accordance with resin manufacturer's recommendation for time and temperature. Post-curing should be completed with warm-to-hot dry air, free of

combustion products. Hot spots shall be avoided.

10. For hypochlorite service, no MEKP cobalt catalyst system shall be allowed in liner. Cure liner with benzoyl peroxide-dimethyl aniline. Structural layer may be cured with either catalyst system.

c. Reinforcements:

1. Surfacing Veil: Chemical surfacing mat, two layers of polyester fabric, 12 mils to 16 mils thick, with a finish and a binder compatible with the lay-up resin.

d. Laminate:

1. Consists of inner surface (corrosion barrier), interior layer, and exterior layer (structural layer).

2. Meet visual acceptance criteria in ASTM C 582.

3. Meet requirements of mechanical properties in ASTM D 3299.

4. Reinforce inner surface with resin-rich surfacing veil as specified herein.

5. Apply a white color coat after inspection of laminate has been completed.

e. Marking:

1. Identify each tank with fabricator's name, capacity in gallons, maximum temperature, design pressure/vacuum, specific gravity, pH, resin, minimum thickness, tank number, tank name, and date of manufacture.

2. Provide permanent marking. Seal decals, labels, etc., into laminate exterior with clear resin.

f. Nozzles:

1. Gusset 4 inch or smaller nozzles with conical or plate type gussets. Larger nozzles shall be gusseted, if noted.

2. Finish flush with inside surface of tank, unless otherwise indicated.

3. Gaskets:

a. Provide two per nozzle, 1/8 inch-thick, full-face elastomeric material having a hardness of Shore A60 plus or minus 5.

b. Material shall be suitable for intended service.

4. Flanged Nozzles: Rated at 100 psi, with other dimensions and bolting corresponding to ASME B16.5 for 150 pound steel flanges.

5. Back face of flanges shall be spot-faced, flat and parallel to flange face of sufficient diameter to accept SAE metal washer

under bolthead or nut.

2.4 APPURTENANCES

a. Tank Insulation

1. The aqueous ammonia storage tank, sodium bisulfite tank, and sodium hydroxide storage tank, shall be fully insulated with polyurethane foam. The spray-on urethane foam shall be tested by the Underwriters Laboratories. Spray-on application shall result in a high quality rigid methane foam with a minimum thickness of 4 inches. The foam shall be FE 303-2.5 HCP as manufactured by Foam Enterprises, Inc. or equal.

2. A elastomeric urethane coating shall be applied. Total coating thickness shall be 45 mils dry film. Color of the topcoat for the coating shall be white or off-white.

3. The completed urethane insulation and coating shall be guaranteed for a period of 5 years against failure or workmanship and materials. Repair of the system, including materials and labor, shall be by the Supplier and at no additional cost to the Owner.

b. Level Indicators and Transmitters

1. Provide level indicating transmitter, as shown on the Drawings, each with a 4 to 20 mA signal output for transmission to the destinations as shown on the Drawings. Level transmitter shall be type L5 as specified in Section 40 95 00, PROCESS CONTROL. Transmitter enclosure shall be pedestal mounted adjacent to the tank. The Contractor shall flange mount the level element (sensor) on the top of the tank as located on the Tank Data Sheets in Volume Standard Details of the Contract Documents.

c. Level Switches

1. Provide level switches, as shown on the Drawings, each with a discrete signal output for transmission to the destinations as shown on the Drawings. Level switches shall be type L9 as specified in Section 40 95 00, PROCESS CONTROL . The Contractor shall mount the level switches on the side of the tank as located on the Tank Data Sheets in Volume Standard Details of the Contract Documents.

d. All chemical storage tanks require chemical fill by a chemical tanker truck, as shown on the Drawings, the fill line from each of these tanks shall be connected from the tank to within one foot inside the concrete containment wall where a 2-inch cam lock coupling (with a cap) fill connection is reachable by an operator standing outside of the containment wall, except as shown on the Drawings.

e. Tank Heat Tracing

1. The sodium bisulfite storage tank and the sodium hydroxide storage tank shall be installed with heat tracing and temperature controls. Each tank shall be maintained above 55 degrees F.

f. Sight Glass (Type 1):

1. Tubular type PVC with 1.5 inch, 150-pound, raised flanged connection.

2. Furnish with valves, drain cock, Pyrex glass, and stainless steel guard rods.

3. Parts coming in contact with liquid shall be either PVC or glass.

4. Calibrate tank in 100 gallon increments and paint calibrations adjacent to level tube with graduations and boldface figures.

5. Manufacturer and Product: Ernst Flow Industries; Model EFI-PVC or approved equal.

g. Supports:

1. Pipe Supports:

a) Provide for tank overflow pipes, loading pipes and recirculation pipes.

b) Spacing of supports shall be as recommended by fabricator, but shall not be greater than 4 feet on center.

c) As shown on Drawings, shall allow removal of pipe.

d) Type 316 stainless steel complete with necessary bolts, nuts, and washers.

h. Lifting Lugs: Provide suitably attached for tank weighing over 100 pounds.

i. Anchor Bolts: Type 316 stainless steel bolts, sized by fabricator.

j. Manway Bolts: Type 316 stainless steel bolts and nuts.

2.5 SOURCE QUALITY CONTROL

a. Independent FRP Inspector:

1. To be present at point of manufacture at time fabrication is started, to perform the following:

a) Observe manufacturing methods, machinery, and techniques to ensure compliance with industry standards and these Specifications.

b) Observe initial fabrication to verify compliance with these Specifications.

c) Observe quality control methods for mixing resins and testing of completed equipment.

d) Generally observe quality of other ongoing fabrication.

e) Prepare Initial QA Inspection Report.

2. To be present at point of manufacture, upon completion of fabrication and prior to shipment, to perform or witness the following:

a) Visual inspection to requirements of ASTM C 582.

b) Barcol Hardness measurements per ASTM D 2583.

c) Acetone sensitivity test for internal secondary bonds.

d) Glass content by ignition loss on three cutouts per ASTM D 2584.

e) Hydrostatic Leak Test:

1) Perform on each tank.

2) Fill to top nozzle; allow to stand for 2 hours with no visible leakage.

3. Prior to beginning repair work, repairs deemed acceptable by Independent FRP Inspector shall be approved by Engineer.

b. Identify and retain cutouts. Engineer may select certain cutouts for testing for physical properties of laminate.

c. Factory Test Reports: Certify results, by signature, of the following:

1. Inspections.

2. Results of hydrostatic testing.

3. Test reports of physical properties of standard laminates.

PART 3 EXECUTION

3.1 INSTALLATION

a. In accordance with fabricator's written instructions.

b. Accurately place anchor bolts using templates furnished by fabricator.

c. Interface with Other Products: Coordinate with heater and chiller manufacturers as required for proper mounting.

3.2 FIELD QUALITY CONTROL

a. Functional Test:

1. Conduct on each tank.

2. Hydrostatic leak test with tank full of clean water. Allow water to stand for 24 hours to verify no leakage.

3.3 MANUFACTURER'S FIELD SERVICES

Provide fabricator's representative at Site for installation assistance, inspection and certification of proper installation for specified component, subsystem, equipment, or system.

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