

## SECTION 44 44 13.15 01

FIBERGLASS REINFORCED PLASTIC (FRP) DECARBONATOR  
04/08

## PART 1 GENERAL

## 1.1 WORK INCLUDED

This Section covers the work necessary to furnish one fiberglass reinforced plastic (FRP) decarbonator vessels and appurtenances as specified herein and shown on the Drawings. The system shall include the FRP cylindrical shell components, complete with distributor supports, manways, full-body flanges, internal structural members, media support grating, access ladder and handrail and all necessary FRP components, fasteners, gaskets, lug and bracket attachments, and other accessories required for a complete installation.

## 1.2 OTHER REQUIREMENTS

See Section 44 44 13.15, DECARBONATOR TOWER SYSTEM - GENERAL, for additional requirements.

## 1.3 COORDINATION

The manufacturer of the equipment shall coordinate the design, fabrication, and erection with other suppliers of the overall system components as required to provide a complete operational system.

## 1.4 SERVICE CONDITIONS

See Section 44 44 13.15, DECARBONATOR TOWER SYSTEM - GENERAL, for service conditions.

## 1.5 WARRANTY

In addition to the warranty provisions stated in the General Conditions, the manufacturer of the vessels shall provide a written warranty against defects in materials and workmanship for a period of 5 years.

## 1.6 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.

## ASTM INTERNATIONAL (ASTM)

ASTM C 582	(2002) Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment
ASTM D 2563	(1994; R 2002e1) Classifying Visual Defects in Glass-Reinforced Plastic Laminate Parts
ASTM D 2583	(2007) Indentation Hardness of Rigid

## Plastics by Means of a Barcol Impressor

ASTM D 3299

(2000) Filament-Wound  
Glass-Fiber-Reinforced Thermoset Resin  
Corrosion-Resistant Tanks

## 1.7 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

## Fabrication Drawings

Complete manufacturer's drawings showing the dimensions of the vessel, thickness of the vessel walls, and the size and location of all fittings and nozzles, manways, and accessories being provided for the specific installation.

## SD-03 Product Data

## material requirement

The manufacturer shall submit detailed descriptions of the laminate and the type of reinforcing to be used. This shall be accompanied by a letter from the resin manufacturer stating:

- a. That the laminate and reinforcing material used will provide suitable chemical resistance for the intended service.
- b. That the resin is suitable for the environmental conditions intended and the fabrication technique proposed.
- c. That the resin is suitable and approved for contact with potable water.

Color chart showing all available pigment colors for exterior coating system.

## SD-05 Design Data

## Design calculations

Structural design calculations for the FRP vessel, pipe supports, access ladder, walkways, handrail and structural members. The design criteria for the calculations shall be performed and in accordance with the requirements presented herein and shall be performed and, signed and sealed by a qualified registered Civil or Structural Engineer currently licensed in the State of California. Design criteria is as stated on Drawing G-10, Structural Construction Notes. The design calculations shall include, but not be limited to, consideration of the following:

- a. Wind and Seismic loads in accordance with Design Criteria as stated on Drawing G-10 Structural Construction Notes.
- b. Tower packing support design.
- c. Access platform design.
- d. Anchor lug attachment to shell.
- e. Anchor bolt size and embedment requirements.

- f. Consideration of effects of all cutouts and openings into the vessel walls.
- g. Attachment lugs ladder, for piping, structural members for walkway, pipe supports, and other appurtenances.

Recommended bolt torque's for all bolted FRP connections.

#### SD-07 Certificates

##### Certification and Warranty

7. Prior to shipment of the vessel, submit four copies of a report, including certification, that the quality control, testing, and inspection have been completed and that the standards specified herein have been met for that unit.

Written manufacturer's warranty.

#### SD-08 Manufacturer's Instructions

##### instructions

Instructions for shipment, storage, handling, and installation.

## PART 2 PRODUCTS

### 2.1 GENERAL

The use of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired only. Products of other manufacturers will be considered in accordance with the General Conditions.

### 2.2 MANUFACTURERS

- a. Daniel Company, Upland, CA.
- b. Paramount Fabricators, Rancho Cucamonga, CA.
- c. Diamond Fiberglass Fabricators, Victoria, TX.
- d. Or equal.

### 2.3 SAFETY FACTORS

a. All vessels and appurtenances shall be designed based on the following safety factors:

- 1. Internal Pressure: 10:1.
- 2. Stability: 10:1.
- 3. Catastrophic: 10:1.

b. The structural properties used for the safety factor calculations shall be based on actual tests of a resin laminate system that is similar to the one specified in this Section.

## 2.4 TOWER DESIGN

The decarbonator tower shall be helically filament wound, cylindrically shaped, with upflow air passage and countercurrent liquid flow. All materials used shall meet the [material requirement](#) specified herein. Vessel size and configuration shall be as shown in Section [44 44 13.15](#), DECARBONATOR TOWER SYSTEM - GENERAL, and the drawings and data sheet. Unit shall be complete with flanges, nozzles, manways, lifting lugs, anchor lugs, and other appurtenances. [Design calculations](#) shall be based on design criteria stated on Drawing G-10, Structural Construction Notes.

## 2.5 RESIN

- a. Resin System: Selected by the Fabricator, subject to approval by the Engineer, and suitable for the intended service.
- b. Corrosion Barrier Resin: Premium grade and corrosion resistant.
- c. The same resin shall be used throughout the structural layer. Dual laminate systems shall not be used unless specifically requested by or approved by the Engineer.
- d. Add ultraviolet absorbers to the exterior surfacing resin to improve weather resistance.
- e. No dyes, pigments, or colorants shall be used except in the exterior gel coat.
- f. The resin shall not contain fillers or thixotropic agents unless specified.
- g. Use resin manufacturer's currently recommended cure system, unless otherwise agreed upon by the Fabricator and Engineer.
- h. Cure all products to a minimum of 90 percent of the minimum Barcol hardness specified by the resin manufacturer.
- i. Barcol hardness shall be measured according to [ASTM D 2583](#).

## 2.6 REINFORCEMENT

- a. Veil: Chemical surfacing veil, polyester fabric, 12 to 16 mils thick, with a finish and a binder compatible with the lay-up resin.
- b. Corrosion Barrier: Thickness shall be [100 to 120 mils](#) using chopped strand mat backing the veil. Additives shall not be used in the corrosion barrier.
- c. Chopped Strand Mat: Type E glass, minimum [1-1/2 ounces](#) per square foot, with saline finish and styrene soluble binder.
- d. Continuous roving used in chopper gun for spray-up shall be Type E glass.
- e. Woven roving shall be Type E glass, nominal 24 ounces per square yard, 4 by 5 weave, with saline finish.
- f. Continuous roving used for filament winding shall be Type E glass with a saline type finish, with a nominal yield of at least [110 strand](#)

yards per pound.

## 2.7 LAMINATE

a. Laminate shall consist of an inner surface (resin rich liner), an interior layer (corrosion barrier), and an exterior layer.

b. Laminate Quality: Meet requirements of the visual acceptance criteria in [ASTM C 582](#) and NBS Voluntary Product Standard PS15-69 including, but not limited to, the following:

1. Appearance.
2. Defects.
3. Cut edges.
4. Construction joints.

c. Reinforce inner surface with a resin-rich surfacing veil of 10 to 20 mils thick.

d. The resin content of the inner surface shall be a minimum of 80 percent by weight.

e. Construct interior layer of resin reinforced with at least two plies of chopped strand mat. Thickness of interior layer shall be at least 100 mils.

f. Glass content of combined inner surface and interior layer shall be 25 percent plus or minus 5 percent (70 to 80 percent resin by weight).

g. The exterior or structural layer shall be filament wound. Filament winding shall be with continuous strand roving to provide a glass content of 50 to 80 percent.

## 2.8 ACCESSORIES

### 2.8.1 Equipment Identification Plates

A 16 gauge Type 316 stainless steel identification plate shall be provided for the vessel. The following information shall be included:

1. Name and Address of Manufacturer.
2. Date of Manufacture.
3. Equipment Number as Shown on the Drawings.
4. Resin Manufacturer and Type.
5. Reinforcement Manufacturer and Type.
6. Vessel Height, Diameter, and Empty Weight.

### 2.8.2 Lifting Lugs

Each removable section of each vessel shall be provided with three lifting

lugs designed for symmetrical removal of each section. The lugs shall be of FRP and/or Type 316 stainless steel construction and shall be an integral part of the vessel construction. Design weights for lifting lug design shall include an allowance for vessel internals.

#### 2.8.3 Anchor Lugs

The bottom section of each vessel shall be provided with a minimum of eight anchor lugs designed to transmit all vessel reaction loads to the reinforced concrete foundation. The actual number of anchor bolts shall be determined by the manufacturer's registered structural engineer. The lugs shall be of FRP and/or Type 316 stainless steel construction and shall be an integral part of the vessel construction. An anchor bolt template shall be utilized to locate the lugs on the vessel during manufacture. A matching template for each vessel shall be shipped to the project site at least 2 weeks prior to the scheduled shipping date of the vessel for use in setting the embedded anchor bolts in the tank foundation.

#### 2.8.4 Anchor Bolts

Provide a complete set of anchor bolts. The anchors shall utilize a double nut arrangement with all appropriate washers. Anchor bolt materials shall be Type 316 stainless steel.

#### 2.8.5 Structural Members for Packing and Demister Supports

Provide integral structural members for support of the packing support grids and demister section (provided as a part of the work specified in Section 44 44 13.15 02, DS - RANDOM PACKING MEDIA AND APPURTENANCES). The members for the upper section of packing shall be designed to minimize adverse effects on flow distribution due to reduction in aperture area of the vessel diameter. The design of these components of the vessel shall be coordinated with the manufacturer of the packing material.

#### 2.8.6 Flanged Nozzles and Manways

Provide flanged nozzles and manways as shown on the Drawings and as needed for proper performance. Nozzle connections shall be mounted flush with the interior of the vessel to provide unrestricted, full vessel diameter access for installation and removal of the packing material.

1. Flanged nozzles shall be made by hand-layup construction, with nozzle neck and flange made integrally in one piece. All layers of reinforcement in the nozzle neck and hub shall extend uninterrupted into the flange. Utilize ring cutouts of mat to achieve additional flange thickness. Use of press molded or filament wound flanges is not acceptable.
2. Overall machine facing of the back of the flanges is not permitted. Spot face bolt holes for SAE size washers and coat holes and all other cut surfaces with resin so that no fibers are exposed. Depressions or projections in flange face shall be no more than 0.0625 inch.
3. Flanges shall utilize 150 pound bolt pattern as per ANSI B16.1. Bolt pattern shall straddle vertical centerline of pipe. Tolerance in bolt hole size and location shall be (plus or minus) 0.0625 inch.
4. Manway covers shall be of opaque Lexan or fiberglass, designed for

the internal pressures of the system. Manway covers and flanges shall be uniform for all units, such that each cover shall be interchangeable at any orientation.

5. All nozzles shall be gusseted with conical type gussets.

#### 2.8.7 The Tower

1. The towers shall include supports for external vertical pipes and ducts. Supports shall be fiberglass made with resins as specified in this Section. Supports shall be located to provide a maximum L/D ratio of 1.5. These supports shall be designed, furnished, and installed by the tower manufacturer.

2. The tower shall be equipped with an air outlet at the top of the tower. The air outlet shall be designated to insure that the maximum air velocity is 25 feet per second. The air outlet shall be baffled with a Type 316 stainless steel or corrosion resistant plastic screen to prevent the ingress of insects or debris.

3. The tower manufacturer shall coordinate the required size and location of the blower inlet ducts. Invert of the ducts shall be at least 4 inches above the crown of the basin overflow. A minimum distance of 6 inches shall be provided between the packing support and the top of the air inlet duct to facilitate distribution of air across the packing.

4. Level transmitter to monitor and to detect high level shall comply with requirements in Specification Section 40 95 00, PROCESS CONTROL.

### 2.9 FABRICATION

#### 2.9.1 General

1. Detailed Fabrication Drawings shall be provided for approval.

2. All parts of the equipment and appurtenances shall be amply proportioned for all stresses that may occur during fabrication, shipment, erection, and intermittent or continuous operation. Workmanship shall be of high grade in all respects.

3. The Contractor shall be responsible for the equipment's condition until the completion of the work. Damage or loss of equipment and materials shall be repaired or replaced at the Contractor's sole expense.

#### 2.9.2 Laminating Sequence

The vessel shall be helically filament wound in accordance with the referenced standards, and shall be designed for the service conditions listed herein.

#### 2.9.3 Dimensions and Tolerances

1. Allowable values for equipment fabrication and assembly shall be as specified in the latest version of ASTM D 3299, unless otherwise specified herein.

2. The outside surface of the vessel bottom shall be flat within

(plus or minus) 0.5 inch. Indentations or protrusions shall not exceed (plus or minus) 0.25 inch within a 24 inch radius.

2.9.4 Visual Defects

Visual Defects: The completed vessels shall be better than Level II for the vessel interior and Level III on the vessel exterior in accordance with ASTM D 2563.

PART 3 EXECUTION

3.1 GENERAL

All parts and components shall be factory assembled in sections convenient for field handling and installation but requiring the minimum amount of work for field assembly. Any field assembly work shall be bolted. No cutting or welding should be required for field assembly or erection.

All assembled parts and components ready for shipment shall be securely bundled, coiled, or crated and adequately protected from damage and corrosion during shipment and storage.

3.2 PACKAGING

The fiberglass vessel shall be prepared and protected for shipment and shipped as specified in ASTM D 3299 and per manufacturer's instructions. The vessel shall be shipped with the manways and blind flanges installed.

3.3 MANUFACTURER'S CERTIFICATE(S)

A. Provide manufacturer's Certification and Warranty in accordance with Section 01 78 00.00 40, CLOSEOUT SUBMITTALS.

3.4 MANUFACTURER'S REPRESENTATIVE

The fabricator shall provide the services of a qualified field representative to be present at the jobsite during the unloading and erection of the equipment to provide technical assistance and direction.

3.5 DECARBONATOR TANK DATA

<u>Name of Tank</u>	<u>Decarbonator</u>
Equipment Numbers	TK-40010
Minimum Capacity Measured to High Solution Level (gallons)	*
Diameter (feet)	12
Straight Shell Height (ft)	25
Chemical Composition	Water
Concentration	N/A
Specific Gravity	1
pH Range	5.0 - 7.0
Material	FRP
Installation (Vertical/Horizontal)	Vertical
Support (saddles, flat pad, legs)	Flat
Type of Top and Bottom Head	Top dish, Bottom Flat
Ladder Required (Yes/No)	Yes
Insulation Requirements	No
Containment Area	No

-- End of Section --