

# FACTORY-WELDED TANK SPECIFICATIONS

## 2PART 1 – SELECTION

### 1.1 ENGINEER'S SELECTION

- A. The Engineer's selection of factory-welded (factory-coated carbon steel) (stainless steel) tank construction for this facility has been predicated upon the design criteria and construction methods specified. Deviations from the specified design and construction details will not be permitted.

## PART 2 – SPECIFICATION

### 2.1 DRAWINGS AND SPECIFICATIONS

- A. After receipt of order, the Vendor is required to furnish, for the approval of the Engineer, complete specification and construction drawings for all work shown on the bid drawings. When approved, one set of such prints will be returned to the Vendor marked *Approved* and these drawings will govern the work detailed. The approval by the Engineer of the Contractor's drawings shall be an approval relating only to their general conformity with the bid drawings and specifications.
- B. Construction shall be governed by the Owner's drawings and specifications showing general dimensions and construction details. After approval by the Engineer of detailed drawings prepared by the Vendor, there shall be no deviation from the drawings and specifications except upon written order or approval from the Engineer.

## PART 3 – QUALIFICATION OF BIDDER

### 3.1 GENERAL INFORMATION

The Bidder shall be a specialist in the design and fabrication of factory-welded carbon steel and stainless steel tanks. Bidder shall also submit, upon request a list of five comparable tanks now in service in the United States for references.

- A. Jobsite location: City \_\_\_\_\_ State \_\_\_\_\_ Zip Code \_\_\_\_\_
- B. Material stored: \_\_\_\_\_
- C. Loose density of product: \_\_\_\_\_ pounds per cubic foot
- D. Maximum compacted product density: \_\_\_\_\_ pounds per cubic foot
- E. Product angle of repose: \_\_\_\_\_ degrees
- F. Required working capacity each tank: \_\_\_\_\_ cubic feet of tonnage
- G. Tank size – diameter x height
- H. Configuration – (Specify skirt support design)(Tank elevated on structural steel)(Legs)(Lugs)(Girder)(Load Cell Legs)
- I. Hopper slope \_\_\_\_\_ specify degrees
- J. Hopper Outlet size: \_\_\_\_\_
- K. Clearance from foundation to hopper discharge: \_\_\_\_\_  
(Mass Flow) (Funnel Flow) (Fluidized) design loads: \_\_\_\_\_
- L. Operating pressure and vacuum: \_\_\_\_\_ / \_\_\_\_\_ ounces/square inch
- M. Dust collector and/or equipment load \_\_\_\_\_ pounds
- N. Roof live load: \_\_\_\_\_ PSF

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- O. Seismic loads per IBC 2006/ASCE 7-05 (optional: IBC 2012/ASCE 7-10)
  - a.  $S_s = \underline{\hspace{1cm}}$ ,  $S_1 = \underline{\hspace{1cm}}$ , Site Class D ( $\underline{\hspace{1cm}}$ ),  $I = 1.0$  ( $\underline{\hspace{1cm}}$ )
- P. Wind loads per IBC 2006/ASCE 7-05 (optional: IBC 2012/ASCE 7-10)
  - a.  $\underline{\hspace{1cm}}$  mph, Exposure C ( $\underline{\hspace{1cm}}$ ),  $I = 1.0$  ( $\underline{\hspace{1cm}}$ )

## 3.2 SCOPE OF SUPPLY

- A. Furnish all material necessary for the tanks and appurtenances specified.
- B. Tanks will be designed to be self-supporting on customer supplied foundation or structure.
- C. Delivery will be accomplished on specialty trailer equipment. Actual transportation equipment will be dictated by tank geometry.
- D. Welded tank installation services at the jobsite will be optional at customer request.

## 3.3 DESIGN CRITERIA

- A. Vendor to quote on the nearest standard size welded tanks of manufacturer.
- B. Based on the International Building Code, when designing a tank, the load producing the higher stresses comparing wind and seismic will control the dynamic portion of design. A 1/3 allowable stress increase for structural shape stiffeners is not allowed.
- C. Combined live and dead roof load shall be uniformly distributed with all nozzle, manhole, and filter locations designed for a minimum of 200 lbs. each. Live and dead loads to be a combined minimum of 20 psf. Roof to have 10° (2.116 to 12) slope for water drainage. Roof is typically not designed as a working platform.
- D. Shell and Hopper Design
  1. Shell and hopper product pressures are calculated using the technical paper *effect of Solid Flow Properties and Hopper Configuration on Silo Loads*, by Jenike, A.W. Jenike and Johanson, Inc. The analysis uses the Janssen formula for defining pressures and load imposed by funnel or mass flow. Radial tension in the shell, from the above mentioned product loads are from the *Design of Steel Bins for Storage of Bulk Solids, Gaylord and Gaylord*, Section 8-2. Loadings in the hopper, from the above mentioned product loads, are from the *Design of Steel Bins from Storage of Bulk Solids, Gaylord and Gaylord*, Sections 5-12, 8-6.
  2. Allowable stresses for carbon steel are per the AISC Manual of Steel Construction. Allowable Stress Design, 9<sup>th</sup> Edition and ASTM for carbon steel materials. Weld joint efficiencies, where applicable, shall be per steel materials. Weld joint efficiencies, where applicable, shall be per ASME Section VIII, Division I, Table UW-12.
  3. Shell design is based on the critical buckling formula for a long cylinder from the book *Structural Analysis of Shells*, by Baker, Kovalevsky & Rish. The shell material's critical buckling stress is not allowed to exceed its yield strength.
  4. Shell resistance to radial tension from dry product pressure is based on the principles of API 620, Section 3.10 with allowable seam loads based on the principles of AISC.

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5. Hopper resistance to tension from dry product pressure is based on the principles of API 620 Section 3.10 with allowable seam loads based on the principles of AISC. The hopper to sidewall connection design is based on the principles of API 620 Section 3.12.
6. Deck sheet design under internal pressure is based to the principles of API 620 Section 3.10 with allowable seam loads based on the principles of AISC. The deck to sidewall connection under the internal pressure is based on the principles of API 650.
7. Shell design under vacuum is based on the critical buckling formula from the book *Structural Analysis of Shells*, by Baker, Kovalevsky & Rish.
8. Tank shall be designed for (center fill) (off-center fill) (center discharge) (off-center discharge) of product.
9. Tank design pressure shall be 14 oz per square inch positive and .5 oz per square in negative (designed tank for atmospheric pressure). (Stainless steel tanks are designed to a positive pressure of 10 oz per square inch.)
10. Tank design to be based on the maximum compacted density of the product.
11. Owner solicits recommendations that may improve the price, delivery, or performance of tanks. As an alternate vendor is invited to quote changes in physical dimensions, modifications to the design, fabrication or stock of Vendor's standard equipment that would reduce the initial cost of the equipment as specified without changing the design premise. Any alternate quotations submitted must be clearly labeled as "Alternate Quotation".

### 3.4 MATERIAL SPECIFICATIONS - SHELL STRUCTURE

The materials, design, and fabrication of the welded shell shall conform to the manufacturer's standard specifications including the following:

- A. Materials – Carbon Steel
  1. Hot Rolled Sheet and Plate - ASTM A1011 Grade 40 or equal with a minimum yield strength of 40,000 psi and ASTM A36 or equal with a minimum yield strength of 36,000 psi.
  2. Structural Shapes - Carbon steel structural shapes shall conform to ASTM A36 or ASTM A992.
  3. Pipe - Carbon steel structural pipe shall conform to ASTM A53 GrB or ASTM A500 GrB.
- B. Materials – Stainless Steel
  1. Stainless steel - 304, 316, 304L, 316L typical grades
  2. Other grades of carbon steel and stainless steel are available.

### 3.5 BOLTS

- A. Bolts shall be 1/2 inch diameter and shall meet or exceed *API Specification 12B*. Standard bolt coating is mechanically galvanized per ASTM B695, Class 50.
- B. Anchor bolts conform to ASTM F1554 Gr36 or Gr105.
- C. Other bolts shall meet or exceed ASTM A307 or ASTM325.

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## 3.6 GASKETS

- A. Bolted connections shall incorporate white EPDM gasket material.

## 3.7 MANUFACTURING

- A. Welding - All structural welding shall be to the latest edition of AWS using ASME or AWS certified welders - AWS D1.2 for aluminum, AWS D1.1 for carbon and stainless steel. Welding procedures are qualified to AWS or ASME Section IX.
- B. Shell seams shall be full penetration using the SAW (sub-arc welding) process with copper backup.
- C. Other seams may be made with GMAW (gas metal arc welding), SMAW (shielded metal arc welding), FCAW (flux-cored arc welding) or SAW (submerged arc welding) process.

## 3.8 COATINGS – (APPLICABLE TO CARBON STEEL ONLY)

- A. All carbon steel plates, members, and miscellaneous parts (except bolts) shall be factory coated in accordance with the provisions of **Part 4** specifications.

## 3.9 APPURTENANCES/ACCESSORIES

### A. STANDARD ACCESSORIES

1. 3'-0" x 6'-8" walk-in door in skirt below hopper
2. 20" center roof dome with cover plate
3. Foundation loads
4. Foundation anchor bolts and clips

### B. OPTIONAL ACCESSORIES

#### Product material testing

1. Hillside flange in deck for mounting filter (size and weight required)
2. Double door access in skirt – 6' wide x 6'8" ht.
3. Hopper manway access (manway with bolt-on cover)(hinged style)(quick access)
4. Specify - Stub and flanged nozzles required in deck, sidewall, and hopper
5. Specify – Level indicator nozzles/couplings/openings required
6. Complete fill pipe assembly (stainless)(carbon steel) specify schedule required
7. Wear-back elbows on fill pipe assembly
8. TC target box located in tank center dome
9. Deck manway access (20" snaplock)(20" combination manway ventilator)(20" combination PRV)(24" combination manway prv)
10. Specify - Special hopper outlet size or configuration required
11. Deck perimeter guardrail with toeboard (OSHA)(rails, hot-dip galvanized posts)
12. Outside ladder with safety enclosures and rest platforms (OSHA), hot-dip galvanized with rest platform
13. Crossovers for access between tanks (OSHA)(rails, bar grate material, hot-dip galvanized posts)

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## 3.10 SHIPPING

- A. All tanks, structures and miscellaneous parts shall be packaged for shipment in such a fashion as to minimize abrasion or scratching of finished coating system.
- B. Shipment by special trailers designed for hauling tank/cylinder shapes.
- C. Shipping covers shall be provided for all openings.

## PART 4 – TC COATING SPECIFICATION

### 4.0 SURFACE PREPARATION

- A. An SSPC-SP6 (commercial) blast surface profile is required for the coatings listed.
- B. Blasted surface profile will not be exposed to rain, dew or other contaminants prior to coating application.

### 4.1 INTERIOR COATINGS

- A. **FDA & USDA Epoxy** – dry bulk materials & food grade applications. One coat of amine adduct epoxy, spray applied at 5 mils DFT.
- B. **Polyamide Epoxy** – dry bulk materials & protective primer applications. One coat corrosion-inhibitive polyamide epoxy primer, spray-applied at 2.0 mils nominal DFT.
- C. **Abrasion Plus** – flow promotion, abrasion resistant food grade application. One coat of amine adduct epoxy, spray applied at 5 mils DFT.
- D. One coat of abrasion resistant urethane, Ameron (or equal) applied at 1.5 mils DFT.
- E. **No internal coating required.**
- F. **Special field applied coating – to be specified**

### 4.2 EXTERIOR COATINGS

- A. **POLYAMIDE EPOXY** – dry bulk materials & protective primer applications. One coat corrosion-inhibitive polyamide epoxy primer, spray-applied at 2.0 mils nominal DFT.
- B. **INORGANIC ZINC** – coastal / salt spray environment / primer application. One coat inorganic zinc primer will be applied at 2.5 mils DFT.
- C. **POLYAMIDE EPOXY WITH POLYURETHANE TOPCOAT** - prime + best topcoat. One coat of polyamide epoxy applied at 2 mils DFT. One coat of polyurethane will be applied to 1.5 mils DFT. (Standard light colors include: white, blue, green, gray & tan) Note: Total coating system application – 3.5 mils DFT.
- D. **MAXCOAT DRY-SW PROTECTION SYSTEM** – extreme external protection – prime + intermediate coat + topcoat. Prime coat inorganic zinc primer will be applied at 2.5 mils DFT. Intermediate coat polyamide epoxy will be applied at 2 mils DFT. Topcoat polyurethane will be applied to 1.5 mils DFT. (Standard light colors include: white, blue, green, gray & tan). Note: Total coating system application 6 mils DFT.
- E. **NO EXTERNAL COATING SYSTEM REQUIRED.**

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F. **SPECIAL FIELD APPLIED COATING SYSTEM** – to be specified.

G. **CURING & SHIPPING**

1. All coated parts shall be inspected prior to shipment.
2. Touch-up paint with instructions shall be included for application by erection crew.