

**UNITED INDUSTRIES GROUP, INC.**

**SPECIFICATION SECTION 13210**

**EVERSTORE GLASS-FUSED-TO STEEL BOLTED STORAGE TANKS**

**PART 1 – GENERAL**

* 1. **DESCRIPTION**

1. CONTRACTOR shall furnish all labor, materials, equipment, and incidentals

required to design, fabricate, deliver, erect, and test tank constructed of

factory prefabricated glass‐coated, bolt‐together steel panels. Each tank

structure shall include a foundation and other accessory components as

shown on the Contract Drawings and described herein.

1. All required tank materials and principal appurtenances shall be supplied by the tank

manufacturer.

1. Installation shall be executed by a qualified and experienced erection crew,

trained and certified by the tank manufacturer.

1. Tank structures and appurtenances shall be new and not previously used.
   1. **QUALITY ASSURANCE**
2. The Supplier shall offer a factory applied glass coated bolt together shop pre‐fabricated sectional steel tank.
3. The Supplier will offer a new tank structure as a manufacturer specializing

in the design, fabrication and erection of factory applied glass coated, bolted

tank systems. Structural design per the latest AWWA D103 Standard for Bolted Steel Water Storage Tanks (AWWA D103-09).

1. **Design and Fabrication Criteria:**
2. Except as otherwise shown or specified, all materials, joints, workmanship and all other aspects of the tank and fabrication shall conform to ANSI/AWWA D103-09std hereinafter AWWA D103.
3. Tanks with roofs shall be designed for roof live loads and roof dead loads.
4. The ground snow load shall be \_\_\_\_ pounds per square foot.

**a**. Snow Load Importance Factor: \_\_\_\_(ls)

**b**. Thermal Factor: \_\_\_\_(Ct)

**c**. Snow Exposure Factor: \_\_\_\_ (Ce)

1. Tank shall be designed for a basic wind speed of \_\_\_\_\_miles per hour.
2. Tank shall be designed for the following seismic conditions:

**a**. Map Spectral Response:

i. Ss = \_\_\_\_\_\_\_\_

ii. S1 = \_\_\_\_\_\_\_\_

**b.** Seismic Use Group = \_\_\_\_

**c.** Site Class = \_\_\_\_

1. Tank foundation shall be designed with an allowance soil bear capacity of \_\_\_\_\_\_\_\_ psf.
2. Specific Gravity of stored media: \_\_\_\_\_.

**1.3 SUBMITTALS**

**A. Action Submittals:**

Submit for approval the following:

1. Copies of detailed tank drawings. Drawings shall include all

dimensions, sizes, plate thicknesses, anchorage, nozzle details, and details of all required accessories.

1. Fabrication shall not be started until submitted drawings are approved.

**B. Informational Submittals: Submit the following:**

Manufacturer’s Design Calculations.

Structural calculations shall be submitted for tank structures

and foundations. The calculations shall be reviewed and the

submittals sealed by a Professional Engineer licensed and

registered in the state of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**C. Warranty:**

If within a period of Five (5) years from date of completion the tank structure or any part thereof shall prove to be defective in material or workmanship upon examination by the manufacturer, the manufacturer will supply a replacement part, will repair, or allow a credit for same.

The tank manufacturer shall provide a standard Maintenance Manual upon

approval of the drawings and completion of the tank installation.

**PART 2 – PRODUCTS**

**2.1 GENERAL**

1. Tanks shall be manufactured by the following manufacturer:

1. United Industries Group, Inc.

2. Pre‐approved equal

**2.2 TANK**

1. **Tank Size:**

1. Nominal Diameter: \_\_\_\_\_feet.
2. Max. Nominal Tank Sidewall Height: \_\_\_\_\_feet.
3. Design Freeboard: \_\_\_\_\_\_\_\_inches.
4. Min. Nominal Tank Capacity: \_\_\_\_\_\_\_\_\_\_\_\_gallons.

5. Number of Tanks: \_\_\_\_.

1. **Plates and Sheets:**
2. Plates and sheets used in the construction of the tank shell, tank floor

(if required) and tank roof (if required) shall meet or exceed structural requirements of AWWA D103-09std latest edition.

1. Design requirements for High Strength Hot Rolled carbon steel shall be ASTM A572 Grade 50, 55, 60 or special Titanium rich carbon steel ART310 specifically prepared for enameling application with the following mechanical properties:

Titanium (Ti) Rich Hot Rolled Carbon Steel with Min. Yield Strength of: 46.5 KSI - 50.5 KSI before firing and Min. ultimate tensile strength of 36KSI after firing.

1. Steel plates shall be mechanically rolled in factory to the required tank radius utilizing rolling machines.
2. When Rolled Structural Shapes are used, the design and engineering shall conform to minimum standards of the latest AWWA D‐103-09std.
3. **Horizontal Wind Girders/Stiffeners:** A36 or equal.
4. Web-truss design.
5. The number and size of wind girders shall be determined by the design calculations. Multiple wind girders shall be utilized as determined by the calculations permitting wind loads to distribute uniformly around the tank.
6. Wind girder shall be fabricated of steel with hot dipped galvanized coating.
7. **Bolt Fasteners: Grade 8 bolts only.**
8. Finned/4-splined Bolts or Finless Bolts Composed of Carbon Steel as follows:
9. Bolt Fasteners used in tank lap joints as follows: *½”* - 13 UNC - 2A rolled thread.

* SAE J429 Grade 8/ASTM A490/ASTM A354

**SAE J429 Grade 8**

a) Tensile Strength - 150,000 psi Min.

b) Proof Load - 120,000 psi Min.

c) Allowable shear stress with threads excluded from the shear plane: 36,818psi Min.

1. **Bolt Finish**

* JS1000 Coating/Plating System by Leland Industries or equal.

1. Bolt Head Encapsulation: By PIMCO Plastic Molding Company or equal.

* High impact polypropylene co-polymer encapsulation of entire bolt head up to the splines on the shank.
* Natural resin with UV (ultraviolet) light inhibitor (ultraviolet light resistant material).

Color: Black

1. Tank sidewall bolts shall be installed such that the head portion is located inside of the tank and washer and nut are located on the exterior.
2. All lap joint bolts shall be properly selected such that threaded portions will not be exposed in the "shear plane" between the sheets.

Also, bolt lengths shall be sized as to achieve a neat and uniform appearance.

1. Excessive threads extending beyond the nut will not be permitted.
2. **Sealants:**
3. The lap joint sealant shall be a one component, moisture cured, polyurethane based elastic sealant. For potable water storage tanks the sealant shall be suitable for contact with potable water and shall be approved by the manufacturer and certified for this use (NSF61), as an indirect additive: such as Manus Bond 75AM or Sikaflex-1a.
4. Sealant shall be used to seal lap joints and bolt connections and edge fillets for sheet notches and starter sheets. The sealant shall cure to a rubber‐like consistency, have excellent adhesion to glass coating, low shrinkage, and be suitable for interior and exterior use. Neoprene gaskets and tape type sealer shall not be used.
5. **Glass Coatings: NSF 61 and NSF372 approved**

The tank coating system shall conform solely to Section 12.4 of the latest ANSI/AWWA D103-09std.

The manufacturer shall be currently listed on NSF website ([www.nsf.org](http://www.nsf.org)) as approved and in full compliance with NSF61 and NSF372 standards.

1. **Surface Preparation and Cleaning:**

After plate fabrication and prior to application of the glass coating system, all sheets/plates shall be grit-blasted to SSPC SP-10/NACE2 (Near White Metal) on both sides.

1. **Coating Application:**

Glass coatings to be applied by Wet Spraying and must be fused-to-steel by firingin high temperature ovenat 1450°F - 1600°F.

1. **Availability of UIG Coating Systems based on the application as follows:**

System No 1: 2-Coats & 2-Burns Process: 7-18 MILS DFT

System No 2: 3-Coats & 2-Burns Process: 7-19 MILS DFT

As per AWWA D103-09 latest edition Section 12.4 Glass Coatings - Dry Film Thickness of the interior and exterior coating should be minimum 6.0 mils and should not exceed 19.0 mils DFT. In no case dry film thickness (DFT) shall exceed 20mils (500 microns).

All plates with DFT over 20mils shall be rejected.

1. **Enamel Coating Characteristics:**

* Acid and alkali resistant:
* Standard pH:3-11
* Special Request: pH:1-14
* Hardness: 6.0 (Mohs)
* Adhesion: 3,450 N/cm

1. **Available Standard Tank Colors:**

* Indigo Blue
* Olive Green
* Titanium Dioxide White

**Custom Colors:**

* Forest Green
* Desert TAN.
* Sky Blue

1. **Inspections:**

* Holiday testing per AWWA D – 103-09.
* The maximum voltage of the meter shall not exceed 67.5 volts for wet testing.
* The sponge shall be dipped in plain tap water as required to keep it uniformly damp, not soaked or dry

Visible inspection as well as Holiday Detection Test shall be performed on both sides of the glass coated plates. If any unacceptable pinholes are found they shall be repaired i.e. coated second time and Holiday Detection Test shall be performed again on the entire panel.

If upon completion of Holiday repairs still any unacceptable pinholes are found at least on one side of the panel, the entire plate shall be rejected and substituted with the one that has successfully passed Holiday Testing inspection.

1. All coated sheets shall be inspected for mil thickness (Mikrotest or equal).
2. An electrical leak detection test shall be performed on the inside surface of each panel after fabrication. Every sheet shall be 100% tested for holidays and any sheet with unacceptable discontinuity shall be rejected.
3. **Tank Foundations and Tank Floors:**
4. All steel-bottom tanks shall be supported on a concrete ringwall foundation or full slab concrete foundation.
5. All concrete-bottom tanks shall consist of a base-setting ring embedded in concrete.
6. The top of the foundation shall be a minimum of 6-inches above the finished grade.
7. Tank foundation design shall be based on the maximum allowable soil design bearing capacity as determined by the geotechnical report/soils analysis performed by a licensed geotechnical engineer. The cost of this investigation and analysis shall not be included in the bid price.

Copies of the soil report shall be provided to the bidder prior to bid date by the Owner or Project Engineer.

1. Foundation Types:
2. **Type 1. Steel-bottom tanks supported on ringwalls.**

A sand or fine stone cushion at least 3-in. (76-mm) thick shall be provided above the earthen interior under the tank bottom.

The shell to be supported on a minimum 1/ 2 in. (13 mm) thick cane-fiber joint filler meeting the requirements of ASTM D1751.

Ringwalls after grouting or before placing the cane-fiber joint filler, shall be leveled within ±1/ 8 in. in any 30-ft circumference under the shell. The levelness on the circumference shall not vary by more than ±1/ 4 in. from an established plane.

1. **Type 2. Steel-bottom tanks supported on concrete slabs**

A sand or fine stone cushion not less than 1-in. thick shall be provided between the

flat bottom and the concrete slab foundation. In lieu of a cushion, the bottom may

be supported on a minimum 1/ 2-in. (13-mm) thick cane-fiber joint filler meeting

the requirements of ASTM D1751. The tank shell shall be supported with fiber joint filler

Slabs after grouting or before placing the cane-fiber joint filler, shall be leveled within ±1/ 8 in. in any 30-ft circumference under the shell. The levelness on the circumference shall not vary by more than ±1/ 4 in. from an established plane.

1. **Type 6. Concrete-bottom tanks with embedded steel base setting ring.**

The base-setting ring shall be properly assembled and rigidly supported and attached to a concrete ringwall footing prior to placement of concrete for the curb and tank bottom (2nd pour).

Base-setting rings shall be leveled ±1/16 in. and concentric ± 1/ 4 in.

Base-setting ring shall be embedded in concrete at least 6 inches deep.

A minimum distance of 3-inches between the top of the footing and the bottom of the base-setting ring shall be provided.

The exterior curb shall have a width of minimum 8-inches.

A suitable water-sealing material, shall be installed on the interior surface of the base-setting ring, completely around the entire circumference and prior to placement of concrete for the curb and tank bottom.

The top of the sealing material shall be a minimum distance of 2 in. below the finished top of the concrete bottom.

Concrete shall be reinforced and designed in accordance with ACI 318.

Additional reinforcing steel shall be installed around the base-setting ring, as required, to control shrinkage and resist horizontal loads.

1. **Nozzles & Accessories:**

* Hot-Dip Galvanized CS.
* SS304L - Optional
* SS316L – Optional

1. **Tank Roofs:**
2. **General:**
3. Tank roofs shall be furnished by the tank manufacturer.
4. Clear-span self‐supporting aluminum geodesic dome roof type by UIG-EVERDOME or pre-approved equal.

**NOTE: Optional Roof Cover up-to 55FT in diameter:**

2:12 rafter supported Glass Fused-to-Steel CS cone

deck type without center column.

1. Roof live loads and dead loads shall be carried by tank sidewalls, without additional support.
2. **Aluminum Dome Roof**

**Design Standards:** ADM2015, AWWA D108-10std, ASCE7-10, IBC 2012.

1. Aluminum dome roofs shall be constructed of non‐corrugated, triangular aluminum panels, which are sealed and firmly clamped in an interlocking manner within a fully triangulated aluminum space truss system.
2. Dome roof shall be clear span and designed to be self-supporting from the periphery structure with primary horizontal thrust contained by an integral tension ring. Dome roof dead weight shall not exceed 3 pounds per square foot of surface area.
3. Dome roof and tank will be designed to act as an integral unit. The tank will be designed to support an aluminum dome roof including all specified live loads.

Roof Vent ‐ A properly sized atmospheric vent assembly in accordance with AWWA D103‐09 shall be furnished and installed on the roof.

The overflow pipe shall not be considered as a tank vent.

The vent to prevent the entrance of birds and/or animals by including an expanded aluminum screen.

**MATERIAL:**

All aluminum alloys shall be as defined by the Aluminum Association, ADM 2015 and published in the ALUMINUM STANDARDS AND DATA.

1. **Bolts and Fasteners:**

Bolts shall be 300 series stainless steel per ASTM F593, Alloy Group 1, UNE-EN-ISO 3506 AISI 316 (A4).

Screws shall be aluminum or 300 series stainless steel.

2. **Plates and Sheets:**

Roof panels shall be AA3000 or AA5000 series with 0.050” (1.2mm) thickness

Plate and sheet material shall be aluminum alloy, 3003-H16, 5754-H22/H24, 3105-H154, 6061-T6, 5052-H32, 5052-H36; mill finish AA - M10 as fabricated.

Tension ring gussets shall be 0.3125 inch minimum thickness.

Sheet materials shall be 0.050” (1.2mm) minimum thickness.

The aluminum closure panels shall be attached continuously along their edges to the structural members by means of batten bars which engage the panels in an interlocking joint. This batten bar shall also secure an elastomeric weather-seal gasket that shall form a continuous watertight seal along the panel edges.

3. **Structural Shapes**:

Aluminum structural shapes shall be alloy 6082-T6, AA6005A-T6, 6061-T6.

The aluminum structural members shall be a minimum of 4 ½ inches deep.

4. **Internal Columns** - 300 series stainless steel (if they are used).

5. **Miscellaneous Shapes:**

Miscellaneous aluminum shapes shall be alloy 6061-T6, 6082-T6/T651, 6063-T5.

6. **Gaskets:**

All gaskets shall be Neoprene, EPDM or Silicone. The gaskets must have a 1/8” - ¼” minimum thickness.

7. **Sealant:**

All sealants shall be silicone and resistant to ozone and ultraviolet light.

8. **Miscellaneous Penetration Seals**:

All other penetration seals shall be weatherproof rubber seals.

**NOTE:**

The entire roof structure shall be designed to sustain the loads specified herein, with the stress limitations of the Aluminum Association SPECIFICATIONS FOR ALUMINUM STRUCTURES and/or ADM2015. For members subjected to axial forces and bending moments due to load eccentricity or lateral loads, the combined member stresses shall be determined by adding the stress component due to axial load to the stress components due to bending in both the major and minor axis.

In no case shall the roof be designed for any loads less than those specified by the local building code and/or local amendments.

1. **Dead Load** – The dead load shall be defined as the weight of the structure and all permanently attached to and supported by the structure.

2. **Load Combinations** – As required per ASCE 7-10 Section 2.4.1.

3. **Temperature** - The load combinations listed above shall be considered for a temperature change of 100 degrees F below the installation temperature and 100 degrees F above the installation temperature and for a material temperature range of 40 degrees F below 0 to 160 degrees F above zero.

4. **Panel Design Load** - In addition to the above mentioned loads and load combinations, the aluminum panels shall be designed for a 250 pound load distributed over one square foot at any location and a plus or minus 60 psf load distributed over the entire area of any given panel. These loads are to be taken as acting separately from one another and not simultaneously with other design loads.

**AVAILABLE LIST OF ACCESSORIES FOR AL. DOME ROOF:**

* Access Hatch composed of AL
* Gravity vent with AL. insect screen composed of AL
* Eyebolt/Safety Pin/Painters Pin composed of SS304
* Non-Slip traction tape to the apex of the dome roof
* AL. single handrail to the apex of the dome roof
* Full or partial perimeter handrails composed of AL
* SS304 Safety Line
* Skylights
* Roof Nozzles composed of AL or SS
* Anode Hand Holes

1. **Glass-Fused-to-Steel Carbon Steel Roof**
2. Glass-Fused-to-Steel Carbon Steel roof can be provided for tanks up‐to 50FT in diameter.
3. The roof will be rafter supported 2:12 cone deck composed of glass lined panels.
4. The roof panels shall be assembled in a similar manner as sidewall panels utilizing a single component industrial grade sealant and bolting techniques to assure water tight connections or optionally gas tight assembly up to 30mbar (0.45PSI) design pressure.
5. The manufacturer will furnish a roof opening placed near the outside tank ladder and which will be provided with a hinged cover and a hasp for locking.

**2.3 TANK ACCESSORIES**

1. **Level Indicator:**
2. Manufacturer shall supply and install visual liquid level indicator on the side of the tank.
3. **Pipe Connections:**
4. Where pipe connections are shown to pass through tank panels, they shall be factory located and cut at factory prior to the application of the glass coating system.
5. The manufacturer shall utilize an interior and/or exterior flange assembly and the tank shell reinforcing as required by the project engineer and owner’s requirements.
6. A single component urethane sealer shall be applied on any cut panel penetrations or bolt connections.
7. **Access Door/Manway:**
8. Tank shall be provided with min. One (1) 24‐inch diameter manway in first (bottom) ring as shown on Contract Drawings or as per AWWA D103.
9. **Identification Plate:**
10. A manufacturer’s nameplate shall list the tank serial number, tank diameter and height, maximum design capacity, intended storage use, and date of installation. The nameplate shall be affixed to the tank exterior sidewall at a location approximately 5' from grade elevation in a position of unobstructed view.
11. **Cathodic Protection System:**
12. The manufacturer shall design and supply a passive, cathodic protection system if required.
13. **External Overflow Weir and Pipe:**
14. Overflow pipe shall be determined by the manufacturer or specified by the Engineer and shall be composed of galvanized CS sch 40 pipe or equal PVC pipe or CS epoxy coated sch 40 pipe.
15. **Roof Access Hatch:**
16. Provide min. One (1) 24‐inch x 24‐inch access hatch.
17. **Ladders:**
18. An exterior vertical caged tank ladder shall be furnished and installed as shown on the contract drawings.
19. Ladders shall be fabricated of carbon steel. Finish shall be hot dipped galvanized or epoxy coating.
20. Safety cage and step‐off platform shall be constructed of galvanized steel. A locking cage gate shall be attached to the bottom of the safety cage.
21. Depending on the application and the location of the tank, ladders could be composed of Aluminum, Stainless Steel, Fiberglass, Epoxy Coated or Galvanized Carbon Steel.

**2.4 TANK PACKAGING**

1. All sheets that pass Factory Inspection and Quality Control checks shall be protected from damage prior to packing for shipment.
2. Suitable non‐abrasive packaging sheets shall be placed between each panel to eliminate sheet‐to‐sheet abrasion during shipment.
3. Individual stacks of panels will be wrapped in heavy mil black plastic and steel banded to special wood pallets built to the roll‐radius of the tank panels. This procedure minimizes contact or movement of finished panels during shipment.

**PART 3 – EXECUTION**

**3.1 - ERECTION**

1. Except as otherwise shown or specified, Tank shall be erected in accordance with the requirements of AWWA Standard D103 latest edition and manufacturer’s recommendations and instructions.
2. Supervisory personnel of the erection crew shall identify themselves to responsible personnel of the Engineer or Inspector upon initially entering the job site.
3. **Tank Foundation:**
4. The tank foundation shall be designed by a certified PE to safely sustain the structure and its live loads.
5. Place a water‐stop seal on the inside surface of the starter ring below concrete floor line. Sika‐Swell Sealant bead approximately 6” below top of concrete on the internal and/or external surface of the starter ring could be utilized as a water stop. Install materials in accordance with tank manufacturer’s instructions as shown on the foundation plans.
6. Tank footing design shall be based on the soil bearing capacity given by the engineer.
7. **Tank Structure:**
8. Field erection of the glass‐coated, bolted‐steel structures and components shall be in strict accordance with the procedures established by manufacturer and performed by the manufacturer or an authorized dealer of the tank manufacturer regularly engaged in erection of these tanks.
9. Specialized erection jacks, and other building equipment developed and supplied by the tank manufacturer may be used to erect the tanks as well as scaffolding, wooden ladders, crane, scissor lift and/or others depending on the application and location of tank and tank site, and specific tank dimensions that would provide the best value to the tank owner or the purchaser.
10. Particular care shall be taken in handling and bolting of the glass coated steel tank panels, appurtenances and members to avoid abrasion of the coating system. Prior to liquid test, all surface areas shall be visually inspected. Chips or scrapes in the glass coating shall be repaired per the tank manufacturer's recommended procedure.
11. The placement of the sealant on each panel may be inspected prior to placement of adjacent panels. However, the inspection shall not relieve any responsibility for liquid tightness.
12. No backfill is to be placed against the tank sidewall without prior written approval of the tank manufacturer. Any backfill allowed shall be placed strictly in accordance with the instructions of the tank manufacturer.

**3.2 - FIELD TESTING**

1. Following completion of erection and cleaning of the tank, the structure shall be tested for liquid tightness by filling to its overflow elevation.
2. The erector in accordance with the manufacture’s recommendations shall correct any leaks disclosed by this test.
3. The owner shall furnish water required for testing at the time of tank erection completion, and at no charge to the manufacturer or the appointed tank erector. Disposal of test water shall be the responsibility of the owner.
4. Upon request labor, water and equipment necessary for hydrostatic tank testing shall be included in the contract price of the tank as optional.

**3.3 - DISINFECTION**

1. If required, the tank structure shall be disinfected at the time of testing by chlorination in accordance with AWWA Standard C652 “Disinfection of Water Storage Facilities” or as modified by the manufacturer or the appointed erector.
2. Disinfection shall not take place until tank sealant is fully cured.
3. Acceptable forms of chlorine for disinfection shall be:
4. Liquid chlorine as specified in AWWA C652. (Section 4.2.1).
5. Sodium hypochlorite as specified in AWWA C652. (Section 4.2.2).
6. Calcium hypochlorite (HTH) is not acceptable.
7. Acceptable methods of chlorination per AWWA C652:
8. Section 4.3.1.
9. Section 4.3.1.2 – chemical feed pump only (4.3.1.2).
10. Section 4.3.3.
11. Section 4.3.1.3 is not acceptable

**END OF SECTION**