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WATER STORAGE TANKS FOR THE SALINITY REDUCTION PROJECT

PROJECT BACKGROUND

Some of ASPA's wells have high salinity issues and need RO's to reduce salinity levels to improve water quality. For Aunu'u Island, there is not have enough fresh water supply to sustain the growing population and the freshwater source for the island is from an infiltration gallery that yields brackish water and the organic content in this water causes trihalomethane problems when mixed with chlorine that is used for water treatment. To resolve issues with limited freshwater supply in Aunuu Island, ASPA will be installing a desalination system to convert seawater to freshwater.

The Eastside of Tutuila Island also has wells that are producing high salinity water in the villages of Pago Pago, Fagaitua and Alao. To resolve the high salinity issues from these water sources, reverse osmosis systems are being procured to improve the quality of water. The desalination and reverse osmosis systems will need water storage tanks. The water storage tanks will ensure enough feedwater to supply and pressurize the units and enable efficient operation. This RFQ aims to provide feeder tanks, permeate tanks and flushing tanks for Reverse Osmosis (RO's) and Desalination systems for the Water Salinity Reduction Project.

PROJECT LOCATION & DESCRIPTIONS

Tank#	Project Locations	Liquid Stored	Tank Capacity (U.S. Gallons)	Tank Dimensions	Existing Foundation or New
1	**Pago Pago**	Brackish groundwater from a water well	100,000 (approx.)	Approximately 30 feet Ø x 20 feet height	New
2	**Aunu'u**	Seawater (Tank materials and bolts must be suitable for seawater storage)	65,000 (approx.)	Approximately 27 feet Ø x 16 feet height	New

3	**Fagaitua**	Brackish groundwater from a water well	30,000 (approx.)	Approximately 22 feet Ø x 12 feet height	New
4	**Alao**	Brackish groundwater from a water well	30,000 (approx.)	Approximately 22 feet Ø x 12 feet height	New
5	**Alao**	Permeate Water from reverse osmosis system	15,000 (approx.)	Approximately 15 feet Ø x 12 feet height	New
6	**Pago Pago**	Permeate Water for reverse osmosis system daily flushing	2000 (approx.)	Supplier to provide tank dimensions available and tank material for ASPA review and approval	New
7	**Aunu'u**	Permeate Water for reverse osmosis system daily flushing	1000 (approx.)	Supplier to provide tank dimensions available and tank material for ASPA review and approval	New
8	**Fagaitua**	Permeate Water for reverse osmosis system daily flushing	1000 (approx.)	Supplier to provide tank dimensions available and tank material for ASPA review and approval	New
9	**Alao**	Permeate Water for reverse osmosis system daily flushing	1000 (approx.)	Supplier to provide tank dimensions available and tank material for ASPA review and approval	New
Note: Tank dimensions may change during submittal approval to accommodate project area space, capacity will remain the same.					

SCOPE OF WORK

1. The supplier must provide the tank design data.
2. The roof, shell, and floor for tanks #1, 2, 3, 4 and 5 must be made of steel bolted glass fused or a similar material with corrosion protection.
3. Tank # 2 (Aunu'u 65,000 U.S Gallons) stores seawater and supplier must include in the proposal suitable tank material (bolts and fittings included) that will accommodate seawater storage.
4. The tank color should be Forest Green or another color approved by ASPA.
5. The tank foundation for Tanks #1 to 5 will be a concrete ringwall, and the tank must be anchored to the foundation.

WATER TANK COMPONENTS

To be included in the bid proposal for Tanks #1 to 5:

- 6" dia Inlet nozzle with 8" projection composed of SS304/316
- 6" dia Outlet nozzle with 8" projection composed of SS304/316
- 6" dia Exterior Overflow Nozzle with 8" projection, composed of SS304/316
- 6" dia PVC sch 40 Overflow pipe with flap valve terminated about 12" above ground
- Overflow pipe support standoff brackets, HDG CS
- 4" dia Drain Nozzle with 6" projection and blind flange, composed of SS304

- 1 – 24” diameter Manway in tank side shell first ring, composed of HDG CS
- 3/4” dia SS316 MPT, SS316 – for sampling
- Local Liquid Level Indicator Pressure Gauge Type with a 6” dia Dial and a dual display window displaying the water level in Feet of Water and PSI. All wetted parts are must be composed of SS316. Should Include SS316 needle valve and 90deg SS316 elbow.
- 20” DIA Gravity mushroom vent with insect screen composed of SS304/316
- 24” x 24” Roof Hatch composed of SS304/316
- Exterior vertical caged ladder with climb prevention, SS304/316
- 3FT x 3FT step off platform composed of SS304/316
- Partial Perimeter handrails and Toe board as per OSHA, 5FT each way, composed of SS304/316
- HDG CS or JS1000 coated Bolts and Nuts and Washers
- PP Encapsulated head bolts
- NSF 61 approved Sealant as required to compete installation
- (3-6) Grounding lugs SS304/316
- ASTM D1751 fiber board/joint filler between concrete and steel floor
- Wind Girder as required by design calculations, HDG CS
- Tank nameplate
- Anchor bolts, adhesive epoxy of anchor bolts with dispensing gun 23. HI PE stamped submittals

SPECIFICATION SECTION 13210
GLASS-FUSED-TO STEEL BOLTED STORAGE TANKS

PART 1 – GENERAL

1.1 DESCRIPTION

A. 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 described herein.

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

C. Installation shall be executed by a qualified and experienced erection crew, trained and certified by the tank manufacturer.

D. Tank structures and appurtenances shall be new and not previously used.

1.2 QUALITY ASSURANCE

A. The Supplier shall offer a factory applied Glass-Fused-to-Steel coated bolt together shop prefabricated sectional steel tank.

B. 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 AWWA D10309std. or the latest code for Bolted Steel Water Storage Tanks.

C. Design and Fabrication Criteria:

1. 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. or the latest code hereinafter AWWA D103.

2. Tanks with roofs shall be designed for roof live loads and roof dead loads.

3. Roof Live Load shall be min. **25 psf** (pounds per square foot) as per ASCE 7-16 Section
4.8.2

4. Snow Loads: The ground snow load shall be **0 psf.**

5. Structure Risk Category: **III**

6. Wind: Tank shall be designed for a basic wind speed of **200 mph** (miles per hour).

a. Importance Factor: **1.0 (Iw)**

c. Exposure Factor = **C**

7. Seismic:

Tank shall be designed for the following seismic conditions:

a. Map Spectral Response:

i. Ss = **0.55**

ii. S1 = **0.18**

b. Seismic Use Group: **II**

c. Seismic Site Class: **D**

d. Seismic Design Cat: **D**

8. Tank Foundation

Shall be designed based on the design recommendations as per project's Geo-technical report.

a. Maximum allowable soils design bearing capacity: should be as per project's Geotechnical report.

b. Site Class: as per project's Geo-technical report.

c. Frost Depth: as per project's Geo-technical report.
d. Note : Foundation design will be carried out by ASPA engineers.

9. Specific Gravity of stored media: **1.0**

10. Pressure:

Water Tanks:

Internal Design pressure Cg: **0.18**

Operating pressure - **Atmospheric (ATM)**

1.3 SUBMITTALS

A. Action Submittals:

Construction shall be governed by the Owner's drawings and specifications showing general dimensions and construction details, after written approval by the Engineer of detailed erection drawings prepared by the tank bidder. There shall be no deviation from the Owner's drawings and specifications, except upon written order from the Engineer.

Submit for approval the following:

a. Copies of detailed tank Design Drawings & Structural Calculations.

Submittals shall be sealed/stamped by a Professional Engineer licensed in the State of HI or CA
Drawings shall include all dimensions, sizes, plate thicknesses, anchorage, nozzle details, and details of all required accessories.

b. Fabrication shall not be started until submitted drawings are approved. When approved, an electronic copy of the submittal information will be returned to the tank manufacturer marked "APPROVED FOR CONSTRUCTION" and these drawings will then govern the work detailed thereon. The approval by the Engineer of the tank supplier's drawings shall be an approval relating only to their general conformity with the bidding drawings and specifications and shall not guarantee detail dimensions and quantities, which remains the tank suppliers' responsibility

B. Warranty:

If within a period of Five (5) years from date of completion the tank structure or any part thereof including tank coating system 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

A. Tanks shall be manufactured by the following manufacturer:

1. United Industries Group, Inc.
2. Preapproved equal

2.2 TANK

A. Tank Size:

1. Nominal Diameter: Refer to the table above.

2. Max. Nominal Tank Sidewall Height: Refer to the table above.

3. Design Freeboard: Refer to the table above.

4. Min. Nominal Tank Capacity: Refer to the table above..

5. Min. Usable Tank Capacity: Refer to the table above.

6. Number of Tanks: Refer to the table above.

B. Plates and Sheets:

1. Plates and sheets used in the construction of the tank shell, tank floor and tank roof shall meet or exceed structural requirements of AWWA D103std.

2. Design requirements for High Strength Hot Rolled Carbon Steel shall be ASTM A1011 Grade 50,
55, 60, 65, 70; ASTM A572 Grade 42, 50, 60, 65; or special Enamelable Titanium Rich Hot Rolled Carbon Steel SRT480, 550 that is specifically manufactured for Enameling application with the following mechanical properties:

   SRT480, 550: Titanium (Ti) Rich Hot Rolled Carbon Steel with Min. Ultimate Tensile Strength of 60KSI before firing and Min. Yield Strength of 42KSI after steel firing utilizing min. 30% reduction of steel's published yield strength as outlined by AWWA D103-19 Sections 5.3.2; 5.3.2.1 & 5.3.2.2.

3. Steel plates shall be mechanically rolled in factory to the required tank radius utilizing rolling machines.

4. When Rolled Structural Shapes are used, the design and engineering shall conform to minimum standards of the latest AWWA D.103std.

A. Material shall conform to minimum standards of ASTM A36, Q235

C. Horizontal Wind Girders/Stiffeners: A36, Q235

A. Design requirements for intermediate horizontal wind stiffeners shall be of the Web-truss design type with an extended tail creating multiple layers of stiffener, permitting wind loads to be distributed around the tank.

B. Web truss stiffeners shall be of steel with hot dipped galvanized coating.

C. Rolled steel angle stiffeners are not permitted for use as intermediate horizontal wind stiffeners.

D. 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.

E. Wind girder shall be fabricated of steel with hot dipped galvanized coating.

D. Bolt Fasteners:

A. Bolts used in tank lap joints shall be ½" - 13 UNC- 2A rolled thread, with 4-splines, and shall meet the minimum requirements of AWWA D103, Section 4.2.

B. Bolt Material 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.

e) 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.

E. Bolt Finish

o JS1000 Coating/Plating System by Leland Industries or equal. o Zinc, mechanically deposited. 2.0 mils minimum - under bolt head, on shank and threads.

F. Bolt Shank

Fully threaded Carriage Type Bolts shall not be permitted.
Bolts shall have a shank.
Threaded portion of the bolt shall not exceed 1" in length and the rest shall be unthreaded bolt shank that is positioned between the tank plates.
All lap joint bolts shall be properly selected such that threaded portions will not be exposed in the "shear plane" between the sheets.
Bolt lengths shall be sized as to achieve a neat and uniform

appearance. Excessive threads extending beyond the nut will not be

permitted. **G. Bolt Head Encapsulation:**

a. High impact polypropylene copolymer encapsulation of entire bolt head up to the shank.
b. Resin shall be stabilized with an ultraviolet light resistant material such that the color shall c. appear black.

d. The bolt head encapsulation shall be certified to meet the ANSI/NSF Standard 61 for indirect additives.

H. Sealants:

I. 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.

II. 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.

III. Sealant curing rate at 73°F and 50% RH.

Tack-free time: 6 to 8 hours.

Final cure time: 5 to 12 days.

NOTE: Neoprene gaskets and tape type sealer shall not be used.

I. Surface Preparation and Cleaning:

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

b. The surface anchor pattern shall be not less than 1.0 mil (0.001 inches).

c. All sheets shall be air blasted to remove any latent grit and then coated immediately with a rust preventative material.

J. Sheet Edge Preparation

Prior to glass slurry application all four (4) exposed rectangular continuous sheet edges for each specific sheet radii shall be mechanically rounded in profile resulting in an optimized radius and adhere to The Porcelain Enameling Institute's Technical Manual PEI-101.

All edges shall receive glass coating system approx. 5mils DFT.

K. Glass Coatings; Application And Firing.

a. The tank coating system shall conform solely to Section 12.4 of the latest ANSI/AWWA D103std.
b. The manufacturer shall be currently listed on NSF website (www.nsf.org) as approved and in full compliance with NSF61 and NSF372 standards.
c. Glass coatings to be applied by Wet Spraying and must be fused-to-steel by firing in high temperature oven at min. 1450°F - 1650°F in strict accordance with the ISO 9001 quality control procedures, including firing time, furnace humidity, and temperature control requirements.
d. The tank manufacturers coating process shall employ equipment that evenly coats the sheet surfaces and all (4) exposed sheet edges.
e. Manufacturer shall maintain and use supplementary directional spray nozzles using an automated machine process to consistently coat the sheet edge profiles per PEI 101 standard.
    i. The sheet edges shall be coated with the same Vitreous enamel glass coating system as the sheet surface.
    ii. A base coat of Nickel Oxide (NiO) primer, or a ground coat of glass frit shall contain Nickel Oxide (NiO) primer and it is to be applied to all 6 sides of the sheet.
    iii. A second coat of milled Cobalt Blue or Olive-Green glass shall be applied to both sides of the sheets.
    iv. For NSF61 potable water application a third coat of Titanium Dioxide (TiO2) reinforced glass mixture shall be applied to all interior sidewall and floor, roof sheet surfaces.
    Note: For NSF61 certified tanks the interior coating color shall be White.

f. Glass-Fused-to-Steel Coating Systems shall be min. 7-18 MILS DFT

NOTE:
As per AWWA D103-09 Section 12.4 Glass Coatings - Dry Film Thickness (DFT) 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.

g. **Glass Coating Characteristics:**

- Acid and alkali resistant pH: 6-9
- Hardness: 6.0 (Mohs)
- Adhesion: 3,450 N/cm

h. **Tank Color:**

- Interior:
  - Titanium Dioxide White

- Exterior:
  - Forest Green

i. **Inspections:**

- **Holiday testing per AWWA D103-19std**

  I. 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.
  II. Min. 1500V Dry Volt Holiday test on each panel on both sides of every panel.

  - Any sheet registering a discontinuity shall be rejected. o All inside sheet surfaces shall be holiday free.
  - Frequency of the test shall be every sheet.

  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.

- **Measurement of Glass Thickness:**

  All coated sheets shall be inspected for mil thickness (Mikrotest or equal). The thickness gage shall have a valid calibration record.

  - Interior and Exterior surfaces.
  - Glass thickness shall be measured using an electronic dry film thickness gauge (magnetic induction type or equal).
  - Frequency of the test shall be every Tenth (10^{th}) sheet.

- **Fishscale Testing:**

    - Glass coating shall be tested for fishscale by placing the full-size sheet in an oven at 400 degrees F for one hour.
    - Then the sheet will be examined for signs of fishscale.
    - Any sheets exhibiting fishscale shall be rejected and all sheets from that gauge lot will be similarly tested.
    - Frequency of this test shall be one sheet per gauge lot run minimum.

- **Adhesion Testing:**

    - Coating adhesion shall be tested in accordance with ISO 28765 Class 2 or better. Sheet face and sheet edge must meet the same glass quality test.

- **Impact Adherence Testing:**

    - The adherence of the glass coating to the steel shall be tested in accordance with ISO standards. Any sheet that has poor adherence shall be rejected.

L. Tank Foundations and Tank Floors:

1. Tank to be equipped with bolted glass-fused-to-steel floor in full compliance with ASCE 7-16.

2. All steel-bottom tanks shall be supported on a concrete ringwall foundation or full slab concrete foundation.

3. The top of the foundation shall be a minimum of 6-inches above the finished grade.

4. 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.

5. Foundation settlement:

   For Type 1 foundations the total settlement shall not exceed 2”, and the differential settlement shall not exceed 13mm per 10m (1/2” per 32’) of circumference.

   For Type 2 foundations the total settlement shall not exceed 2”, and the differential settlement shall not exceed 13mm per 10m (1/2” per 32’) of circumference.

For Type 3 foundations the total settlement shall not exceed 2”, and the differential settlement shall not exceed 13mm per 10m (1/2” per 32’) of circumference.

For Type 4 foundations the total settlement shall not exceed 2”, and the differential settlement shall not exceed 13mm per 10m (1/2” per 32’) of circumference.

For Type 5 foundations the total settlement shall not exceed 2”, and the differential settlement shall not exceed 13mm per 10m (1/2” per 32’) of circumference.

For Type 6 foundations the total settlement shall not exceed 1”, and the differential settlement between the center and edge of the tank shall not exceed 0.5”.

6. **Tank Foundation Type:**

Type 1. Steel-bottom tanks supported on ringwall.

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.

Tolerances on Concrete Foundations.

- Ringwalls and slabs, after grouting or before placing the cane-fiber joint filler, shall be level within +/- 1/8 in. (3 mm) in any 30-ft (9-m) circumference under the shell.

- The levelness on the circumference shall not vary by more than +/- ¼ in. (6 mm) from an established plane.

- The tolerance on poured concrete before grouting shall be +/-1 in. (25 mm).

7. **Finish on Concrete Foundations.**

The top portions of foundations, to a level 6 in. (150 mm) below the proposed ground level, shall be finished to a smooth form finish in compliance with ACI 301. The top corners of the foundation shall be either neatly rounded or finished with a suitable bevel. Any small holes may be troweled over with mortar as soon as possible after the forms are removed.

8. **Tolerances on anchor bolts.**

   Anchor bolt location, projection, and embedment tolerance shall be +/- 1/4 in. (6 mm). Anchor bolt plumbness tolerance shall be +/- 3 degrees from vertical.

9. **Foundation edge distance.**

   The tops of foundations shall project at least 3 in (76 mm) beyond the tank sidewall, or greater if required by design. In base-setting ring applications, the top of the foundation should project a minimum of 8 in (200 mm) beyond the tank sidewall, or greater if required by design.
   When anchor bolts are used, the foundations shall project min. 9 in. (230 mm) beyond the tank.

M. **Nozzles & Accessories:** material as per plans Standard: Hot-Dip Galvanized CS

   Optional:

   - SS304L
   - SS316L

N. **Nozzle and Manway Openings:**

   To be shop located and cut in factory, mechanically rounded prior to glass application and shall receive glass coating system on the edges approx. 5mils DFT.

O. **Roof Vent:**

   Vent - A properly sized atmospheric vent assembly in accordance with AWWA D103 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.

   When insect screening is specified, a pressure-vacuum screened vent or a separate pressure-vacuum relief mechanism shall be provided that will operate in the event that the screens frost over or become clogged with foreign material. The screens or relief mechanism shall not be damaged by the occurrence and shall return automatically to the operating position after the clogging is cleared.

P. Steel Cone Type Tank Roof:

1. General:

Tank roofs shall be furnished by the tank manufacturer.

a. Tanks under 58FT in Diameter shall be equipped with 2:12 slope, rafter & structure supported Glass-Fused-to-Steel CS Cone Decks without center column. Roof sheets must be minimum 12GA in thickness.

b. Tanks over 58FT in diameter shall be equipped with a Clear-span self-supporting aluminum geodesic dome roof type by UIG-EVERDOME or pre-approved equal. Roof live loads and dead loads shall be carried by tank sidewalls, without any additional support.

2. Aluminum Geodesic Dome Roof:

Design Standards: ADM2015, AWWA D108-19std, ASCE7-16, IBC 2018.

a. 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.

b. 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.

c. 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 D103-19 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.

3. **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.

4. **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.

5. **Internal Columns** – SS316 series stainless steel (if they are used).

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

7. **Gaskets:**
   All gaskets shall be Neoprene, EPDM or Silicone. The gaskets must have a 1/8" - ¼" thickness.

8. **Sealant:**
   All sealants shall be silicone and resistant to ozone and ultraviolet light.

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 7-16 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 60psf 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.

LIST OF ACCESSORIES FOR AL. DOME ROOF:

- 30" x 30" Roof Access Hatch composed of AL
- Min. 20" dia ATM Gravity vent with AL. insect or bird 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
- OSHA approved handrails composed of AL
- SS304 Safety Line

2.3 TANK ACCESSORIES

A. Level Indicator:

1. Manufacturer shall supply and install visual liquid level indicator type on the side of the tank (Float Type or a Pressure Gauge type).

B. Pipe Connections:

1. 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.

2. 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.

3. A single component urethane sealer shall be applied on any cut panel penetrations or bolt connections.

C. **Access Door/Manway:**

1. 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.

D. **Identification Plate:**

1. 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.

E. **Cathodic Protection System:**

1. The manufacturer shall design and supply a passive, sacrificial magnesium cathodic protection system as required.

F. **External Overflow Weir and Pipe:**

1. Overflow pipe shall be determined by the manufacturer or specified by the Engineer and shall be composed of galvanized CS sch 40 pipe, Schedule 80PVC, SS304 or DI Pipe.

G. **Roof Access Hatch:**

1. Provide min. One (1) 24_inch x 24_inch access hatch.

H. **Ladders:**

1. An exterior vertical caged tank ladder shall be furnished and installed as shown on the contract drawings and as per OSHA

2. Ladders shall be fabricated of carbon steel. Finish shall be hot dipped galvanized or SS304 as specified on the plans.

3. Safety cage and step_off platform every 20FT shall be constructed of galvanized steel. A locking cage gate shall be attached to the bottom of the safety cage, HDG CS or SS as specified on the plans.

2.4 TANK PACKAGING

A. All sheets that pass Factory Inspection and Quality Control checks shall be protected from damage prior to packing for shipment.

B. Suitable non_abrasive packaging sheets shall be placed between each panel to eliminate sheet _to_sheet abrasion during shipment.

C. 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

A. 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.

B. Supervisory personnel of the erection crew shall identify themselves to responsible personnel of the Engineer or Inspector upon initially entering the job site.

C. Tank Foundation:

1. The tank foundation shall be designed by a certified PE to safely sustain the structure and its live loads.

2. Tank footing design shall be based on the soil bearing capacity given by the geotechnical engineer or as specified in these specifications.

D. Tank Structure:

1. 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.

2. 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.

3. 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.

4. 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.

5. 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

A. Following completion of erection and cleaning of the tank, the structure shall be tested for liquid tightness by filling to its overflow elevation.

B. The erector in accordance with the manufacture’s recommendations shall correct any leaks disclosed by this test.

C. 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.

D. 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 TANK DISINFECTION

A. 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.

B. Disinfection shall not take place until tank sealant is fully cured.

C. Acceptable forms of chlorine for disinfection shall be:

1. Liquid chlorine as specified in AWWA C652. (Section 4.2.1).
2. Sodium hypochlorite as specified in AWWA C652. (Section 4.2.2).
3. Calcium hypochlorite (HTH) is not acceptable.

D. Acceptable methods of chlorination per AWWA C652:

1. Section 4.3.1.
2. Section 4.3.1.2 – chemical feed pump only (4.3.1.2).
3. Section 4.3.3.
4. Section 4.3.1.3 is not acceptable

GS-9 MIXER DESCRIPTION

1. **GS-9-120volt Mixer**:

- Maximum recommended tank volumes for moderate conditions is **3,000,000 USG.**
- This high-flow submersible mixer rests on the tank floor, with polymer pads to protect the floor.
- It is constructed of 316 stainless steel and non-corrosion polymers, and the entire mixing system is certified to NSF/ANSI Standard 61, including Annex G for lead.
- This mixer can easily be placed by the City or a contractor through any hatch with a 12" diameter minimum unobstructed clearance.
- The standard unit includes 75' of submersible cable, the tank roof junction box, throughtank fitting for the power cord, the motor pigtail & splice kit, and other items needed for an easy and smooth placement.
- The power service should be sized for 120 volts AC, 11 amps, with a 20amp circuit breaker or fuse.
- Operating footprint: 24 inches length x 10 inches width x 10 inches height.
- Shipping box size:42 inches length x15 inches width x 11 inches height. Shipping weight: 65lbs.

2. **GS Series Control Panel with SCADA Monitoring**:

- Completely assembled, Carlon NEMA 4X enclosure, Hand- Off-Auto switch, contactor for mixer control, run indicator light on exterior of door, grounding lug, 120v/1ph or 240vAC/1ph male molded plug, and locking latch for security.

- SCADA: 4-20mAmp current transducer provides analog output for motor current which allows for monitoring proper operation, and a 24 VDC relay for remote on/off control of the mixer.
- Complete panel as shipped is UL508A certified. Dimensions: 10"H x 8"W x 4"D

3. Installation:

Contractor Scope of Supply as follows:

- Place and startup of GridBee GS-9-120v mixing systems, including the junction boxes beside the hatches/vents on roof and thru-wall fittings to bring the cords into the tanks.

- Provide electrical connections from the junction boxes to the control boxes, mount the control boxes, and provide 120vAC /20amp power supplies. **Notes:**
  a) 3-conductor power cable (2-Power + 1-Ground).
  b) Supply and place all necessary conduit.
  c) Terminate conduit using flex conduit with male thread end for panel mount

- GFCI to be added at the circuit breaker panel for the mixer power source.

- Coordinate SCADA connection and integration.

4. Approved supplier:
United Industries Group Inc.
Info@unitedind.com

Tideflex Mixing System (TMS) by RedValve

RedValve Tideflex Mixing System:

The Reservoir Mixing Analysis (RMA) is to be supplied to the water utility/owner as it provides guidance on the tank turnover/fluctuation required to ensure complete mixing with the TMS installed. Maintaining water quality in tanks and reservoirs is a combination of achieving complete mixing AND tank turnover to minimize water age. It is critical to achieve complete mixing to prevent a localized increase in water age (and associated water quality problems) due to short-circuiting and dead zones.

The RMA calculates the dependent variables and uses the mixing time formula to calculate the "Theoretical Mixing Time" (MT) at various filling flow rates. The MT is the fill time required to achieve complete mixing. The required drawdown (in feet), % turnover, and the required volume exchange (in gallons) are calculated based on these mixing times. These values are shown in the

"Guide to Tank Fluctuation and Turnover" section of the RMA. A slightly greater drawdown/turnover is typically recommended to be conservative.

Within the "Guide to Tank Fluctuation and Turnover" is a "Minimum Tank Fluctuation Target". This is applicable for tanks that operate in fill-then-draw. This is the minimum amount the tank should be drawn down on the draw cycles to ensure complete mixing on the fill cycles. This data is intended to be used by operators in conjunction with SCADA and strip charts (where applicable) to verify adequate tank turnover and to determine "pump on" and "pump off" set points (where applicable). For tanks that operate in simultaneous fill and draw, the "Theoretical Mixing Time" (fill time required to achieve complete mixing) should be used to ensure the minimum fill time required is achieved.

The RMA also provides data on the time required to draw down the tank, at various draw rates, to the required level as determined by the mixing time calculations.

Note, the data provided on the required drawdown, % turnover and volume exchange are to ensure complete mixing of the tank volume to prevent water quality problems associated with short-circuiting, incomplete mixing, and increased water age. A water age evaluation of the entire distribution system may dictate greater tank turnover than provided with the RMA. As long as the actual tank turnover/fluctuation is equal to or greater than that provided with the RMA, the tank will be completely mixed.

WATER QUALITY:

Maintaining storage tank water quality is a function of:

1) Maximizing volume turnover to minimize water age. See Water Age vs. Turnover Guideline below. 2) Achieving complete mixing to avoid a localized increase in water age due to incomplete mixing and short-circuiting * The TMS design addresses #2. Consultant and/or Owner to address #1 by looking at the "operation" of the distribution system and tank in order to maximize turnover.

Minimum required per tank:

TIDEFLEX MIXING SYSTEM (TMS) PATENT NO. 7,104,279

ITEM 1:

(3) 3" TIDEFLEX VARIABLE ORIFICE INLET NOZZLES

NSF-61 Certified, EPDM Elastomer
Complete with 316 Stainless Steel Retaining Rings for Inlet Valves
Flange Drilling: ANSI 125/150#

ITEM 2:

TMS-PIPE/MANIFOLD PIPING

Length of pipe based on tank diameter.
The diameter of pipe based on the tank inlet diameter.
Pipe Material: PVC Schedule 80 Flanged and Socket Welded Manifold Pipe in approx. 9FT long Sections. PVC Schedule 80 Blind Flange
PVC Schedule 80 – 90° Elbow
PVC Schedule 80 Inlet Reducing Tees
Carbon Steel Mating Flange
PVC Schedule 80 Reducers
Various sizes and quantities of PVC Schedule 80 Van Stone Flanges
Hardware- Flanged Mounting Kit- including 316 Stainless Steel Bolts, Nuts, Washers and NSF-61 Gaskets

ITEM 3:

TMS Pipe supports:

Material SS304
Pipe supports to be provided by the tank manufacturer.
Pipe support quantities to be confirmed by RedValve.

ITEM 4:

LICENSE AGREEMENT FOR TIDEFLEX TECHNOLOGIES PATENT NO. 7,104,279

ITEM 5:

TMS-Modeling & Documentation
NSF-61 CERTIFICATION FOR ABOVE VALVES
MANIFOLD HYDRAULIC ANALYSIS, MIXING TIME AND WATER AGE ANALYSIS
COMPUTATIONAL FLUID DYNAMICS (CFD) – A "Representative" CFD Model Evaluation of the Proposed HMS System Configuration Applied within a Reservoir of Similar Geometry
COMPLETE SYSTEM INSTALLATION DRAWINGS FOR CONSTRUCTION
Pre-start up inspection: A Pre-Start Inspection of the Installed TMS System to be Performed by a Red Valve Factory Representative or a Red Valve Approved Inspector.
At a minimum submit detailed installation picture of the TMS for our visual inspection.
NOTE: TMS WILL NOT BE WARRANTIED WITHOUT INSPECTION.

ITEM 6:

If the ability to draw backwards thru the inlet pipe will be required, thus requiring WF-3 Outlet Check Valves, please let us know as adding a WF-3 Outlet Check Valves will increase the cost of the mixing system.

ITEM 7:

Approved supplier:

United Industries Group Inc.
Info@unitedind.com

END OF SECTION