SPECIFICATION FOR FACTORY COATED GLASS-FUSED-TO-STEEL BOLTED STEEL TANKS FOR WATER STORAGE

Whilst every care has been taken to ensure the accuracy of this specification through 1 September 2005, the Manufacturer shall have no liability for any loss or damage (direct, indirect, special or consequential) arising out of or in connection with this specification. This specification is subject to supplementation or change at any time without notice in the Manufacturer’s sole discretion. This specification does not constitute a representation or warranty of any kind in favour of the Customer, and the Customer’s sole warranty is that which is provided in its sales contract with the Distributor. This specification does not amend or change such sales contract in any way.

Permastore Limited
Eye, Suffolk,
IP23 7HS,
England

Tel : +44 (0) 1379 870723
Fax : +44 (0) 1379 870530
Email : sales@permastore.co.uk
SPECIFICATION FOR

FACTORY COATED GLASS-FUSED-TO-STEEL BOLTED STEEL TANKS FOR WATER STORAGE

FOREWORD

This foreword is for general information only and does not form part of the subsequent specification.

It should be noted that local agencies and standards may override the specification. Full consultation must be obtained with the relevant local agencies and standards to confirm compliance and suitability. It is a requirement when using this specification for the purchasing of tanks that the Purchaser must specify certain core information. If required the Purchaser may modify, delete or amplify sections of this specification to suit specific or localized requirements, this specification should be viewed as a template for such revisions, which should be incorporated into this specification rather than the creation of a new or revised format.

The tank foundation is a core aspect of the tank design. The foundation design is not the sole responsibility of the Manufacturer, this specification does not require the Manufacturer to be responsible for the base design unless otherwise stated by the Purchaser. A suitably qualified geotechnical engineer must establish the foundation design and the foundation specification.

Annual inspection and maintenance is crucial in order to maintain and achieve the tanks optimum design life. Regular inspection and maintenance should be carried out in accordance with the recommendations and instructions supplied by the Manufacturer.

The disinfection process is a crucial part of the tank commissioning and testing process. Strict adherence with the relevant standards and amendments to those standards as specified by the Manufacturer must be observed.

It is the responsibility of the user to ensure the suitability of this specification for compatibility with the users intended application.
CONTENTS

1. GENERAL
   1.1 Scope of work
   1.2 Definitions
   1.3 Responsibilities of Parties
   1.4 Submittal Drawings, Calculations and Specifications
   1.5 Prequalification

2. DESIGN CRITERIA
   2.1 Tank size
   2.2 Tank Capacity
   2.3 Floor Elevation
   2.4 Design Standards
   2.5 Design Loads

3. MATERIALS
   3.1 Structure Bolts
   3.2 Plates and Sheets
   3.3 Structural Shapes
   3.4 Horizontal Wind Stiffeners
   3.5 Sealant

4. GLASS COATING
   4.1 Surface Preparation
   4.2 Cleaning
   4.3 Coating
   4.4 Inspection
   4.5 Packing

5. ERECTION
   5.1 General
   5.2 Bolting and Sealants
   5.3 Coating Inspection and Repair

6. FOUNDATION DESIGN
   6.1 General
   6.2 Foundation Design Requirements
   6.3 Glass Coated Bolted Steel Floor (If Required)

7. ROOF
   7.1 Small Diameter Roofs
   7.2 Large Diameter Roofs

8. ACCESSORIES
   8.1 Inclusion and Location of Accessories
   8.2 Pipe Connections
   8.3 Outside Tank Ladder
   8.4 Shell Manholes
   8.5 Identification Plate
   8.6 Cathodic Protection

9. FIELD TESTING
   9.1 Hydrostatic Testing

10. DISINFECTION
    10.1 Disinfection Standard

11. WARRANTY
    11.1 Materials and Coating

12. REFERENCES
1 GENERAL

1.1 Scope of Work

1.1.1 Supply and erect cylindrical Glass-Fused-to-Steel bolted water storage tank(s), including foundation, tank cover, tank structure and appurtenances as shown on the Engineer's drawings and described herein.

1.1.2 All labor, materials, plant, equipment and tools, as required for the construction of the storage tank shall be included.

1.2 Definitions

1.2.1 Capacity: The net volume that may be removed from a tank filled just to the top capacity level and emptied to the bottom capacity level. The bottom capacity level if not specified by the purchaser, shall be the water level in the tank shell when the tank is emptied through the specified discharge pipe.

1.2.2 Constructor: The party that furnishes the work and materials for placement or installation. Also referred to as the bidder at tender stage.

1.2.3 Manufacturer: The party that manufactures, fabricates, or produces materials or products.

1.2.4 Purchaser: The person, company, or organization that purchases any materials or work to be performed. Also referred to as the engineer at tender stage.

1.2.5 Reservoir: A flat-bottom cylindrical tank having a shell height equal to or smaller than its diameter.

1.2.6 Standpipe: A flat-bottomed cylindrical tank having a shell height greater than its diameter.

1.2.7 Tank: A standpipe or reservoir used for water storage.

1.3 Responsibilities of Parties

1.3.1 Manufacturer's responsibility: The Manufacturer shall furnish a tank structure free of defective materials, including coatings.

1.3.2 Bidder's responsibility: The Bidder shall offer new tank structures as supplied from a Manufacturer specializing in the design, fabrication and erection of factory applied Glass-Fused-to-Steel, bolted sectional tank systems. The Manufacturer shall own and operate its own production plant, fabricate and glass coat the tank plates at one location so as to provide full quality control responsibility over product.

1.3.3 Purchaser's responsibility: The Purchaser shall allow access to the structures at the request of the Manufacturer or the Bidder for the purpose of inspection, if required.
1.4 **Submittal Drawings, Calculations and Specifications**

1.4.1 Construction shall be governed by the Owner's plans and specifications showing general dimensions and construction details, after approval by the Engineer of submittal drawings prepared by the Manufacturer. There shall be no deviation from these drawings and specifications, except upon written order or approval from the Engineer. As a minimum, the submittal drawings shall show:

1.4.1.1 Dimensions, description of materials and other pertinent information.

1.4.1.2 Joint and foundation attachment details.

1.4.1.3 Tank assembly (general arrangement drawing) with positions of appurtenances.

1.4.1.4 Details of appurtenances.

1.4.1.5 Roof details (if applicable).

1.4.1.6 Floor details (if applicable).

1.4.2 The Bidder is required to furnish, for the review and approval by the Engineer, no sets of construction drawings for all work not shown in complete detail on the bidding drawings. A complete set of structural calculations shall be provided for the tank structure and foundation. All such submissions shall be authorized by an engineer employed by the Manufacturer.

1.4.3 When approved, two sets of such prints and submittal information will be returned to the Bidder marked "APPROVED FOR CONSTRUCTION" and these drawings will then govern the scope of work detailed thereon. The approval by the Engineer of the Manufacturer's drawings shall be on approval relating only to their general conformity with the bidding drawings and specifications and shall not guarantee detailed dimensions and quantities, which remains the Bidder's responsibility.

1.4.4 The Manufacturer's standard published warranty shall be included with the submittal information.

1.4.5 The Bidder is to include the Manufacturer's standard Inspection and Maintenance Manual upon receipt of approved drawings.

1.5 **Prequalification**

1.5.1 The Engineer's selection of factory applied Glass-Fused-to-Steel bolted sectional tank construction for this facility has been based upon the design criteria, construction methods specified, and optimum coating for resistance to internal and external tank surface corrosion. Deviations from the specified design, construction or coating details shall not be permitted.

1.5.2 All standards of design, fabrication, erection, product quality and long term performance as outlined in this specification are to be adhered to with no deviation.
1.5.3 Manufacturer's wishing to pre-qualify shall submit the following to the Engineer for consideration:

1.5.3.1 Typical structure and foundation drawings.
1.5.3.2 List of tank materials, ancillary equipment and tank coating specifications.
1.5.3.3 List of five (5) tanks presently in service for a similar duty, or size and character specified herein, operating satisfactorily for a minimum of five (5) years, including reference name, location, duty and year of supply.

1.5.4 Only bids from Manufacturers who have successfully pre-qualified will be considered.

1.5.5 The Engineer shall fully consider the life time cost implications of the diverse range of tank sheet coatings and finishes available and reserves the right to evaluate all bids based on life time costs (i.e. long term operation, tank shut down time, coating and maintenance costs). Values to be used in this evaluation will be at the discretion of the Engineer, as detailed in this specification and bid tabulation form. As a minimum the Engineer shall consider such cost implications over a 30-year operational period. The Engineer will add all such costs, dependent upon the type of tank offered, to the Bidder's bid price to determine the effective low bid for purposes of making the award.

2 DESIGN CRITERIA – (Complete the spaces)

2.1 Tank Size

2.1.1 The tank shall have a nominal diameter of _______ ft (_______ m), with a nominal shell height of _______ ft (_______ m).

2.2 Tank Capacity

2.2.1 Tank capacity shall be _______ US Gallons (_______ m³) with _______ ft (_______ m) water depth.

2.3 Design Standards

2.3.1 The tank materials, design, fabrication and erection of the tank shall conform to the ‘AWWA STANDARD FOR FACTORY-COATED BOLTED STEEL TANKS FOR WATER STORAGE’ – ANSI/AWWA D103-97.

2.3.2 The Glass-Fused-to-Steel coating system shall fully conform to Section 10.4 of ANSI/AWWA D103, latest revision.

2.3.3 The tank and all materials in contact with the stored water shall be certified and listed by the National Sanitation Foundation (NSF) to meet ANSI/NSF Additives Standard 61.

2.4 Design Loads

2.4.1 Specific Gravity _______.

2.4.2 Design (guaranteed) Freeboard _______ ft (_______ m).

2.4.3 Wind speed _______ mph (_______ m/s) – AWWA D103 Standard is 100 mph (44.7 m/s).
2.4.4 Allowable Soil Bearing Capacity _______psf (_______KPa) – To be furnished in Engineer's Soils Report.

2.4.5 Roof Snow Load _______psf (_______KPa).

2.4.6 Earthquake Seismic Zone _______ - In accordance with AWWA D103, latest revision (Zones 0, 1, 2A, 2B, 3 or 4).

2.4.7 Site Amplification Factor _______ - In accordance with AWWA D103, latest revision (Soil Profiles A, B, C or D).

2.4.8 Use (Importance) Factor _______ - In accordance with AWWA D103, latest revision (Typically 1.25 unless otherwise specified).

3 MATERIALS

3.1 Structure Bolts

3.1.1 Bolts used in tank lap joints shall be ½” – 13 UNC-2A rolled thread, conforming to ASTM A325\[2\] and A490\[3\].

3.1.2 Bolt Strengths:

3.1.2.1 ASTM A325 Compliant Bolts:

3.1.2.1.1 Minimum Tensile Strength – 120,000 psi (827 MPa)

3.1.2.1.2 Minimum Proof Load – 85,000 psi (586 MPa)

3.1.2.1.3 Minimum Allowable Shear Stress with threads excluded from the shear plane – 30,000 psi (207 MPa)

3.1.2.2 ASTM A490 Compliant Bolts:

3.1.2.2.1 Minimum Tensile Strength – 150,000 psi (1034 MPa)

3.1.2.2.2 Minimum Proof Load – 120,000 psi (827 MPa)

3.1.2.2.3 Minimum Allowable Shear Stress with threads excluded from the shear plane – 37,500 psi (259 MPa)

3.1.3 Bolt finish to be hot dipped galvanized coating.

3.1.4 Bolt Head Encapsulation:

3.1.4.1 All structure bolts shall have ultraviolet resistant polypropylene encapsulation of the bolt head.

3.1.4.2 Bolt head encapsulation shall be certified to meet ANSI/NSF standard 61\[4\] for indirect additives.

3.1.5 All lap joint bolts shall be properly selected such that threaded portions of the bolts will not be exposed to the shear plane between tank sheets.

3.1.6 All bolts for the tank shell and optional Glass-Fused-to-Steel roof shall be installed such that the head portion is located inside the tank, and the nut and washer are on the exterior.

3.1.7 Bolt lengths shall be selected to achieve a neat and uniform appearance. Excessive threads extending beyond the nut after torquing will not be permitted.
3.1.8 The torque values (as set down in the Manufacturer’s Construction Guide) shall not be exceeded during tank construction.

3.1.9 All lap joint bolts shall be designed to prevent rotating during tightening.

3.2 **Plates and Sheets**

3.2.1 Plates and sheets used in the construction of tank shell, optional steel floor and optional steel roof shall comply with the minimum requirements of Section 2.4 of AWWA D103-97.

3.2.2 All steel plates and sheets shall be sourced from reputable international steel mills, and produced by a hot rolling process.

3.2.3 Raw materials delivered to the Manufacturer’s plant shall be tested/inspected to ensure compliance with the Manufacturer’s requirements for strength and chemical composition.

3.2.4 Typical Test Certificates and Certificates of Conformity shall be available for the Engineer's inspection if required. Such Certificates shall be requested at the time of issue of the Purchase Order.

3.2.5 Mild strength steel shall conform to ASTM A1011 SS Grade 33\(^5\).

3.2.6 High strength steel shall conform to ASTM A1011 Grade 55 Class 1 or ASTM A1011 Grade 60 class 1.

3.2.7 When multiple vertical bolt line sheets and plates are used, the effective net section area shall not be taken as greater than 85% of the gross area, as required by AWWA D103-97, Section 3.5.2.

3.2.8 The annealing effect created from the glass coated firing process shall be considered in determining steel ultimate and yield strengths.

3.3 **Structural Shapes**

3.3.1 Material shall conform to the minimum requirements of ASTM A36\(^6\).

3.4 **Horizontal Wind Stiffeners**

3.4.1 Where a roof is specified within the scope of supply, the top stiffener shall provide a flat, horizontal, continuous surface at tank rim level.

3.4.2 Where an open topped tank is specified within the scope of supply a variation of top stiffeners may be utilized (internal and external) to suit the specific application.

3.4.3 Wind stiffeners shall be steel, hot dipped galvanized, rolled steel angle or web truss types.

3.5 **Sealant**

3.5.1 The sealant shall be used to seal lap joints, bolt connections and sheet edges.

3.5.2 The sealant shall cure to a rubber-like consistency and have excellent adhesion to the glass coating, have low shrinkage and be suitable for interior and exterior exposure.

3.5.3 The sealant shall be a one component, moisture cured, polyurethane compound.
3.5.4 EPDM or Neoprene gaskets and tape type sealer shall not be used other than for shell access manway door.

3.5.5 The sealant shall be suitable for contact with potable water and be compliant to NSF Standard 61 for indirect additives.

4 GLASS COATING

4.1 Surface Preparation

4.1.1 Sheets shall be steel grit-blasted to a silver gray finish on both sides to remove mill scale and surface oxidation.

4.1.2 Grit blasting shall be performed to the equivalent of SSPC SP10[^7], as required by AWWA D103-97, Section 10.4.1.

4.1.3 The surface anchor pattern shall be in the range of 1.0 mil (0.02mm) to 4.0 mils (0.10mm), with a target value of 2.4 mils (0.06mm).

4.2 Cleaning

4.2.1 Immediately after fabrication and grit blasting and prior to application of the coating materials, all sheets shall be thoroughly cleaned by an alkali wash.

4.2.2 Following the alkali wash all sheets shall be rinsed in hot water containing a nitrite based rust inhibitor.

4.2.3 The rust inhibition process shall be followed by heat drying to ensure the sheets are clean and dry ready to be coated.

4.3 Coating

4.3.1 All sheets shall receive a coat of catalytic nickel oxide based pre-coat to both sides, as required by AWWA D103-97, Section 10.4.2.1. The pre-coat application weight is controlled and measured and sheets that do not meet the required specification, in accordance with the Manufacturer’s specified parameters, shall be rejected at this point.

4.3.2 All pre-coated panels shall be heat dried to ensure that a moisture free surface has been achieved before the final coating is applied.

4.3.3 A coat of cobalt rich glass slip shall be continuously applied to both sides of the sheet followed by heat drying.

4.3.4 The coated panels shall be visually inspected and sheets with spray or glass defects shall be rejected at this point.

4.3.5 The thickness of the coating system shall be measured using an electronic instrument; the instrument shall have a valid calibration record. Interior and exterior dry film coating thicknesses shall be between 6.0 mils (0.15mm) and 19.0 mils (0.48mm) as required by AWWA D103-97, Section 10.4.2.2. Sheets that are not within the Manufacturer’s specified parameters shall be rejected at this point.

4.3.6 After inspection sheets shall be fired through the furnace at approximately 1562°F (850°C) in accordance with the Manufacturer’s approved procedures and, as required by AWWA D103-97, Section 10.4.2.3.
4.3.7 Tank internal sheet color shall be as specified by the Manufacturer. Tank external sheet color shall be Blue (Munsell 5PB 2/4) or Green (Munsell 2.5GY 2/2).

4.3.8 Sample tests shall be carried out by the Manufacturer to ensure that enamel materials meet the physical properties and chemical resistance characteristics as published in the Manufacturer’s specification.

4.4 **Inspection**

4.4.1 Inspection procedures shall be carried out within the Manufacturer’s plant under ISO 9001:2000 Quality Systems\[8\].

4.4.2 **Color Measurement:**

4.4.2.1 A colorimeter shall be used to measure the external sheet surfaces. Electronic color control shall be used to ensure that allowable color uniformity is achieved within the Manufacturer’s specified parameters. Sheets of a color outside of these limits shall be rejected.

4.4.2.2 The instrument used shall have a valid calibration record and shall be regularly checked against the Manufacturer’s approved calibration standard.

4.4.2.3 Color measurement frequency shall be every 15 minutes and every color and sheet thickness change.

4.4.3 **Glass Thickness Measurement:**

4.4.3.1 Finished sheets shall be inspected for coating thickness using an approved electronic instrument suitable for a measurement range of 0 - 20.0 mils (0.50mm).

4.4.3.2 The instrument shall have a valid calibration record and shall be regularly checked against the Manufacturer’s approved calibration standard.

4.4.3.3 The thickness of the glass coating shall be maintained in the range specified in AWWA D103-97 section 10.4.2.2. Sheets that have a thickness outside of these limits shall be rejected at this point.

4.4.4 **Coating Inspection – External Surface:**

4.4.4.1 The external/non-contact surfaces of all sheets shall be inspected visually under good daylight (or equivalent lighting) for defects in the glass coating.

4.4.4.2 Any sheet having visible defects larger than 0.04" (1.0mm) shall be rejected. Any sheet having more than 3 visible lesser defects per square yard of external surface shall be rejected.

4.4.4.3 Any visible defects on the external surface of accepted sheets shall be repaired to the Manufacturer’s approved procedure.

4.4.5 **Coating Inspection – Internal Surface:**

4.4.5.1 Voltage testing shall be performed on the contact surfaces of the finished sheets in accordance with ASTM C 537 – 87 (Re-approved 2004)[9] and BS EN 14430[10]. The voltage test shall be used to identify any discontinuities in the glass contact surfaces.
4.4.5.2 Inspection shall be carried out using a sampling procedure complying with ISO 2859: Part 1\textsuperscript{[11]}.

4.4.5.3 The Tester shall have an accuracy of ±1% at the test probe and shall have a valid calibration record.

4.4.5.4 Only finished sheets with zero glass continuity defects on the contact surfaces shall be released for packing. Sheets containing any discontinuities on the contact surfaces shall be rejected.

4.4.6 Chemical Resistance Testing:

4.4.6.1 Production specimen shall be tested in accordance to the following:

- PEI Test T-21\textsuperscript{[12]}.
- Clause 9 of BS EN 14483-1:2004\textsuperscript{[13]} – Citric Acid at Room Temperature.
- Clause 10 of BS EN 14483-2:2004\textsuperscript{[14]} – Boiling Citric Acid
- Clause 13 of BS EN 14483-2:2004 – Boiling Distilled or Demineralised Water.
- Clause 9 of BS EN 14483-4:2004\textsuperscript{[15]} – Hot Sodium Hydroxide.

4.4.6.2 Chemical resistance tests shall be conducted on a monthly or annual basis in accordance to the Manufacturer’s specifications.

4.4.7 Physical Property Tests:

4.4.7.1 Adherence tests on production specimen shall be in accordance to BS EN 10209 Annex D\textsuperscript{[16]}.

4.4.7.2 Impact tests on production specimen shall be in accordance to ISO 4532\textsuperscript{[17]}.

4.4.7.3 Scratch hardness tests on production specimen shall be in accordance to EN 101\textsuperscript{[18]}.

4.4.7.4 Physical property tests shall be conducted on a monthly basis in accordance to the Manufacturer’s specifications.

4.4.8 An owner’s representative may be present during these inspection procedures at their own cost.

4.5 Packing

4.5.1 All finished sheets shall be handled within the manufacturing plant using magnetic or suction pads.

4.5.2 All approved sheets shall be protected from damage prior to packing for shipment.

4.5.3 Heavy paper sheets shall be placed between each panel to eliminate sheet-to-sheet abrasion.

4.5.4 Individual stacks of panels shall be wrapped in a specified heavy duty plastic and steel banded to special pallets built to the roll radius of the tank panels where necessary. This procedure eliminates contact movement of finished panels during shipment.
4.5.5 Transportation of finished products shall be by dedicated haulier.

5 **ERECITION**

5.1 **General**

5.1.1 Field erection of the Glass-Fused-to-Steel bolted water storage tank shall be in accordance with the procedures outlined in the Manufacturer's Construction Guide and performed by an Authorized Distributor of the Manufacturer, regularly engaged in erection of these tanks or a suitably qualified specialist sub-contract builder under the control and supervision of the Authorized Distributor.

5.1.2 Levelling of the starter ring (or first full ring) shall be required and the maximum differential elevation within the ring shall not exceed 0.11" (2.8mm), nor shall it exceed 0.04" (1.0mm) within any 3ft length (914mm).

5.1.3 Specialized erection jacks or building equipment as specified by the Manufacturer shall be used to erect the tanks.

5.1.4 No backfill or mechanical loads shall be placed on the tank side wall without prior written approval of the Manufacturer. Any backfill shall be placed according to the instructions of the Manufacturer.

5.1.5 Particular care shall be taken in handling and bolting of the tank panels, structural items and ancillaries to avoid abrasion of the coating system.

5.2 **Bolting and Sealants**

5.2.1 All bolts are to be located and tightened in accordance with the procedures outlined in the Manufacturer's Construction Guide.

5.2.2 All sealants are to be applied in accordance with the procedures outlined in the Manufacturer's Construction Guide.

5.3 **Coating Inspection and Repair**

5.3.1 All surface areas may be visually inspected by the Engineer during construction and prior to liquid tests.

5.3.2 An electrical Holiday test shall be performed on all contact surfaces of the shell plates during or following construction using a 9 volt leak detection device. Any electrical leak points found on the contact surface shall be repaired in accordance with the Manufacturer's Inspection and Maintenance Manual.

5.3.3 After completion of the tank build and liquid tests, the Engineer shall sign the Manufacturer's standard Certificate of Satisfaction issued by the Authorized Distributor.

6 **FOUNDATION DESIGN**

6.1 **General – Circle the Contract Requirement**

6.1.1 The tank foundation IS / IS NOT a part of this supply.

6.1.2 The tank shall have a CONCRETE FLOOR / GLASS COATED BOLTED STEEL FLOOR.
6.2 Foundation Design Requirements

6.2.1 The tank foundation shall be based on the soil bearing capacity as detailed in section 2.4.4 of this specification. All Earthquake factors are to be considered. Should the foundation be a part of this supply, the information required for the design is to be supplied free of charge by the Engineer prior to the bid date. All information is to be certified by a licensed Engineer.

6.2.2 The Manufacturer will provide data on the live and dead loading of the bolted water tank.

6.3 Glass Coated Bolted Steel Floor (If Required)

6.3.1 The floor shall comprise sectional Glass-Fused-to-Steel plates utilizing the same fixings and sealant as the tank shell.

6.3.2 The tank foundation is to be covered with a minimum 0.5" (13mm) layer of bituminous sand for the floor to be installed upon.

7 ROOF

7.1 Small Diameter Roofs

7.1.1 Tanks with diameters of 14ft (4269mm) to 31ft (9393 mm) shall include roofs with either radially sectioned Glass-Fused-to-Steel or Stainless Steel (grade 316) plates utilizing the same fixings and sealant as the tank shell.

7.1.2 The roof shall be free span and self-supporting.

7.1.3 The roof shall be equipped with a 24" (610mm) roof opening for inspection purposes.

7.1.4 The roof shall be air limiting and equipped with suitable venting for air displacement when the tank is filled and emptied so as not to allow an internal pressure or vacuum.

7.1.5 All venting shall be screened to prevent bird / animal entrance.

7.2 Large Diameter Roofs

7.2.1 Tanks with diameters greater than 31ft (9393mm) and up to 62ft (18897mm) shall include either a radially sectioned Glass-Fused-to-Steel roof utilizing the same fixings and sealant as the tank shell or an aluminum dome structure of interlocking construction. Tanks with diameters greater than 62ft (18897mm) shall only include an aluminum dome structure of interlocking construction.

7.2.2 The roof shall be free span and self-supporting.

7.2.3 The live loads of the roofs shall be fully considered in the tank design.

7.2.4 The roof shall be fully vented and shall include a suitably sized vent in the center so as not to allow an internal pressure or vacuum.

7.2.5 All venting shall be screened to prevent bird / animal entrance.
8 ACCESSORIES

8.1 Inclusion and Location of Accessories

8.1.1 All accessories are to be included and located as detailed on the Engineers drawings.

8.2 Pipe Connections

8.2.1 Pipe connections penetrating through the tank panels are to be pre-cut in the Manufacturer's facility.

8.2.2 Where the location of pipe connections is unconfirmed due to site restrictions or added after the opportunity to factory cut has passed, they shall be field located in accordance with the Manufacturer's Construction Guide.

8.2.3 All pipe connections through the tank shell shall utilize the same fixings and sealant as the tank shell.

8.2.4 Overflow piping shall be ________ inches (_______mm) in diameter and shall include an external overflow down pipe of ________ft (_______m) in length.

8.3 Outside Tank Ladder

8.3.1 An outside tank ladder shall be furnished and installed as detailed in the Engineer's drawings.

8.3.2 Ladders shall be manufactured in accordance to Occupational Health and Safety Administration (OSHA 29 CF3 Part 1910)[19] requirements.

8.3.3 Ladders shall have a hinged and lockable anti-climbing device if required to conform to local safety requirements.

8.4 Shell Manholes

8.4.1 One manhole shall be provided in the first ring of the tank shell as detailed in the Engineer's drawings.

8.4.2 The manhole shall be minimum 24" (610mm) in diameter up to a maximum of 31.5" (800mm) in diameter and shall be suitably reinforced.

8.4.3 The manhole shall be hinged or fitted with a davit so as to allow opening without the need for additional lifting equipment.

8.5 Identification Plate

8.5.1 The tank shall be furnished with an identification plate that is fixed to the tank shell during construction. The identification plate shall list all relevant information for the Manufacturer to trace the tank in the future (serial number, model reference, date of manufacture and project number).

8.6 Cathodic Protection

8.6.1 The tank may be supplied with a passive cathodic protection system at the request of the Engineer and as detailed in the Engineer's drawings.
FIELD TESTING

9.1 Hydrostatic Testing

9.1.1 On completion of erection, Holiday testing (as detailed in section 5.3.2) and curing of the tank sealant the tank shall be tested for liquid tightness by filling with water to the overflow elevation and being observed over a 24 hour period.

9.1.2 Any leaks identified during this test shall be corrected in accordance with the Manufacturer's recommended method.

9.1.3 Water for the hydrostatic test shall be provided by the owner at the scheduled time of sealant curing and shall be free of charge. Disposal of the water shall be the owner’s responsibility.

DISINFECTION

10.1 Disinfection Standard

10.1.1 At the time of testing the tank shall be disinfected for use by Chlorination in accordance with method 3 of ANSI/AWWA C-652-02[20], as amended by the Manufacturer.

WARRANTY

11.1 Materials and Coating

11.1.1 The Manufacturer shall provide a warranty for the tank materials and coating. This warranty shall cover against defects in material or workmanship for a period of 1 year and against manufacturing defects in the coating for a period of 5 years.

REFERENCES

1. AWWA D103-97, AWWA Standard for Factory-Coated Bolted Steel Tanks for Water Storage.
5. ASTM A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. SSPC SP10 Surface Preparation Standard.

12. PEI Test T-21 – Test for Acid Resistance of Porcelain Enamels.


