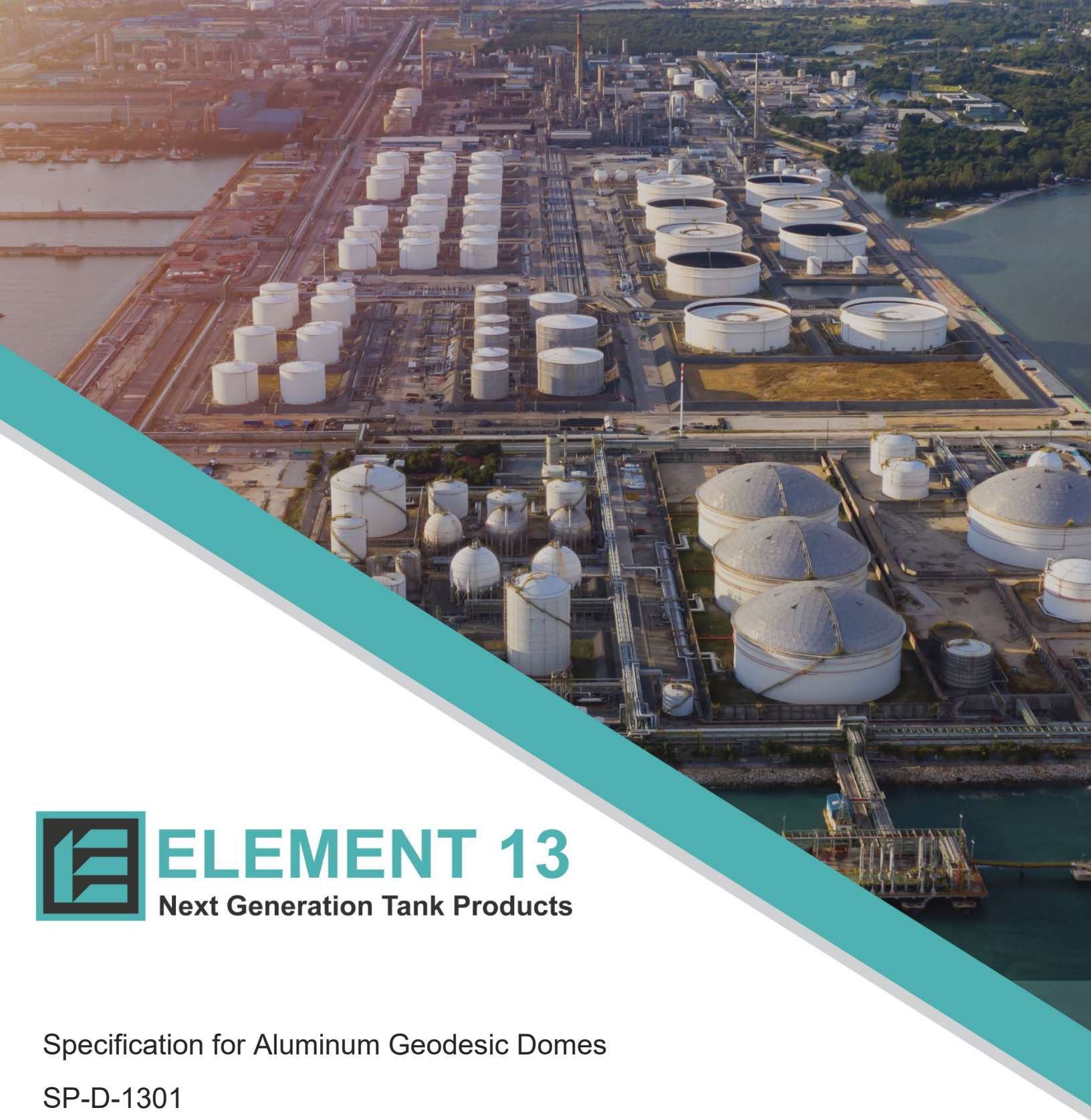

ELEMENT 13

Next Generation Tank Products

Specification for Aluminum Geodesic Domes

SP-D-1301

Rev	Date	Prepared By	Checker Approval	Operations Approval	Management Approval
D	August/2023	KHP	CAB	KRK	BEL

I. GENERAL

A. Purpose

i. This specification covers the design, fabrication, and construction of a geodesic clear span aluminum dome roof structure(s).

B. References

The following codes form part of this specification and the latest editions will govern the minimum criteria for the design, fabrication, and erection of structurally supported aluminum dome roof structure(s).

i. API 650

ii. ASCE 7 Minimum Design loads for Buildings and other Structures

iii. ASTM C509 Standard Specifications for Cellular Elastomeric Preformed Gasket Sealing Material

iv. Aluminum Association Aluminum Design Manual

v. AISI Stainless Steel Cold-Formed Structural Design Manual

vi. AWWA D-100, D-103, or API 650

vii. ASTM F 593 Standard Specification for Stainless Steel Bolts

II. SCOPE OF WORK

Element 13 (“Supplier”) shall furnish a design that includes all materials necessary to fabricate and deliver a geodesic aluminum dome roof as specified herein.

III. DESIGN

A. Materials

i. All materials furnished to meet the specifications shall adhere to all properties, alloys, and tolerances as defined in the latest edition of the Aluminum Association’s Aluminum Design Manual.

ii. Structural Members: AA6005A-T5 aluminum, AA6061-T6 aluminum, or a recognized alloy with established properties.

iii. Closure Panels: 0.050” nominal thickness, 3000 series or 5000 series

aluminum.

iv. Skylight Panels: 0.250” nominal thickness, acrylic or polycarbonate.

v. Tension Ring: AA6005A-T5 aluminum, AA6061-T6 aluminum, or a recognized alloy with established properties.

vi. Bolting Hardware: AA7075-T73 aluminum, AA2024-T4 aluminum, or series 300 stainless steel.

vii. Closure Panel Hardware: Stainless steel with a domed and gasketed washer.

viii. Anchor Bolts: Series 300 stainless steel.

ix. Sealant: Low modulus silicone or urethane compounds by an industry recognized manufacturer; Dow, Pecora, GE Silpruf, or equivalent. Sealants will remain flexible over a temperature range of -60°C to + 150°C (-80°F to +300°F) without degrading.

x. Gasket Material: Silicone unless specified otherwise for stored product compatibility.

xi. Doors, Dormers, Vents, Hatches: AA6061-T6 aluminum, AA6005A-T5 aluminum, AA3003-H14 aluminum, AA3003-H16 aluminum, or AA5052-H32 aluminum.

xii. Gusset/Node Plates: AA6061-T6 aluminum, AA6005A-T5 aluminum, or a recognized alloy with established properties.

xiii. Slide Bearing Pads: Series 300 stainless steel on Teflon.

B. Description

i. The dome structure will adhere to applicable design codes as specified herein incorporating the client’s dimensional requirements. The dome structure is a fully triangulated all-aluminum space truss. Closure panels and sidewalls shall be non-corrugated. The dome horizontal forces shall be either transferred through the outer tension ring while imparting no additional load on the supporting structure or transferred into the supporting structure through fixed supports. Provisions shall be made in the design to allow for thermal expansion of the dome and its parts over a temperature range of +/-120°F.

ii. The dome paneling is designed to be a substantially watertight system under all required design load and temperature conditions. Batten bar to roof panel gaskets shall be silicone. Roof panel designs that do not use

batten bars and an interlocking panel joint or that otherwise do not comply with The Aluminum Design Manual Part IX Section 4.1 as published by the Aluminum Association will not be considered.

iii. The structural analysis shall be performed using stiffness analysis models, which include the effect of geometric irregularities such as dormer openings, sidewalls, and perimeter support members.

iv. Connection forces shall be transferred through gusset plates connected to the top and bottom flanges of the beam-struts, with connections which are designed as moment connections. A minimum of four bolts are to be used to connect the gusset plate to each beam flange.

v. All dome fasteners should be designed with a minimum safety factor of 2.5 on ultimate strength.

vi. The vertical loads should be transferred from the roof to the tank in-line with the tank wall. The transfer of horizontal loads to the tank shall be minimized by means of low friction slide supports from both the upward and the downward forces on the tank shell. Designs which do not have a friction reducing slide which reduces horizontal force from uplift shall not be considered.

vii. Dissimilar materials shall be isolated by an insulator to prevent galvanic corrosion.

viii. Dome support legs shall be pin supported.

C. Engineering Deliverables

i. Prior to the shipment and/or installation of the dome as specified, a “For Construction” set of engineering calculations and drawings package shall be submitted to the client for review and approval. A design summary outlining the load criteria, allowable stresses, and resulting design stresses will also be submitted. The approved design and drawings package will be signed and sealed by a registered Professional Engineer.

IV. ALLOWABLE STRESSES

A. Structure

i. The structure shall be designed in accordance with the latest edition of the Aluminum Association’s Specifications for Aluminum Structures.

B. Snap Through Buckling

i. General shell buckling is considered by using either non-linear finite element analysis (FEA) with a minimum safety factor of 1.65 or a formula from an applicable code.

V. DESIGN LOADS

A. Dome Design Loads

i. The dome roof structural frame and closure panels shall be designed in accordance with the latest edition of The Aluminum Design Manual, as published by the Aluminum Association, and designed for all applicable loads.

B. Closure Panel Design Loads

i. Each aluminum panel shall be secured to the dome frame and capable of withstanding one 250-pound load distributed over one square foot at any location or 60 psf distributed over the total area of any panel.

C. Dead Loads

i. Defined as the self-weight of the dome roof which includes structural framing and all other materials attached to the structure.

D. Environmental Loads

i. Shall be as defined in the latest edition of the ASCE 7.

E. Customer Specified Loads

i. Shall be as defined in the purchase order.

VI. INSTALLATION

Skilled construction crews experienced in the assembly of aluminum domes shall perform the installation. Field re-fabrication of structural components or panels will not be accepted. Forcing of the structure to achieve fit-up during construction is expressly forbidden and not acceptable. Any indication of improper fit-up of parts shall be immediately reported to the fabricator. All sealant joints shall be tooled slightly concave after the sealant is installed. Care shall be taken to keep sealant confined to the joint in a neat manner. Any sealant applied outside of the joint shall be removed so that the panels will be free from misplaced

sealant. All gasket materials installed on batten bars shall be continuous; splices will not be allowed.

VII. WARRANTY

A. Materials and workmanship are guaranteed for a period of one (1) year from the date of material delivery. A limited structural warranty is guaranteed for a period of three (3) years from the date of material delivery. Structural defects, faulty workmanship, or defective material shall be reported to be repaired or replaced to Element 13 within 10 working days from discovery, or the suggested structural defects, faulty workmanship, or defective material shall not be subject to this warranty. Faulty workmanship of installation shall not be covered if Element 13 does not perform the installation of materials.

B. This warranty does not cover defects in any component parts or labor of the aluminum tank products which are not considered the structural components or which were not manufactured by Element 13; defects in any items or labor which are covered by a separate warranty from the original manufacturer of any part that is used by Element 13 in the structural components; deterioration due to normal wear, tear and exposure; repairs or replacements made necessary by negligence, negligent use of, misuse of, abuse of, loading the unit beyond its gross weight limitations, accidents, acts of God, modifications or alterations in or to the structural components by anyone, and failure to maintain or care for the structural components, and any and all matters which were not within the control of the Element 13; neglect of the product or structural components; repairs or replacements made necessary by reason of a failure of the original retail consumer purchaser or others to follow ordinary maintenance procedures as recommended by the Element 13 or the manufacturer or dealer of the Structural components; any defects in work, labor, materials or parts not actually manufactured by, performed by or made by Element 13; delamination caused by water intrusion from lack of required exterior seal maintenance; routine maintenance and adjustments; damage that has occurred as a result of misuse, abuse, neglect, or lack of maintenance; damage caused by unregulated water pressure, tank over-fill or plumbing system modifications resulting in flooding; damage caused by overloading or improper weight distribution.

C. If Element 13 did not perform the installation of materials, and structural defects or faulty workmanship is discovered, the Client can provide a change order for Element 13 to visit the worksite and determine the nature of faulty workmanship. Element 13 will not be responsible for repairs or additional

installation requirements at that point but will provide recommendations for repairs and the option to repair at the Client's expense.

D. Any warranty work performed will not extend the term of the original warranty period. Element 13's warranty is limited in scope and liability to repairing or redoing the nonconforming Work or materials. Element 13 shall not be obligated under warranty or otherwise to repair or replace defects caused by operating abuse, neglect, erosion, corrosion, acts of God, or other similar causes or normal wear and tear. No credit shall be allowed for any cost or expense Customer may incur in replacing or connecting materials or workmanship hereunder, unless prior written notice to Element 13 is provided and Element 13 has had the reasonable opportunity to perform and has agreed not to perform in exchange for a credit. Except as expressly provided in herein, Element 13 provides no Warranties, express or implied, of merchantability, fitness for use or otherwise.

END OF SPECIFICATION