Aluminum HC Full Contact Type Internal Floating Roofs
Technical Specifications

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1. GENERAL REQUIREMENTS

DESIGN

1.1.1 The Aluminum HC Full Contact Type Internal Floating Roof (HC IFR) is to be of the full contact type per API 650 Appendix H Section H.2.2.f. The HC IFR shall be a rigid all aluminum structure consisting of a series of factory seal welded and pressure tested, interlocking composite modules. The modules shall be arranged in a regular pattern with their edges mated and clamped in a tight metal-to-metal joint with stainless steel bolts. The edge clamping members shall develop the full strength of the composite panel. When landed, the IFR is to be supported by two position top adjustable legs or fixed-roof mounted adjustable cables located at regular intervals on the interior and around the perimeter. The annular space is to be sealed by a stainless steel mechanical shoe seal. If required, a secondary seal above the shoe seal is to be another stainless steel mechanical shoe seal or an elastomeric wiper seal. If the tank shell is of riveted construction, the annular space may be sealed with a double elastomeric vapor-mounted wiper seal in lieu of a shoe seal(s).

1.1.2 The HC IFR shall be designed, fabricated, and installed in accordance with the requirements in the latest edition of API Standard 650 "Welded Steel Tanks for Oil Storage," Appendix H "Internal Floating Roofs" and New Source Performance Standards (NSPS) for Volatile Organic Liquid Storage Vessels (40 CFR Part 60 Subpart Kb). The design of the IFR shall also meet the requirements of NFPA 11 and 30. The design shall be in accordance with either the allowable stress method (ASD) or the load resistance factor method (LRFD) of The Aluminum Association, Inc. publication “Aluminum Design Manual”.

1.1.3 The HC IFR shall be designed to safely support a live load of at least 750 pounds [340kg] over 1 square foot [929cm^2] anywhere on the IFR while it is floating on 0.70 specific gravity liquid, while maintaining excess buoyancy equal to not less than the dead weight of the IFR and without damaging the IFR or allowing product on the IFR. The IFR shall be designed to safely support a live load of at least 750 pounds [340kg] over 1 square foot [929cm^2] anywhere on the IFR when resting on its supports without damaging the IFR, its supports or the support attachments. For tanks less than 30’ [9.15 M] diameter, the floating live load criteria may be waived subject to agreement between the purchaser and the manufacturer.

1.1.4 All aluminum shall conform to the requirements of Section 2 of ASME B96.1. Stainless steel shall conform to the requirements of ASTM A 240/A 240M (austenitic type only).

FABRICATION

1.1.5 The HC IFR fabrication shall be performed by mechanics and welders skilled and experienced in aluminum IFR fabrication.

1.1.6 All welders shall be ASME certified for the welds performed.

1.1.7 All material thicknesses herein are to be "nominal" thicknesses.

1.1.8 All modules are to be prefabricated to eliminate field location, position and alignment of penetrating components

2. EQUIPMENT AND APPURTENANCES

STANDARD EQUIPMENT

2.1.1 Each HC IFR will be equipped with the following appurtenances unless specified otherwise:

- Two Position Top Adjustable Legs
- Teflon® Insulating Pads for Each Leg
- IFR Manway combination Pressure / Vacuum Relief Vent
- Automatic Tank Level Gauge Float Well
- Sampling Well and Funnel
- Anti-Rotation Systems with stainless steel cable
- Drains
- Stainless Steel Grounding Cables
- Perimeter Seal
- Stainless Steel and Aluminum Hardware

OPTIONAL EQUIPMENT

2.1.2 Each HC IFR will be equipped with one or more of the following appurtenances when specified:

- Tank Roof Support Column Well and Seal
- Internal Ladder Well and Seal
- Aluminum Landing Pad for Portable Ladder
- Multiple Position Cable Supports (In Lieu of Legs)
- Floating Suction Line and / or Floating Suction Track
- Steel Internal Ladder with or without a carbon steel Gauge Pole
- Gauge Pole (aluminum or carbon steel as specified in proposal)
- Inlet Line Diffuser
- Tank Roof Mounted Air Scoop / Vent with Hinged Inspection Hatch
- Tank Shell Mounted Overflow / Vent
- Tank Roof Center Vent with Reinforcing Pad
- Other custom accessories as required

3. IFR DESIGN

COMPOSITE MODULES

3.1.1 The HC IFR shall include buoyancy required to support at least twice its dead weight (including the weight of the seal and all other floating roof and attached components), plus additional buoyancy to offset the calculated friction exerted by peripheral and penetration seals during filling. All flotation calculations shall be based on the lower of the product specific gravity or 0.70.

3.1.2 The IFR shall be self-buoyant with an excess buoyancy of at least 100 percent and shall be capable of floating without additional damage after any two modules are punctured.

3.1.3 Each module shall consist of a composite panel, comprised of aluminum skins top and bottom glued to an aluminum perforated hexagonal core with a heat cured epoxy, welded to extruded aluminum enclosures.

3.1.4 Shop and/or field gluing of the enclosures to composite panels is prohibited.

3.1.5 The top and bottom skins shall both be 0.050" [1.27mm] thick nominal, AL 5052-H34 unless otherwise specified.

3.1.6 The enclosures shall be 6061-T6 or equivalent.

3.1.7 The composite core shall be aluminum 0.003" [.076mm] thick, regular hexagonal cells 1" [25.4mm] across the flats. The core shall be uniformly expanded and cleanly trimmed.

3.1.8 The composite panel shall have a minimum nominal thickness of 1 1/2" [38.1mm].

3.1.9 Modules shall have a nominal size of 60" [1524mm] x 120" [3048mm], except around the perimeter.

3.1.10 Each module shall have a minimum buoyant depth of 2 3/4" [69.85mm].

3.1.11 The module design shall preclude product from getting between the enclosures and the composite panel verifiable by factory pressure testing.

3.1.12 The modules shall butt together with no gap between modules.

3.1.13 The modules shall be assembled with interlocking joints and stainless steel bolts.

3.1.14 The joint bolts and nuts shall be completely above the liquid level and shall not contact the liquid under all design conditions.

Support Legs/Cable Support Systems

3.1.15 Legs shall be 2" diameter [51mm] schedule 10, 6061-T6 alloy aluminum pipe. Eccentric loading shall be considered in leg design. Leg strength shall compensate for "leaning" within the distance of one leg diameter.

3.1.16 Support cables shall be 1/4" [6.35mm] 7x19 stainless steel stranded wire rope. All eyebolts and cable clamps shall be stainless steel. Compression fittings shall be copper or tin-plated copper. To minimize emission losses, the cables shall not penetrate the IFR.

3.1.17 The cable support system shall allow for the setting to be adjusted from the topside of the fixed roof. No entry onto the IFR shall be required.

3.1.18 Each support leg or cable shall have two positions - a normal low or operating position and a high or maintenance position.

3.1.19 The low position shall provide a clearance of not less than 2" [50mm] between the underside of the IFR and the highest obstruction that would cause interference with the IFR. The high position shall provide 6' [1828mm] nominal head clearance. Cable suspended IFRs may have an increased high position elevation and/or a third position near the top of the tank.

3.1.20 The IFR shall be uniformly supported with each support supporting a maximum of 200 square feet [18.58M^2].

3.1.21 The leg sleeve assembly shall be factory seal welded into the module and pressure-tested in accordance with the HC Module Pressure Test Procedure..

3.1.22 If legs are used as supports, the bottom of each leg shall be designed to provide for drainage of product. The IFR structure is to be constructed such that it will float as well as rest on its supports in all positions in an unstressed, flat, and level condition at the elevations specified herein.

3.1.23 Aluminum support legs shall be isolated from the tank bottom with a Teflon® isolation pad.

PERIMETER SEAL

3.1.24 The peripheral rim seal shall consist of a primary seal and if required an independent secondary seal. Both seals shall seal the rim space for the full travel of the IFR and prevent the release of vapors and liquids from the rim space.

3.1.25 All seal components shall be prefabricated, including mounting holes and component sub-assembly. Their design and fabrication shall ensure that the seal is flexible and has suitable expansion and contraction available.

3.1.26 The seal(s) shall be designed to accommodate ± 4 inches [100mm] of local deviation between the IFR and the tank shell.

3.1.27 The IFR perimeter seal(s) shall be in contact with the tank shell upon installation.

3.1.28 The standard primary seal shall be mechanical shoe type with a 12 mil laminated Teflon® vapor barrier. The shoes shall extend 6" [152mm] above and 4" [102mm] below the design flotation level of the IFR. The shoes shall have stainless steel studs in lieu of holes punched in them for fasteners. The shoes shall be 304 stainless steel. The shoes shall be pressed against the tank shell with hoop type springs of 301 full-hard stainless steel that are fastened to both the IFR and the shoes. The springs shall be beneath the liquid level. The springs shall exert uniform pressure along the shoe, and shall not press on the shoe in small discrete locations.

3.1.29 If required, the secondary seal shall be a mechanical shoe seal of similar design as the primary shoe seal or a solid homogenous elastomeric wiper mounted independently on the IFR rim.

4. APPURTENANCE DESIGN

GENERAL

4.1.1 All IFR appurtenances, wells, funnels, seal plates, etc. shall be fabricated from 0.090" [2.3mm] thick minimum aluminum sheet. All IFR appurtenances shall have solid skirts that extend 6" [152mm] above the design product level.

4.1.2 Each appurtenance frame shall be factory seal-welded into the HC module and pressure-tested in accordance with the HC Module Pressure Test Procedure.

4.1.3 The upper edge of all wells shall have a product compatible gasket.

COLUMN AND LADDER WELLS

4.1.4 Vertical ftank accessories including columns, gauge poles and ladders shall penetrate the IFR through a gasketed well and shall be sealed with a factory cut sliding cover with a wiper.

4.1.5 The wells shall be sized so as to allow a minimum of 5" [127mm] clearance between the penetration and the well.

4.1.6 The cutouts in the sliding cover and wiper shall conform closely to field measurements of the column, pole or ladder.

4.1.7 Each sliding cover plate shall be bonded to the IFR through at least three 1/16" [1.6mm] 7x7 stranded stainless steel tethers securely fastened to the IFR and sliding cover plate.

4.1.8 If specified by purchaser, sleeves to reduce emission losses shall be factory installed on the sliding cover plates

VENTS

4.1.9 IFR Pressure/vacuum vent(s) shall be sized to accommodate the filling and emptying rates. Vent activation pressure and vacuum shall be based on IFR weight. The vent(s) shall seal against a closure gasket when there is no differential pressure across the vent(s). The vent(s) shall be located on the IFR manway cover plate.

4.1.10 Tank circulation vents shall be sized per API 650 Appendix H. Circulation vent area shall be net of the screens. Tank circulation vents shall be fabricated from A-36 steel, factory prime painted with red iron oxide paint

INLET LINE DIFFUSER

4.1.11 If required, an inlet line diffuser shall be designed and installed to allow full pumping rates without damaging the IFR while minimizing static build-up in the product.

4.1.12 The diffuser shall be designed to have a maximum exit velocity of 3 feet per second [1 meter per second] for the full stated pumping rate.

4.1.13 The diffuser shall be supported with at least one set of steel legs. The leg supports shall rest on 6” [152mm] diameter x 1/4" [6.4mm] thick reinforcing pads seal welded to the tank bottom. The legs shall not be welded to both the diffuser and the tank bottom.

MANWAY

4.1.14 At least one (1) manway shall be installed on each IFR. The manway shall be 28” square [181cm^2] and shall be located near a tank shell manway.

4.1.15 The manway shall have a hinged lid, sealed and bolted shut.

SAMPLE WELL & FUNNEL

4.1.16 If required, a funnel with a slit diaphragm sealed opening shall be installed on the IFR directly beneath the gauge hatch on the tank roof.

AUTOMATIC TANK GAUGE FLOAT WELL

4.1.17 The automatic tank gauge float shall be housed in a float well.

4.1.18 The float well shall have a cage extension attached to the well skirt that is field adjusted to allow the float to rest within approximately 2” [50mm] of the tank bottom.

4.1.19 The float well shall have a gasketed, bolted cover with small a gasketed hole for the passage of the gauge tape.

ANTI-ROTATION SYSTEM

4.1.20 The IFR shall be equipped with two (2) anti-rotation cable systems.

4.1.21 Each anti-rotation system shall consist of a 3/16" [4.8mm] 7x19 stranded stainless steel wire rope, carbon steel anchorages in the tank bottom and tank roof, a 302 stainless steel tension spring and stainless steel cable clamps.

4.1.22 The tank bottom anchorage shall include a reinforcing plate 6" [152mm] diameter x 1/4" [6.4mm] thick seal welded to the tank bottom.

4.1.23 The tank roof anchorage shall include a 3" [76mm] pipe nipple and cap along with a 1/2" [13mm] galvanized steel forged eyebolt.

4.1.24 The tension spring shall have a spring rate of 50 pounds per inch [0.98 kilogram per millimeter] and shall be installed with approximately 120 pounds [54kg] of tension.

4.1.25 The anti-rotation cable shall be guided through the IFR with a Nylatron bushing.

4.1.26 The cables shall be aligned to ensure that cables are actively preventing rotation, and binding will not occur between cables and IFR throughout full travel of the IFR.

ELECTRICAL GROUNDING

4.1.27 The IFR shall be equipped with at least two anti-static cable systems

4.1.28 The static cables shall be 1/16" [1.6mm] 7x7 stranded stainless steel wire rope and attachment hardware.

4.1.29 The cables shall attach to the IFR at widely separate points, evenly distributed. The cables shall not drape across IFR appurtenances.

4.1.30 Cables shall have electrically bonded connections to assure electrical continuity between the tank roof and the IFR.

4.1.31 All sliding cover plates shall be electrically grounded to the IFR through similarly bonded connections.

CONDENSATE DRAINS

4.1.32 The IFR shall be equipped with at least two (2) drains to return condensate to the product.

4.1.33 The drains shall be factory seal-welded into the HC module and pressure-tested in accordance with the HC Module Pressure Test Procedure

MATERIAL SPECIFICATION

4.1.34 Refer to attached Standard Material Specifications & Descriptions

Standard Material Specifications and Descriptions
ALLENTECH HC Full-Contact IFR
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Item	Description	Alloy
Composite Module		
Skin	60” x 120” x 0.050” thick	AL 5052-H34
Core	1” hex cell	AL3003
Skin-to-Core Adhesive	Heat cured epoxy	
Test Plug	Hex head sealing bolt 3/8” SS Nyseal	SS18-8
Structure		
Module Closure - Straight	Custom extrusion	AL6061
Module Closure – Perimeter Edge	Custom extrusion	AL6063-T52
Perimeter	Formed sheet – 0.090” thick	AL5052
Supports		
Support Legs	Pipe - 2” sch 10	AL6061
Leg Sleeve	Pipe - 2-1/2” sch 40	AL6061
Leg Sleeve Reinforcing Plates	Sheet - 0.090” thick	AL5052
Leg Insulating Pad	Custom molded	Teflon
Support Cables	Wire rope – 1/4” 7 x 19	SS304
Cable Attachment Plates	Sheet – 14 gauge	SS304
Wire Rope Thimble	Thimble – thin pattern aircraft	SS304
Wire Rope Clip	U-bolt and saddle type – ¼”	SS304
Stop – Upper	Compression sleeve – ¼”	Copper
Stop – Lower	Oval sleeve – ¼”	Tin-plated copper
Wells & Appurtenances		
Sheet for Miscellaneous Wells and Appurtenances	Formed sheet – 0.090” thick	AL5052
Gasket for Miscellaneous Wells and Appurtenances	Extruded bulb with metal insert	NBR or EPDM
Mechanical Shoe Seal		
Shoe	Formed sheet – 18 gauge	SS304
Shoe Seal Spring	Formed spring-tempered strip – 0.030” thick	SS301
Gasket	Volara, Surlyn, EPDM or as required	
Vapor Barrier	12 mil laminated	Teflon
Support Bracket	Formed sheet – 0.090” thick	AL5052
Seal Clamps	Extruded channel - .065” wall	AL6061
Wiper Seals		
Wiper Seal	12” wide closed cell wiper	Urethane
Secondary Seal Riser	6” high or 9” high custom extrusion	6” – AL6063 9” – AL6061
Seal Clamps	Custom extrusion	AL6061
Fasteners		
Bolts	¼”, 5/16”, 3/8”	SS18-8
Nuts	¼”, 5/16”, 3/8”	SS18-8/AL6061

The above are standard material specifications and may be changed to meet project specifications and/or material compatibility. All thicknesses are nominal. Subject to change without notification.