



Aluminum Pontoon Type Internal Floating Roofs Technical Specifications

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Standard Material Specifications and Descriptions
ALLENTECH Aluminum Pontoon Type IFR

1. GENERAL REQUIREMENTS

1.1 DESIGN

- 1.1.1** The aluminum pontoon type Internal Floating Roof (IFR) is to be of the non-contact type per API 650 Appendix H Section H.2.2.e. The IFR is to be an all aluminum structure consisting of a series of interconnected hollow tubular pontoons surfaced with a grid of aluminum beams and sheets. When landed, the IFR is to be supported by two position top adjustable legs or fixed-roof mounted adjustable cables located at the junctions of all main pontoons and at or near the splice of each perimeter segment. The flat surface panels are to be laid out on a supporting grid-work of beams with their edges overlapped and clamped in a vapor tight metal-to-metal joint by an extruded sheet clamp and stainless steel fasteners. 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 is to be sealed with a double elastomeric vapor-mounted wiper seal.
- 1.1.2** The 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** 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).

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1.2 FABRICATION

- 1.2.1** The IFR fabrication shall be performed by mechanics and welders skilled and experienced in aluminum IFR fabrication.
- 1.2.2** All welders shall be ASME certified for the welds performed.
- 1.2.3** All material thicknesses herein are to be “nominal” thicknesses.
- 1.2.4** All components are to be fabricated and packaged to fit through a 24” [610mm] tank shell manway.
- 1.2.5** All components are to be prefabricated to the greatest extent possible to minimize or eliminate field location, position and alignment of components

2. EQUIPMENT AND APPURTENANCES

2.1 STANDARD EQUIPMENT

- 2.1.1** Each 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
 - Gasketed Condensate Drains
 - Stainless Steel Grounding Cables
 - Perimeter Seal
 - Stainless Steel and Aluminum Hardware

2.2 OPTIONAL EQUIPMENT

- 2.2.1** Each 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)
 - Liquid and / or Vapor Fill Line Diffuser
 - Tank Roof Mounted Air Scoop / Vent with Hinged Inspection Hatch
 - Tank Shell Mounted Overflow / Vent

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- Tank Roof Center Vent with Reinforcing Pad
- Other custom accessories as required

3. IFR DESIGN

3.1 BUOYANCY

- 3.1.1** The IFR shall include buoyancy required to support at least twice its dead weight (including the weight of the flotation compartments, 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.
- 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 pontoons are punctured.
- 3.1.3** Each pontoon shall be capable of being field-inspected for the presence of combustible gas. Inspection openings shall be located above the liquid level and shall be capable of being resealed in the field after periodic inspection to prevent liquid or vapor entry. The inspection port shall be sealed with a 3/8" [9.5mm] stainless steel sealing bolt.
- 3.1.4** The IFR shall be designed and built to float and rest in a uniform horizontal plane.
- 3.1.5** All flotation calculations shall be based on the lower of the product specific gravity or 0.70.
- 3.1.6** The IFR shall be designed to safely support the design loads in API 650 Appendix H while it is floating without damaging the floating roof, without allowing product on the roof and while remaining within the Aluminum Association Guidelines for stress and strain.
- 3.1.7** IFRs for tanks less than or equal to 30' in diameter are exempt from the live load buoyancy requirements.

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3.2 STRUCTURE

- 3.2.1** The IFR and its components shall be assembled as a mechanically rigid structure such that will safely support the full dead load plus live loads as specified herein.
- 3.2.2** The pontoons shall be on 10' [3048mm] maximum centers. The surface sheeting shall be 72" [1829mm] maximum wide. The rim shall be a one-piece extrusion with minimum thickness of 0.11" [2.8mm]. The pontoon end caps shall be designed as rigid connections between main pontoons.
- 3.2.3** The IFR shall be designed to support all loads without exceeding the allowable stresses set forth in The Aluminum Association, Inc. publication "Aluminum Design Manual", causing damage to the IFR or allowing product on the IFR surface.
- 3.2.4** The minimum safety factors shall be as recommended in "Aluminum Design Manual" latest edition, as published by The Aluminum Association, Inc.
- 3.2.5** The IFR shall support a concentrated live load of two men – 500 lb [2.2 kN] - over 1 square foot [0.1 square meter] walking anywhere on the roof while it is floating or resting on its supports.
- 3.2.6** If the IFR is equipped with drains it shall support a uniform live load of 5 psf [0.24 kPa] over the IFR surface while the IFR is resting on its supports. If the IFR is not equipped with drains the IFR shall support a uniform live load of 12.5 psf [0.6 kPa] over the IFR surface while the IFR is resting on its supports.
- 3.2.7** The IFR sheets shall not contribute more than 10% to the load resistance when calculating the beam strength of sheet supports and shall not be considered when calculating the strength of the pontoons.
- 3.2.8** Deflections under load when floating or on its legs shall not exceed 1/3 of the available freeboard or 2", whichever is less.
- 3.2.9** Joints and splices shall develop the full strength of the parent members.
- 3.2.10** Compound members shall have fasteners shear planes as close as possible to the neutral axis of the combined section, not to exceed 20% of the extreme fiber distance.
- 3.2.11** The IFR shall have a rim extension around the periphery of the IFR extending into the stored product a minimum of 4 inches. All manways, column wells, gauge hatches and other IFR appurtenances except pressure / vacuum breakers also require this 4 inch minimum projection into the liquid.

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- 3.2.12** A vapor tight rim (skirt), extending at least 150 mm (6 in.) above the liquid at the design flotation level, shall be provided around both the IFR rim and around all IFR penetrations (columns, ladders, stilling wells, manways, open IFR drains, anti-rotation cables and other roof openings).
- 3.2.13** The IFR shall be continuously electrically conductive and bonded to the outer tank structure. This may be accomplished by shunts in the seal area or flexible cables from the external tank roof to the IFR.

3.3 PONTOONS

- 3.3.1** Structural pontoons and parallel auxiliary pontoons shall be 8" [203mm] or 10" [254mm] diameter. Circumferential pontoons shall be 10" [254mm] diameter. The thickness of all pontoons shall be 0.051" [1.27mm]. Pontoon end caps shall be 0.10" [2.54mm] minimum thick with 1/8" [3.2mm] gussets and brackets.
- 3.3.2** Structural pontoon end caps shall be fully welded, including all brackets and gussets. The selection of weld alloy shall take into account the alloys being joined as well as the maximum service temperature.
- 3.3.3** The pontoons shall be shop tested using air pressure at 20 psi [136kPa] and leak detection fluid. The pontoons shall be sealed with approximately 5 psi [34kPa] residual pressure left inside. The pontoon pressure test documentation shall be available at the Owner's request.
- 3.3.4** Each pontoon shall be equipped with a 3/8" [9.5mm] stainless steel sealing bolt located as far from the liquid level as possible.
- 3.3.5** All IFR structural pontoons shall be connected to the sheet support beams at every intersection of pontoon and beam with a bolted strap and extruded saddle. The main pontoons shall also be rigidly connected to the perimeter rim. Auxiliary and circumferential pontoons shall be attached to sheet support beams with bolted straps. Auxiliary and circumferential pontoons that are 10" [254mm] diameter shall also have extruded saddles at the beam connections.
- 3.3.6** The interior structural pontoons of a main row shall be designed as continuous beams. The end pontoons of each main row shall be designed as simply supported on one end and fixed at the other end.
- 3.3.7** Structural pontoons shall be at most 25' [7620mm] long. Main pontoons shall join together with (4) 3/8" [9.5mm] stainless steel bolts with a support leg or cable attachment at the joint.
- 3.3.8** Structural pontoons shall be designed with special length pontoons at both ends of the rows. Support locations shall be uniformly and symmetrically distributed throughout the IFR.

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3.4 Support Legs/Cable Support Systems

- 3.4.1** Legs shall be 2" [51mm] OD x 0.065" [1.65mm] wall thickness, 6061-T6 alloy aluminum tubing. Eccentric loading shall be considered in leg design. Leg strength shall compensate for "leaning" within the distance of one leg diameter.
- 3.4.2** 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. Connections at pontoon joints shall include an 8" [203mm] round plate with a rolled edge under the surface sheeting to protect the surface sheeting from damage. To minimize emission losses, the cables shall not penetrate the IFR.
- 3.4.3** 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.
- 3.4.4** Each support leg or cable shall have two positions - a normal low or operating position and a high or maintenance position.
- 3.4.5** The low position shall provide a clearance of not less than 2" between the underside of the IFR and the highest obstruction that would cause interference with the IFR. The high position shall provide 6' [1828mm] head clearance. Cable suspended IFRs may have an increased high position elevation and/or a third position near the top of the tank.
- 3.4.6** The IFR supports shall be attached to the IFR at joints between main pontoons and at or near joints between perimeter rim sections.
- 3.4.7** The leg sleeve assembly shall include a gasket to minimize emission losses.
- 3.4.8** Support legs shall have a low position bolt through the leg underneath the IFR.
- 3.4.9** 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.
- 3.4.10** Aluminum supports shall be isolated from the tank bottom with a Teflon® isolation pad.

3.5 SHEET BEAMS & CLAMPS

- 3.5.1** The IFR surface sheeting shall be supported by extruded beams of alloy 6061-T6. The spacing of the beams shall provide the surface sheeting with an overlap of at

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least 2" [51mm] for sheeting that is 60" [1524mm] wide and 2 1/2" [64mm] for sheeting that is 72" [1828mm] wide. The overlapped sheeting shall be clamped with extruded clamps. The clamping action shall be from two distinct raised ridges on the clamp that forces the sheeting to deform into depressed grooves on the beam.

- 3.5.2** The support beams shall be factory drilled for pontoon and splice connections.
- 3.5.3** The support beam and clamp shall act as one member to resist the design loads. The beam by itself shall be designed to resist construction loads.
- 3.5.4** Each row of beams and clamps shall have special lengths on both ends, factory cut (and angled if necessary) to suit the IFR
- 3.5.5** The beams and clamps shall have flanges to accept bolts for attachment to other IFR components.
- 3.5.6** The sheet beams shall connect to the perimeter rim via fasteners through their lower flanges.
- 3.5.7** The sheeting clamps shall extend onto the perimeter rim plate within 1" [25mm] of the rim seal
- 3.5.8** The special beams and clamps shall be factory ground to allow for the increased thickness of the perimeter rim where the beams and clamps intersect the rim plate.

3.6 PERIMETER

- 3.6.1** The outer rim of the IFR shall be a one-piece extrusion of alloy 6063-T52. Welding to the perimeter rim is not allowed.
- 3.6.2** The IFR rim shall be rolled to suit the tank size. Rims in multiple straight segments are not allowed.
- 3.6.3** The rim segments shall be 12'-6" [3810mm] long, maximum.
- 3.6.4** The rim section shall be designed to support the design loads as a curved section.

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3.7 PERIMETER SEAL

- 3.7.1** 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.
- 3.7.2** 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.
- 3.7.3** The seal(s) shall be designed to accommodate ± 4 inches [100mm] of local deviation between the IFR and the tank shell.
- 3.7.4** The IFR perimeter seal(s) shall be in contact with the tank shell upon installation.
- 3.7.5** 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.
- 3.7.6** 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

4.1 GENERAL

- 4.1.1** All IFR appurtenances, wells, funnels, seal plates, etc. shall be fabricated from 0.090" [2.3mm] thick minimum aluminum sheet. Except for pressure/vacuum vents, all IFR appurtenances shall have solid skirts that extend 6" [152mm] above and 4" [102mm] below the design product level.
- 4.1.2** Each appurtenance shall be framed underneath the surface sheeting of the IFR structure on all sides. If main beams are required to be cut for the installation of an appurtenance, the framing beams shall be designed to support the live loads specified herein per the Aluminum Design Manual.
- 4.1.3** The upper edge of all wells shall have a product compatible gasket.

4.2 COLUMN AND LADDER WELLS

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- 4.2.1 Vertical tank 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.
- 4.2.2 The wells shall be sized so as to allow 5" [127mm] clearance between the penetration and the well.
- 4.2.3 The cutouts in the sliding cover and wiper shall conform closely to field measurements of the column, pole or ladder.
- 4.2.4 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.
- 4.2.5 If required, sleeves to reduce emission losses shall be factory installed on the sliding cover plates

4.3 VENTS

- 4.3.1 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.
- 4.3.2 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

4.4 INLET LINE DIFFUSER

- 4.4.1 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.
- 4.4.2 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.
- 4.4.3 If vapors are expected in the inlet stream the diffuser shall be designed to render gas bubbles harmless to the IFR.
- 4.4.4 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.

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4.5 MANWAY

4.6 SAMPLE WELL & FUNNEL

4.6.1 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.

4.7 AUTOMATIC TANK GAUGE FLOAT WELL

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

4.7.2 The float well shall have a cage extension attached to the well skirt that is field adjusted to allow the float to rest as close to the tank bottom as feasible.

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

4.8 LADDER PAD

4.8.1 If the tank is not equipped with a vertical access ladder, a ladder pad shall be provided when specified

4.8.2 The ladder pad shall be 5' x 5' [1520mm x 1520mm] plate 0.090" [2.3mm] thick framed on all four sides and secured to two sheet clamps.

4.8.3 The ladder pad shall be field located directly beneath the tank roof manway hatch.

4.8.4 The ladder pad shall have raised edges and a raised members crossing the pad to prevent the ladder legs from slipping

4.9 ANTI-ROTATION SYSTEM

4.9.1 The IFR shall be equipped with two anti-rotation cable systems if the tank is less than 121' [36.6m] diameter, three systems for tanks greater than 121' [36.6m] and less than 201' [61.3m] and four systems for tanks greater than 201' [61.3m] diameter.

4.9.2 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.

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

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

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- 4.9.5** 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.
- 4.9.6** The anti-rotation cable shall be guided through the IFR with a Nylatron bushing.
- 4.9.7** 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.

4.10 ELECTRICAL GROUNDING

- 4.10.1** The IFR shall be equipped with at least two anti-static cable systems
- 4.10.2** The static cables shall be 1/16" [1.6mm] 7x7 stranded stainless steel wire rope and attachment hardware.
- 4.10.3** The cables shall attach to the IFR at widely separate points, evenly distributed. The cables shall not drape across IFR appurtenances.
- 4.10.4** Cables shall have electrically bonded connections to assure electrical continuity between the tank roof and the IFR.
- 4.10.5** All sliding cover plates shall be electrically grounded to the IFR through similarly bonded connections.

4.11 CONDENSATE DRAINS

- 4.11.1** The IFR shall be equipped with drains to return condensate to the product.
- 4.11.2** The drains shall be 1" [25mm] (1-1/2" [38mm] for crude oil service) tube extending 4" [102mm] into the liquid. The top of the drain tube shall be seal welded to a top plate. The top plate shall be installed from above the surface sheeting, sealed with a gasket and clamped with a plate below the surface sheeting.
- 4.11.3** Threaded fasteners shall be used to attach the drains to the IFR sheeting

4.12 MATERIAL SPECIFICATION

- 4.12.1** Refer to attached Standard Material Specifications & Descriptions

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Item	Description	Alloy
Pontoons		
Structural Pontoons	8" or 10" diameter x 0.051" wall	AL3004
Auxiliary Pontoons	8" or 10" diameter x 0.051" wall	AL3004
Circumferential Pontoons	10" diameter x 0.051" wall	AL3004
End Caps, Brackets & Gussets	0.100" thick end caps with 1/8" brackets & gussets	AL5052
Test Port	3/8" NYSEAL® Special Sealing Bolt & Nut	Bolt - SS18-8 Nut – AL2024
Structure & Sheeting		
Perimeter	Extruded - 0.11" min. thickness	AL6063
Beam & Pontoon Clips	Formed sheet - 0.090" thick	AL5052
Perimeter Splice Plates	Formed sheet - 1/8" thick	AL5052
Beams & Clamps	Extruded - 0.065" min. thickness	AL6061
Framing Beams	Extruded - 0.065" min. thickness	AL6061
Support Legs	Extruded 2" O.D. x 0.065" wall	AL6061
Leg Sleeves	Extruded - 1/8" minimum thickness	AL6063
Surface Sheeting	72" wide x 0.020" thick	AL3003
Supports		
Support Legs	Tube - 2" diameter x 0.065" wall	AL6061
Leg Sleeve	2-3/4" O.D. extruded tubing welded to custom extrusion	AL6061
Leg Insulating Pad	Custom molded	Teflon
Support Cables	Wire rope – 1/4" 7 x 19	SS304
Cable to IFR Attachment	3/8" x 3" welded eyebolt	SS18-8
Wire Rope Clip	U-bolt and saddle type – 1/4"	SS304
Stop - Upper	Compression sleeve – 1/4"	Copper
Stop – Lower	Oval sleeve – 1/4"	Tin-plated copper
Wells & Appurtenances		
Sheet for Miscellaneous Wells & Appurtenances	Formed sheet – 0.090" thick	AL5052
Gasket for Miscellaneous Wells & Appurtenances	Nitrile Rubber (NBR), Urethane and/or Cross-linked Polyethylene	Various
Mechanical Shoe Seal		
Shoe	Formed sheet - 18 gauge	SS304
Shoe Seal Springs	Formed spring-tempered strip – 0.030" thick	SS301



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Item	Description	Alloy
Gaskets	Volara, Surlyn, EPDM or as required	
Vapor Barrier	12 mil laminated	Teflon
Fabric Clamps	Extruded channel - 0.065" thick	AL6061
Wiper Seals		
Wiper Seal	12" wide closed cell wiper	Urethane
Secondary Seal Riser	6" high or 9" high extruded channel	6" - AL6063 9" - AL6061
Seal Clamps	Extruded channel - 0.065"	AL6061
Fasteners		
Bolts	1/4", 5/16" 3/8" and 1/2"	SS18-8
Nuts	1/4", 5/16" 3/8" and 1/2"	SS18-8/ AL2024
Framing Screws	#14 self-drilling	SS410
Sheet Clamping Screws	#17 sheet metal screw	SS18-8

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.