SPECIFICATIONS FOR HONEYCOMB INTERNAL FLOATING ROOFS

APPLICATION: REGULAR HYDROCARBONS

SCOPE

The roof shall be full-surface contact type designed to eliminate the presence of air-vapor mixture under the floating roof and shall meet these specifications and the intent of the latest edition of API Standard 650, Appendix H.

MATERIAL

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum Extrusions</td>
<td>Alloy 6061-T6, 6063 T6, or equal</td>
</tr>
<tr>
<td>Aluminum Panels:</td>
<td>Skin -.016&quot; to .020&quot;, Alloy 3003 H14 or equal. Core - 1&quot; ACG NP (non perforated) sealed honeycomb</td>
</tr>
<tr>
<td>Adhesive:</td>
<td>Compatible with product stored and materials joined and have an expected service life equal to the service life of the roof.</td>
</tr>
<tr>
<td>Aluminum Plate:</td>
<td>Alloy 3003 H16, 6061-T6 or equal</td>
</tr>
<tr>
<td>Stainless Steel Plate:</td>
<td>ASTM A 240, Type 304, Type 304L, Type 316, Type 316L</td>
</tr>
<tr>
<td>Aluminum Pipe:</td>
<td>Alloy 6061 T6 or equal</td>
</tr>
<tr>
<td>Seal:</td>
<td>Foam log with polyurethane foam or equal and polyurethane coated fabric, .025&quot; minimum thickness or equal. or Wiper seals or Mechanical shoe seal, stainless steel with fabric vapor barrier (polyurethane, teflon, etc).</td>
</tr>
<tr>
<td>Fasteners:</td>
<td>Austenitic stainless steel</td>
</tr>
<tr>
<td>Cables:</td>
<td>Stainless steel, Type 304</td>
</tr>
</tbody>
</table>
DESIGN

The roof and accessories shall be so designed as to allow the internal floating roof to operate throughout its normal travel without manual attention and without damage to any part of the tank or floating roof.

The roof shall be designed and built to float and rest in a reasonably horizontal pattern.

All basic components, except for the seal materials, are to be metal. For jet fuel service all metal parts in contact with the product shall be aluminum or stainless steel.

The internal floating roof shall be designed to safely support at least two men (500 pounds over one square foot) walking anywhere on the roof while the roof is floating or resting on its supports, without damaging the floating roof and without allowing product on the roof. For floating roofs less than 30 feet in diameter this criteria is reduced to 250 pounds over one square foot.

The floating roof shall be naturally buoyant and provide buoyancy to support at least twice its dead weight, plus additional buoyancy to offset the calculated friction exerted by peripheral and penetration seals, and shall not sink if punctured anywhere. Buoyancy is based on a product with a specific gravity of 0.70.

Complete electrical continuity of the floating roof and the full surface of the liquid shall be provided, with surface resistance less than 0.000725 ohms per foot DC at 70°F.

Panels shall be joined together by means of a bolted and gasketed clamp and channel members bonded to the panel edge. The joint shall transmit the design loads without failure or leakage.

SUPPORT LEGS

a. Legs to be 2-3/8" O.D. x .120" wall or equal aluminum, austenitic stainless steel or, galvanized.

b. Floating roof shall be provided with two position legs: low position 36", and high position ranging from 75" to 79 1/4" depending on material. However, the low position can be preset to other heights.

c. Changing high/low position must be accomplished from the top side of the floating roof and while the tank is in service. In addition the legs shall be completely removable from the top side of the floating roof, while in service if necessary.

d. Each leg must be capable of vertical adjustment of ± 3" in the event that the tank bottom settles after the tank is in service. Adjustment to be made from the top side of the floating roof while the tank is in service.

e. Legs and attachments to be designed to support a uniform load of 12.5 lb. per sq. ft.

f. Legs shall be self-draining (notched or perforated).
SEAL

a. The space between the outer periphery of the floating roof and the tank shell shall be sealed by primary and secondary flexible sealing devices.

b. The seals shall be flexible foam covered with coated fabric wrap, flexible wiper or mechanical shoe seal.

c. All materials used as part of the seals shall be durable in the tank's environment, abrasion resistant and shall not discolor or contaminate the liquid stored.

d. The seals shall be designed to accommodate ± 4 inches of local deviation between the floating roof and the shell.

e. Flexible seal construction shall be such that the seal can be installed, removed and replaced by hand from the top of the floating roof.

f. The primary vapor mounted seal shall function above the liquid level.

g. The secondary seal is to be installed above the primary seal.

PENETRATIONS

Columns, ladders, and other rigid vertical appurtenances that penetrate the floating roof shall have a vapor seal provided which will permit a local deviation of ± 5 inches. Appurtenances shall be plumb within a tolerance of 3 inches. Gasketed sliding cover plates, which are free to move with the appurtenance relative to the cover, shall be sized to allow the full movement without exposing product within the opening.

A rim shall be provided around the floating roof periphery and shall extend 6 inches minimum above the liquid to contain product turbulence. Columns, ladders, and other openings shall extend 6 inches above the liquid.

MANWAYS

At least one 30-inch diameter manhole shall be provided for access to and ventilation of the tank when the roof is on its supports and the tank is empty. The cover shall be gasketed and bolted closed.

GAUGING

If required the floating roof shall have an 8" diameter opening for gauging from the tank roof. The opening is to be located directly below the gauge hatch on the tank roof. On the top side of the floating roof the opening shall have a flapper type seal and a 20" diameter funnel.
AUTOMATIC TANK GAGE

If required the floating roof shall have a covered and gasketed float well for an automatic gage. The float well shall be a minimum of 24” diameter and provide sufficient clearance for the float. The gage tape shall be at least 24” in from the tank shell.

GROUNDING

The floating roof shall be electrically bonded to the tank. This shall be accomplished with flexible cables from the tank roof to the floating roof (minimum of two, uniformly distributed). They shall be 1/8-inch diameter stainless steel aircraft cable to insure strength, corrosion resistance, joint reliability, flexibility, and service life.

ANTI-ROTATION

The floating roof shall be prevented from rotation by means of two (2) or more vertical cables firmly fixed to the tank roof and bottom. The cables shall pass through a stainless steel bushing mounted in the floating roof. The cables shall be 1/4-inch diameter stainless steel aircraft type and made taut by means of a turnbuckle. All cable fittings shall be Type 304 or 316 stainless steel. A guide pole with rollers may be used as an alternative means.

VENTS

Floating Roof: A pressure/vacuum gasketed vent shall be provided on the floating roof to prevent over stressing of the floating roof or seal. This vent shall be adequate to evacuate air and gasses from underneath the roof when the roof is on its supports during filling operations. It shall also be adequate to release any vacuum generated underneath the roof after it settles on its supports during withdrawal operations. It shall not open while the roof is fully afloat due to pressure or vacuum.

Tank Shell: Peripheral circulation vents shall be located on the tank roof. The maximum spacing shall be 32 ft. but in no case shall there be less than four equally spaced vents. The total open area of these vents shall be equal to, or greater than 0.2 sq.ft. per foot of tank diameter. Vents shall be covered with rain hood and coarse screen.

Fixed Roof: An open vent shall be provided at the center or at the highest elevation of the fixed roof. It shall have a weather cover and a maximum open area of 50 sq.in. Vent opening shall be covered with a coarse screen.

EMERGENCY OVERFLOW SLOTS

The use of emergency overflow slots shall only be permitted if specified by the purchaser. If specified see API STD. 650 H.5.3.3 for details.
MATERIAL PLACEMENT

Placement of the floating roof materials into the tank shall be through an opening (provided by others), 2-foot by 6-foot in the tank fixed roof or tank shell.

TESTING

Testing for buoyancy and leaks is not required as panels are inherently buoyant with over 6,000 flotation cells per panel.

EXPERIENCE

PETREX has been installing our full surface contact aluminum honeycomb floating roofs since 1972.

WARRANTY

The internal floating roof contractor must warrant its work for a period of one year from the date of completion of its work to the extent that it will repair any defects which may appear because of faulty design, workmanship or material furnished.