

# CHOOSING THE RIGHT TANK COVER

*Tank Storage Magazine* compares the latest roofs & domes on the market

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**THE ENGINEERING** behind each component of a storage tank is meticulously planned to ensure maximum usability for the terminal operator and the workers of a terminal. Tank covers, whether a dome, a roof, or a deck – are no exception. And the style of tank cover will depend on the product being stored.

Riza Altunergil at Aager says: 'There is no single solution for tank roofs. There are different types of roofs, such as conventional steel roofs, external floating roof and dome roof, that are chosen for various parameters.' One of those factors can be the risk of the product being stored.

'Each product has its own chemical characteristics and that causes certain chemical reactions with the roof material. For instance, we recommend stainless steel or special alloys for highly corrosive chemicals,' explains Altunergil.

Jeff Eickhoff, international vice president at HMT, says: 'We strive to partner with our clients to help them select the best technology for each application, considering selection criteria such as safe installation and operation; regulatory requirements; emissions goals; durability and longevity goals; operational requirements; installation considerations;

fire suppression measures; chemical compatibility; capacity; and heel optimisation.'

## FLOATING TANK ROOFS

Internal floating roofs (IFRs) are highly popular due to their cost-effectiveness, safety credentials, and efficiency levels. They also help to minimise vapours between the roof and the liquid being stored.

'Product compatibility is critically important for floating roofs, to ensure the integrity of the floating roof over time,' says Eickhoff. 'If the floating roof is constructed from materials that are not compatible with the stored product, it can lead to premature degradation of the floating roof, including failure of buoyancy system and sinking of the floating roof.'

For example, DISCUS Engineered Products offers a solution known as the OpenRaft, a full contact aluminium IFR built to steel specs. So tank owners can get the benefits of aluminium, even if they need a steel roof.

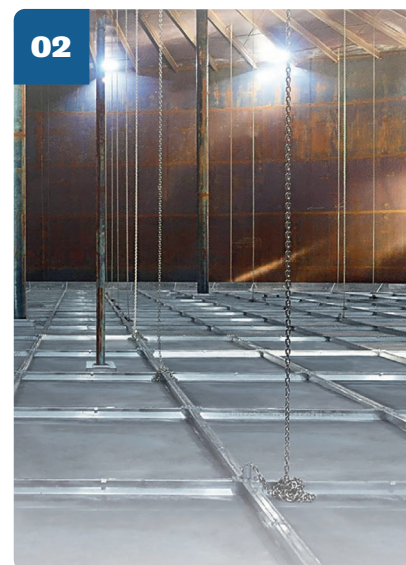
The construction process of an IFR can vary but, broadly, a company will assess your storage needs and come up with a custom design. 'This almost always

involves completion of a product-specific data sheet and can also involve one or more types of surveys, such as verticality and roundness survey or site assessment for dome construction and lifting,' says Eickhoff. This allows revisions and adjustments to be made at the design stage to ensure the best fit.

'We start with a proprietary cribbing/staging system, making the work environment safe to work underneath and on top of the IFR,' says Bill Grimes, at DISCUS. 'The OpenRaft is completely assembled and secured from underneath before workers go on top. The final stage of installation is seam testing, which can be readily achieved from the topside of the IFR.' This means workers aren't placed in perilous conditions at height.

## DOMES

Fixed roof storage tanks, or domes, typically consist of a cylindrical steel shell with a dome, or a cone-shaped roof attached to the tank shell. A pressure vacuum valve or breather valve will be installed, which allows the tank to operate at a slight internal pressure or vacuum. These tanks are also fitted with a ring of nozzles that spray foam over the surface of the tanks, in case of a fire.



A structurally supported aluminium dome roof is clear span and does not require a supporting column and a fully triangulated aluminium space truss with the struts joined at points on the surface of the sphere. Mario Strache, CEO at Elson says: 'Aluminium closure panels are firmly attached to the frame members providing watertight sealing using gaskets. The roof is attached to and supported by the tank or concrete wall at mounting points equally spaced around the perimeter of the substructure.'

'The dome protects the stored product from wind, rain, and sunlight. The IFR seals do not experience negative pressure due to wind,' Strache continues. As a result, the dome can reduce nearly all product loss due to evaporation and lowers emissions, as well as reducing the chance of lightning strike-initiated fires. 'The aluminium weighs 1/3 of the carbon steel roof. There is no corrosion, it is installed fast, and no welding is needed,' says Strache.

An arch configuration enables strong, stable structures. This is because the axial forces hold it together in a state

of equilibrium. This also applies to frictionless surfaces. As a result, arch structures require a restraint, either by using heavy side supports or members connection each end of the arch.

A geodesic dome essentially grows from the inside to out, which establishes a safer construction method for workers. By using an arch configuration, tank roof builders can ensure a strong and stable structure. Once the 'rings' are all closed, the dome can then be lifted via grip hoists or a crane to the top of the tank.

'The arch member is subjected to compressive stress under downward loads, such as snow, live, dead load, but the other member connecting the ends of the arch is subjected to tensile stress. This feature of the arch with a tensile member allows it to be a self-supporting structure. This basic principle from the 2D arch is also applied to the 3D dome structure,' says Strache.

**PRIORITISING SAFETY**

Safety is important when thinking about what roof to use on a tank. One aspect

to consider is how the roof configuration influences whether personnel are required to enter the tank in-service to adjust the roof height. 'With our floating roofs, innovations such as suspension systems allow operators to adjust the IFR position from operating height to maintenance height without putting personnel into a live tank,' says Eickhoff.

The honeycomb design of HMT's Aluminator HFC is designed to minimise welds in contact with the stored product to ensure the integrity of the roof, resulting in a safer removal process when the roof comes out of service.

'Our domes are designed to be assembled from the centre outward, keeping workers at ground level,' continues Eickhoff. This means workers are not put at risk of working at height during construction.

On top of their own best practices, tank roof suppliers and builders should adhere to the API 650 and 653 standards to show they take safety and quality seriously.

'API Standards 650 and 653 are important to establish minimum





acceptable design and maintenance standards, which ultimately prevent catastrophic failures,' says Eickhoff. 'However, they are somewhat limited in their scope of influence. For example, API Standard 650, Annex H, Section H.2.1 describes that purchasers shall consider dozens of factors such as 'both proposed and future product service, operating conditions, maintenance requirements, regulatory compliance, service life expectancy, ambient temperature, maximum design temperature, product vapour pressure, corrosion conditions and other compatibility factors'. But unfortunately, the standard doesn't explain how purchasers should consider these factors, which means that operators are left to their own experience or that of consultants or suppliers.'

Different regions also have specific regulations and expectations. 'Regional regulations and rules are a big factor in choosing the roof type,' says Altunergil. 'For instance, it is mandatory to use internal floating roofs in most of the world due to safety and environmental reasons, however weather conditions, and seismic zones are also other major factors that affect the roof design.'

This is where expertise of a competent roof company comes in. They are key to explaining how terminal operators should consider factors not covered by the standards.

### DURABILITY AND SUSTAINABILITY

An operator needs to be able to rely on their tank roof or dome for years, so that the product being stored is not at risk to outside elements or the terminal's assets and workers are not put in direct danger. There's also the risk to the environment, should a tank roof fail.

Grimes says: 'Aluminium IFRs have been around for over 50 years and life expectancy has improved as technology has improved.' Typically, an operator wants an IFR that has a useful service life of minimum 20 years before it needs

## RECENTS INSTALLATIONS

The tank roof, dome and deck markets are evolving constantly as standards develop and more sustainable options become available. With increasing concern for operator safety and minimising loss or damage to assets, a clean fuel terminal in the Port of Rotterdam approached HMT for a solution addressing these concerns.

Eickhoff explains: 'Last spring, HMT completed one of the largest dome and floating roof projects in storage tank history, a state-of-the-art clean fuels terminal in the Port of Rotterdam. This project involved the design and installation of floating roofs and domes for 54 tanks. HMT managed the complete installation of the floating roof and dome scope, and the project was completed on time and without any recordable safety incidents.'

And while it's key to follow the rules and regulations set out, Altinergil from Aager explains: 'There can be special cases, too. For instance, we built a special underground bulk tank with carbon steel roof covered with a concrete second layer to protect the tank against terrorist attacks.' This extra layer of risk protection is likely to be project-specific, but in a world that's facing hybrid threats that are both physical and through cyberwarfare, it can be crucial in an at-risk zone.

replacing, so one that can achieve over 30 or more years represents a great investment.

When the appropriate solution is implemented for the product being stored, fewer emissions and loss of product occurs. Strache says: 'The dome protects the stored product from wind, rain and sunlight. It eliminates nearly all product loss due to evaporation and lowers the emissions.' So, product is less likely to escape the tank in the form of a leak, spill, evaporation or vapours.

Using aluminium for your roof or dome can also help operators to become more sustainable. 'Aluminium is a very low corrosive product, that ensures a life expectancy of up to 100 years. It can be 100% recycled and re-used for any other application,' says Strache.

The combination of durability and sustainability can be tricky, but it is an essential balance to make. Tank roof providers and terminal operators should ask important questions, such as: what material is best? How sustainable is it?

Emissions technology is central to a sustainable tank solution. IFRs help to

contain vapours and prevent potentially harmful gases from escaping. Julie Helms of DISCUS says: 'Our mission is to provide the best available emissions control technology and we have set the standard for the lowest achievable emissions rate. As our industry progresses, the environment plays an increasingly key role in operations. Our commitment to emission control technology reflects both a personal desire for clean air, as well as a commitment to improving the planet for the wellbeing of everyone.'

### For more information:

[www.aager.de](http://www.aager.de)

[www.discusengineeredproducts.us](http://www.discusengineeredproducts.us)

[www.elsont.com](http://www.elsont.com)

[www.hmttank.com](http://www.hmttank.com)

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