



**ANGUS  
FIRE**

## Storage Tank Protection



# Investing in the safest solution

**Fire in a storage tank, or in the surrounding bund, is a challenge to both fire fighters and tank operators. The value of the contents makes the provision of fire protection commercially viable, while the risk to life makes it essential.**

The fire protection options available to tank operators and designers are wider than ever before, and the selection of the right combination of equipment can mean the difference between safe operation and disaster. Many factors influence the decision making; the type/design of atmospheric storage tanks, the layout and spacing of the tanks, the construction of the bund walls and the product stored in the tanks.

## Standards

From the fire protection perspective EN13565 Part 2 Section 6.1 and in the US, the NFPA (National Fire Protection Association) publish guidelines for tank fire protection. These classify the product stored by fire hazard and specify the foam delivery rates, layout, and spacing of foam delivery systems. Foam application rates depend on the tank contents, and start at 4 litres/m<sup>2</sup>/min typically and could rise as high as 12 litres/m<sup>2</sup>/min for foam destructive products such as Polar Solvents, where fixed foam systems are installed.

Angus Fire manufactures a wide range of fire protection products and systems, which meet international safety guidelines for the storage of petroleum products in terminals, refineries and petrochemical installations. In selecting the correct equipment to protect your specific risks, Angus Fire can support you with technical expertise from our in-house engineering and design team.

## Foam Concentrates

Firefighting foam is an essential component of all tank protection systems. Angus Fire manufactures a range of foam concentrates to suit differing application systems and tank content. These range from general purpose

foams for hydrocarbon based risks – preferably Fluoroprotein foams (FP) with their excellent heat resistant properties and slow drainage – to specialised foams for polar solvent or other water miscible risks, such as Alcohol Resistant Aqueous Film Forming Foam (AR-AFFF) or AR-FFFP (Alcohol Resistant Film Forming Fluoroprotein).

## Foam Induction

At the heart of tank protection is the choice of the foam induction proportioning system, or in other words, mixing the foam and water in the correct proportions. The foam delivery device, such as a Top Pourer or a Rimseal Pourer, dictates the amount of foam solution required. For systems where the foam solution demand is constant, fixed inline inductors can be used. For systems with variable foam solution demand, two options are available, either balanced pressure foam proportioner(s) with a bag tank, or balanced pressure proportioner(s) with a balanced valve on a foam skid. Foam Skids can be powered by water, electric or diesel driven motor foam pumps. Single or multiple skids can be sized to feed all the foam system on the site. Thus foam skids (and water deluge skids) are bespoke items which are not readily available off the shelf.

## Approvals

The engineering and design of foam skids and entire fire systems is a service provided by Angus Fire Engineering (AFE). AFE's team of dedicated engineers are specialists in systems design for high value, high risk applications. They are familiar with the details of the international standards that are specified by most insurance companies and major international oil companies. However, the system design is no good if the equipment connected to it (top pourers, rim seal pourers etc.) does not perform to specification. To overcome this, many insurers and operators insist that the equipment is approved by an independent body. Angus Fire manufactures products certified by international organisations such as UL (Underwriters Laboratory) in the US, and in Europe test protocols such as LASTFIRE.

UL is the most widely recognised approvals body that tests both the foam concentrate together with the delivery equipment that it will be used with, making it a true 'systems' approval.

## Angus Fire

As a world leader in fire protection, with a track record of over 220 years and operations in more than 100 countries around the world, Angus Fire remains at the forefront of the design of cutting-edge fire equipment products that meet the most stringent standards and are approved by key industry approval bodies. An important part of our range is equipment to protect fuel storage Depots and Terminals. Angus Fire manufactures both the equipment and the foam concentrate needed to protect these high risk assets. Almost uniquely amongst Fire Protection companies, Angus Fire has the ability to design and engineer the systems most commonly used for tank protection. As a result we are well placed to guide our customers through the myriad of equipment available for these applications.

*Angus Fire – protecting Lives, the Environment and Critical Assets*

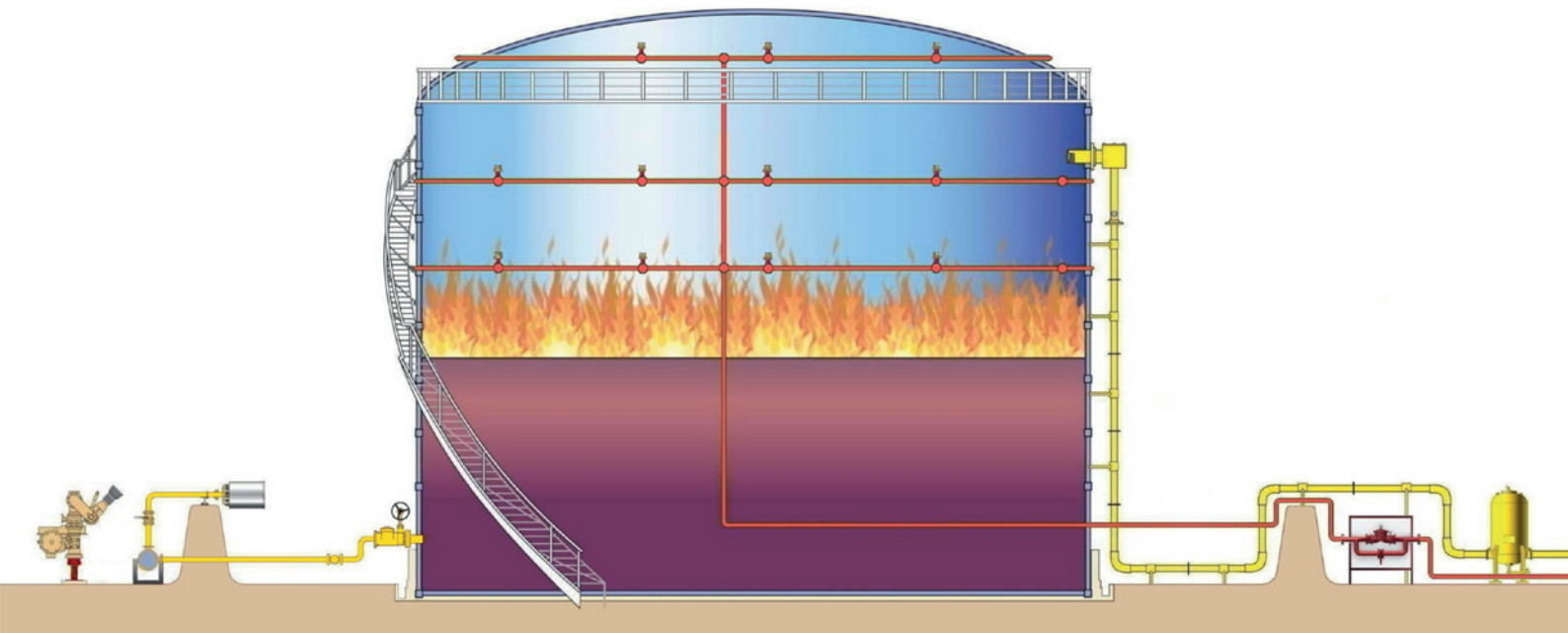




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# Fixed Roof Tank



Fixed/cone roof tanks are used to store hydrocarbon or polar solvents fuels with vapour pressures close to atmospheric. They are usually designed to have a weak seam between the shell and the roof to allow the roof to blow off in the event of a major catastrophe. Some fixed roof tanks feature an inert gas blanket to minimize the risk of fire in the vapour space. In fixed roof storage tanks fires commonly start as a result of over filling the tank.

## Foam System

Fixed roof storage tanks are protected using Top Pouring Systems designed to apply foam gently through the tank wall onto the burning surface of the fuel. Gentle application is preferred to maximise the efficiency of the finished foam. The Angus Fire Top Pourer features a unique butterfly nozzle that is designed to throw the foam back onto the tank wall. One of the most important requirements is that the selected Top Pourer can be easily accessed for maintenance and testing. The Angus Fire Top Pourer features an easily accessible pivoting top cover to allow the system to be tested and samples taken, without discharging foam into the tank.

For pressurised tanks Angus Fire manufactures a specific range of Top Pourers to protect tanks that are pressurised in this way. Other fixed roof tanks have internal blankets to suppress the release of vapours and depending on the type of blanket the firefighting system can be designed in the same way as for a floating roof tank.

To protect fixed roof tanks for aviation depots base injection is often preferred. High

Back Pressure Generators are used to inject expanded foam through the bottom of the tank. As they are located at ground level base injection systems are easy to maintain. The Angus HBPG is able to operate against a back pressure of 45%.

## Water Cooling

Provision should be made for the application of cooling water to fixed roof tanks, to minimise the effect of radiated heat. For the roof itself Angus offers a Mushroom Nozzle and the tank walls can be cooled with the Angus Fire Tank Cool Nozzle. Oscillating Monitors can be used to provide additional cooling to the tank surface.

The Angus Fire OM80 monitor is an automatic oscillating unit – which means it uses a small amount of the water from the fire ring mains, which is converted from rotational energy into a horizontal sweeping action, moving the monitor from side to side through 120 Degrees. The graphic shows an OM80 monitor fitted with a jet spray nozzle. Other options could be a Gearing or a Lever Operated Monitor as pictured elsewhere.

## Bund Protection

Bund protection equipment is often neglected as the focus is mostly on the tank itself. However a fire in the bund area resulting from a leaking tank, valve or a fractured pipe can equally result in a major incident. A medium expansion foam system to protect the bund can provide both vapour suppression and firefighting. The Angus MEX Bund Pourers are designed specifically for this risk using medium expansion foam. They operate at low pressure with minimal water demand.

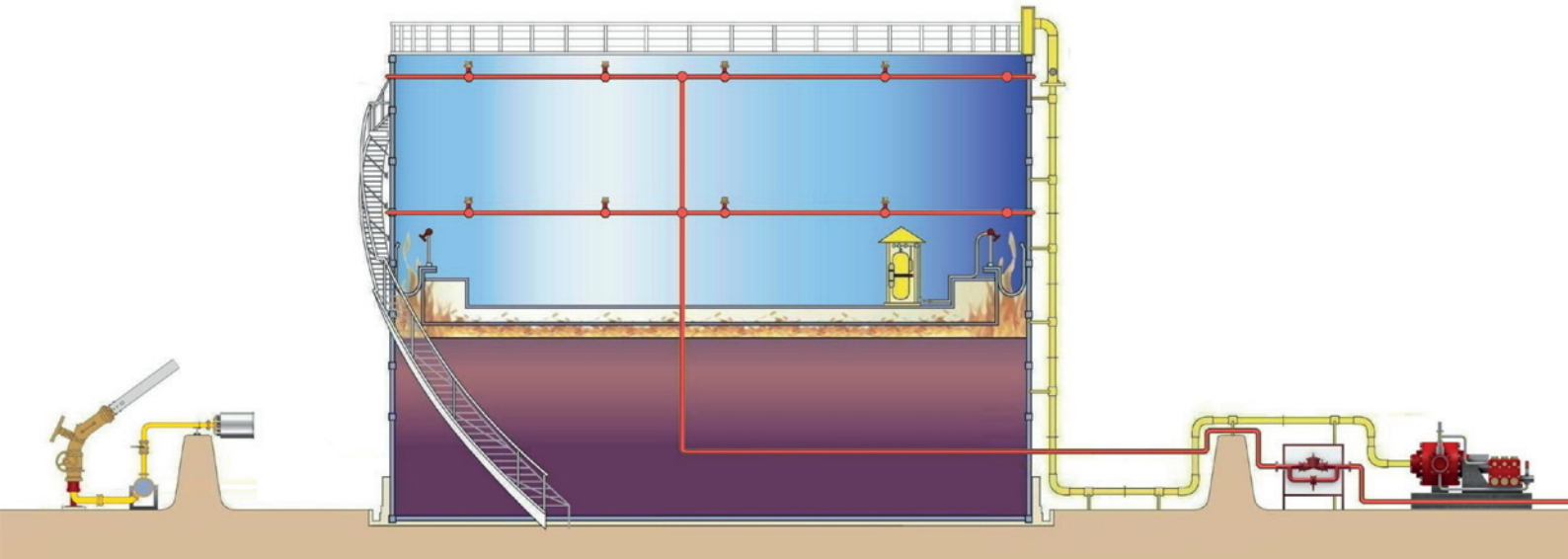


Top Pourer



OM80 Oscillating Monitor

# Open Floating Roof Tank (up to 60 metre diameter)



Floating roof tanks are widely used to store large quantities of petroleum products such as crude oil and condensate. They are designed as opened top cylindrical steel shells fitted with internal floating roofs that rise and fall as the liquid level in the tank changes. By floating on the fuel surface the roof helps to minimise vapour loss. 90% of fires in open floating roof tanks start in the seal between the floating roof and the tank wall, known as the rim seal.

## Foam System

The most effective method to control a fire in the rim seal area is by applying foam from pourers fixed to the tank wall.\* The design of the Rim Seal Pourer should have a low profile to minimize the effect of wind, and to deliver a well formed foam into the rim seal area irrespective of whether the roof is at its highest or lowest level.

Most rim seal foam systems are manually operated, and as tank farms are often located at the far end of the facility it is difficult to visually detect a fire in the rim seal, especially when the roof is low. In this case early detection is vital to minimise losses.

Floatafoam is a first strike, self-contained automatic foam system, which provides additional protection to catch a rim seal fire in its infancy. The Angus Fire Floatafoam incorporates either pneumatic or linear heat detection to catch the fire as early as possible, and at the same time send a signal electronically to the fire station.

## Water Cooling

Water cooling for adjacent tanks is vital to minimise the effect of radiant heat and the possibility of fire spreading to other tanks in the same bund. Medium velocity water spray nozzles are often specified for this purpose. However Angus Fire manufactures a specific Tank Cool Nozzle, which has an ideal spray pattern for this application. Fixed monitors are often installed at strategic points around tank bunds to supplement the rim seal systems. The graphic shows a Geared Monitor with hand wheels to control rotation and elevation along with a foam cannon. This monitor could be used for tank firefighting in the support of the fixed foam system. Other options could be a Lever Operated or an Oscillating Monitor.

## Bund Protection

Bund protection for floating roof tanks is especially important because their capacity is much larger than other types of tanks. The bunds surrounding floating roof tanks are therefore large too. The distance between the base of the tank where a fire might start and the bund wall can be 30-40m, which is a significant distance for a fire crew to cover in the event of an escalation.

A medium expansion foam system to protect the bund will provide both vapour suppression and firefighting without the need for firefighters to put themselves at risk. The Angus MEX Bund Pourers are designed specifically for this risk using medium expansion foam. They operate at low pressure with minimal water demand.

*\* To achieve proper coverage the floating roof of the tank should be fitted with a foam dam to contain the foam in the rim seal gap.*

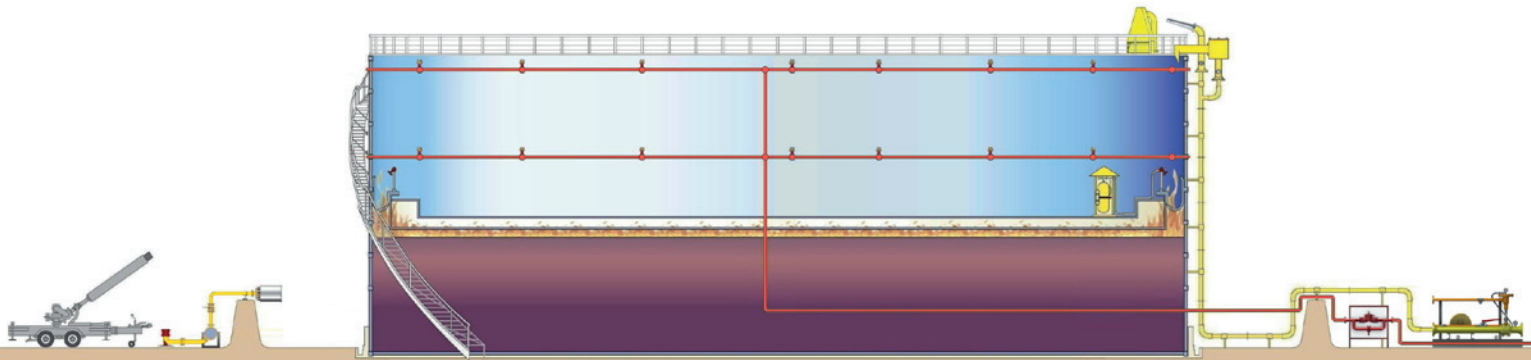


Rim Seal Pourer



Floatafoam

# Open Floating Roof Tank (over 60 metre diameter)



Open top floating roof tanks can now be up to 110m in diameter. However industry practice says foam will typically flow a maximum of 30m creating a dead spot in the centre of tanks over 60m where the foam will not reach. As a result larger tanks require additional protection equipment.

This additional foam equipment includes the Full Surface Pourer and the Full Surface Nozzle. The Angus Fire Full Surface Pourer is designed to apply foam at the rate required for covering the entire tank width. The Angus Fire Full Surface Nozzle features a long throw (range up to 50 metres), fixed jet with no moving parts that will reach the dead spot at the centre of these large tanks. Both these unique products have been subjected to a 2 hour fire test with no impact on performance.



Full Surface Pourer



Full Surface Nozzle

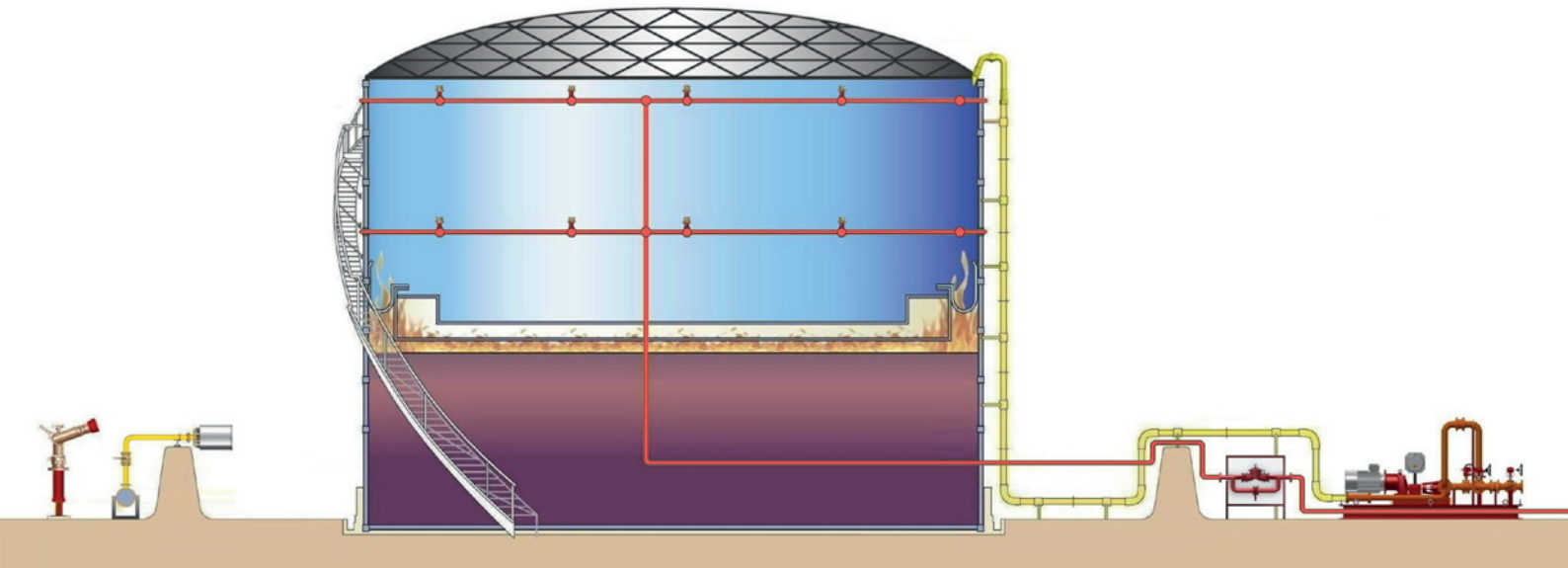
On large tanks without Full Surface Pourers and Full Surface Monitors or when the plan for the 'worst case scenario' incorporates the possibility of damage to the water supply, Large Capacity Monitors are essential back up to achieving the high application rates needed to fight a full surface tank fire.

Angus Fire has a range of large capacity trailer mounted monitors with flows from 15,000-50,000 litres per minute. Water supply to the monitors is best achieved using a large diameter, layflat hose such as Angus Super Aquaduct, which can move high volumes of water extremely long distances.



Large Capacity Trailer Mounted Monitor

# Geodesic Dome Tank



Geodesic tanks are essentially floating roof tanks fitted with (often retrospectively) a domed lightweight roof that extends across the complete roof area of larger tanks. Fitting open floating roof tanks with geodesic roofs has become more popular as a means of keeping the weather out and aiding vapour recovery to maximise efficiency.

## Foam System

The fire protection of geodesic dome tanks is a challenge as the height restriction often prevents the use of Rim Seal Pourers or Top Pourers. Despite the fixed roof the risk area for firefighting remains the seal between the floating roof and the tank wall. Therefore a slim 'Through the Roof' profile pourer is required. The Angus Fire Geodesic Pourer is designed to be supported by its pipework and be efficient against rim seal fires.

## Water Cooling

Similar to floating roof tanks provision should be made for the application of cooling water to geodesic dome tank walls, to minimise the effect of radiated heat. As geodesic dome roofs are lightweight structures, they generally cannot support the weight of the pipework needed to cool the roof. Effective cooling of the roof can be achieved by installing monitors such as the Lever Operated Monitor, which can be locked into position. The graphic shows the LMB40, Lever Operated Monitor from Angus Fire. Other options could be an Oscillating or a Geared Monitor.

## Bund Protection

As with Fixed Roof Tanks a fire in the bund area resulting from a leaking tank, valve or a fractured pipe can equally result in a major incident. A medium expansion foam system to protect the bund can provide both vapour suppression and firefighting. The Angus MEX Bund Pourers are designed specifically for this risk using medium expansion foam. They operate at low pressure with minimal water demand.



MEX Bund Pourer in action



Geodesic Pourer



MEX Bund Pourer

# Supplementary Protection



Angus Fire manufactures equipment for supplementary spill fire protection. These include the world's premier maintenance-free covered fire hose Duraline, fully self-contained mobile foam units AF 120 and Responder 140, foam concentrates, hydrants, Titan Bipod, trailers and mobile extinguishers using high performing Monnex powder. For further information contact your local distributor or visit [www.angusfire.co.uk](http://www.angusfire.co.uk)



Duraline Fire Hose



Responder 140 Mobile Foam Unit



AF 120 Mobile Foam Unit



Monnex Mobile Extinguishers



Titan Bipod



Hydrants



Trailers



Foam Concentrates



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