

# Firefighting Foam Storage Guidance - Fluorine Free Foam (F3)



This guidance document applies to the following fluorine-free foam concentrates from Angus Fire: Respondol ATF, JetFoam, JetFoam ICAO-C, Syndura, Expandol and Forexpan.

## Shelf Life

Angus Fire's foam concentrates are specially formulated to ensure exceptional storage stability as well as firefighting performance.

A shelf-life of at least ten years can be expected if stored properly according to these recommendations and this figure is based on laboratory-based accelerated ageing tests and history of manufacture.

However, to ensure satisfactory performance they should be sampled at least annually as recommended in NFPA 11, which states that "samples of concentrate shall be sent to the manufacturer or qualified authority for quality condition testing." At least annually an inspection shall be made of foam concentrates and their tanks or storage containers for evidence of excessive sludging or deterioration. The Angus Fire Foam Testing Service is a qualified laboratory and will perform such tests on any foam concentrates or foam premix solutions as required.

## Shipping Containers

Foam concentrate may be stored in its original shipping containers. It is available in various styles and sizes of container. However these should be regularly inspected to verify their condition. In the unlikely event of leakage the foam should be decanted into another clean drum, sealed and tested to ensure it is still in satisfactory condition. The maximum safe stacking height for 25 litres plastic drums is two high without pallets or 4 high with pallets (2 high per pallet); for 200 litre plastic drums is 2 high (with pallets); and for IBCs is 2 high. Foam containers should not be stored or transported in direct sunlight.

## Storage Tanks

Foam concentrates are suitable for transferring into bulk storage tanks for long-term storage, but these should normally be kept full, with space allowed for expansion with adequate vacuum/venting arrangements. Foam concentrates need to be stored carefully to withstand climatic extremes. Tanks and/or storage containers should be made from opaque, UV protective materials, in accordance with this guidance document. In some instances, climatic conditions may require foam concentrates to be stored indoors however they should always be stored out of direct sunlight. Particular attention should be paid to the "Evaporation" section overleaf.

## Materials of Construction

Foam concentrates have a neutral pH and generally no corrosion problems will occur with metals or plastics (except where noted below). Storage tanks should be fabricated from or be lined with the following materials:

- Mild Steel (uncoated): Not recommended for synthetic fluorine-free foam concentrates. Ferrous metal ions can contaminate the foam concentrate leading to reduced firefighting performance.
- Stainless Steel: 316L and Duplex 2205 grades. Tanks with welded construction should have all joints treated to ensure consistent properties close to welds. There may be very slight pitting which will not affect tank or contents.
- Glass Reinforced Plastic (GRP): Fibreglass with epoxy resin. Not recommended for foam systems involving pressure displacement.
- High Density Polyethylene (HDPE).
- Polypropylene.

The use of zinc, galvanised materials, and aluminium in storage tanks, pipework, and machinery handling foam concentrates should be avoided. In the event that foam is being replenished into an existing system where zinc or galvanised materials were used in original construction, it is advised that Angus Fire is contacted for more information.

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Gaskets, seals, and bladders may be fabricated from all commonly-used elastomers:

- Ethylene Propylene Diene Monomer (EPDM) or Ethylene Propylene Rubber (EPR)
- Butyl rubber (modified isobutylene) (eg. Bucar, Polysarbutyl, MD551, Buna N, Nitrophyl).
- Fluoroelastomer (eg. Viton).
- Nitrile Rubber (butadiene acrylonitrile copolymer).
- PTFE although users should note this is fluorinated and may leach into a fluorine free foam.

Fittings in foam concentrate pumps and valves may be made from brass, bronze, and gunmetal. Dissimilar metals in contact with one another (eg. a stainless steel tank and a brass valve) will lead to electrolytic action. This will cause galvanic corrosion of the metals. Dissimilar metals should either be avoided or a non-conducting gasketing material should be used in the joint.

## Pipework

The choice of pipework materials depends on the anticipated contact time with the foam concentrate. For continuous contact the same materials of construction apply as for storage tanks (see above). PVC pipes are also acceptable for continuous contact. For intermittent contact normal pipework materials (i.e. copper, brass, and bronze) are satisfactory subject to normal engineering criteria.

Inlet pipework should be located at the base of the tank to avoid excessive foaming during filling. Outlet pipework should be located above the base of the tank to prevent clogging in the event of any minor sediment that might have formed or other foreign materials in the tank.

Pipework systems should be designed to prevent water and other liquids accidentally entering the tank and foam concentrate accidentally escaping from the tank.

Foam concentrates are suitable for decanting into small containers. Agitation and air intrusion should be kept to a minimum if foam concentrate pumps are used.

## Evaporation

If foam concentrate is allowed to evaporate freely, the water and solvent in the concentrate will evaporate. This may cause a skin to form on the surface of the concentrate which could plug proportioning orifices.

To minimise evaporation losses, the concentrate tank should be sealed and a pressure vacuum vent installed to break the seal when the concentrate is required.

Evaporation will also be reduced by keeping the concentrate tank full. However, an ullage of 5-10% of the tank volume (eg. expansion dome) should be maintained to allow for differences in thermal expansion coefficients between the tank materials of construction and the foam concentrate. Avoid ullages greater than 10%.

Alternatively a nitrogen inerting system comprising a nitrogen layer maintained above the concentrate at a pressure fractionally above atmospheric pressure will reduce evaporation and ensure that leaks are of nitrogen gas, and not fresh air entering the vessel. A layer of hollow plastic spheres, either polypropylene or polyethylene, may be floated on the surface of the concentrate to reduce evaporation.

## Flushing (NOTE: not decontamination)

Where decontamination is required, specialist third-party support may be appropriate.

Storage tanks, pipework, and pumps that have been filled with foam concentrate or solution should be flushed with clean water and drained after use. The need for flushing storage tanks falls into two areas:

- When changing foam concentrate stored in an existing tank, or after commissioning: The foam system should be emptied of any foam concentrate previously contained in it (or water used for hydrostatic tests), cleaned, and dried prior to filling it with the final charge of foam concentrate. Particular care should be taken when changing foam types. Drain down system - open all valves. Fill foam tank with water and allow to drain. Repeat. Backflush through outlet using sufficient water as calculated to completely fill and overflow the tank twice. Allow to drain. Purge out all water, check to see foaming has ceased. If not continue to cycle through process until foaming has diminished. Set valves correctly. Fill slowly with foam concentrate to minimise frothing and formation of air pockets. Charge foam line to furthest designated valve so that foam concentrate is present in all pipes where it is required. Drain foam concentrate from any pipes where drying out could occur and rinse through with pressure hose reel or similar.

- In normal usage of system: This presumes it has been designed to avoid "dead-legs" in the system and drainage/flushing points are included to facilitate preventative maintenance. Judicious use of high pressure water regularly will enable pipework to be flushed and drained to dry so preventing any drying out of foam concentrate which could lead to the deposition of any solid material. Drain and flush until foaming diminishes.

Use of a transparent bottle filled to half level and shaken regularly will assist in judging the cessation of frothing.

Ensure all flushing by-products are managed in accordance with Angus Fire recommendations.

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When using polymer based foam concentrates in locations where drained areas may be heated or open to the atmosphere (pipework, foam-fill lines, recently operated pumps), flushing should be carried out immediately after use to prevent localised drying-out of foam concentrate which could result in the deposition of solid material.

## **Bunding**

In some instances there may be a need for bulk foam concentrate stocks to be banded or diked to comply with local environmental regulations. This will depend on the circumstances of a particular site, and the relevant enforcing authority should be consulted.

## **Compatibility**

Foam concentrates must not be diluted or contaminated by foreign materials or other types or brands of foam concentrate. Such mixing may lead to physico-chemical changes in the product and a reduction in or loss of firefighting capability.

This is recognised by NFPA 11. "Different types of foam concentrates shall not be mixed for storage. Different brands of the same type of concentrate shall not be mixed unless data are provided by the manufacturer to and accepted by, the authority having jurisdiction, to prove that they are compatible."

## **Temperature**

The maximum storage temperature is typically 49°C (120°F) although intermittent temperatures up to 60°C (140°F) are acceptable for short periods of up to one month for some concentrates. If ambient temperatures exceed 35°C (95°F) then storage vessels should be shaded or located indoors where temperature cycling is reduced, or in temperature controlled environments.

The Lowest Use Temperatures (LUT) at which foam concentrates will proportion correctly are available on the product data sheets. If ambient temperature is below the LUT or freezing point then storage vessels should be fitted with insulation lagging. Do not add freezing point depressants such as ethylene glycol or any proprietary brands of antifreeze.

Repeated freezing and thawing have no adverse effect on the performance of most foam concentrates. However, it should be noted that foam concentrates expand on solidification and, like water turning into ice, may damage a completely rigid container.

In accordance with UL 162 foam concentrate shipping containers are marked with the minimum and maximum storage temperatures. Details of UL Listings are available on the product data sheets and the UL website [www.ul.com](http://www.ul.com) in the Online Certifications Directory.

## **Foam Testing**

In accordance with NFPA installations, Angus Fire's "Foam Testing Service" can test all manner of foam concentrates for their firefighting capability.

Please ask your Angus Fire contact for more information..

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