

**Foam Systems**

**Fire Protection Solutions**

## Foam Extinguishing Systems

### FOREWORD

Foam fire suppression systems are, in most cases, the only suitable solution for the protection of special hazards. They are widely used in the chemical, petrochemical and pharmaceutical industries to protect flammable liquid fire hazards. The core components of foam systems are the proportioners and the dischargers. The proportioner has the duty of mixing water to foam concentrate to a precise rate that will be delivered to the discharger. In this final point, the foam is created adding air to the water/foam solution to initiate the foam emulsification process. For any type of system configuration such as low, medium or high expansion foam, SA Fire designs and manufactures foam system components capable of mixing and generating foams. Every component is tested against EN 13565-1 & UL 162 requirements.

### BLADDER TANKS

Bladder tanks are positive displacement proportioning systems made of a tank and an in-line mixer.

The tank is equipped with an elastomeric bladder that is used to hold the foam concentrate and it is normally kept unpressurised. The mixer is directly piped to the bladder tank via two lines, the water inlet line and the foam outlet line. When in operation, water flows into the mixer passing through a water orifice that creates a pressure differential across the disc in the area of the mixer where the foam concentrate is injected.

Some water is deviated from the main supply and enters the tank surrounding the bladder, increasing the tank pressure. This squeezes the bladder and forces the foam concentrate to leave the tank and enter the foam line. The concentrate is then delivered to the mixer injection point, where another orifice plate is located to meter its flow in the low pressure water stream zone. The system works till the concentrate in the bladder has been consumed and the tank is full of water.

Bladder tanks are manufactured according to ASME or EN standards with variable thicknesses according to the client design pressure. Every unit is available in a horizontal or vertical configuration and is customised according to client requirements, including accessories such as: double tank

system (only for verticals), ladders for easy access to man hole(s), deluge or remote-controlled valves for system automation, manual filling pump, base plates, special metal treatments or painting procedures. The Bladder tank can be manufactured also with foam concentrate to be contained inside or outside the bladder.

### BLADDER TANK PSLV SERIES

The bladder tank is a very reliable and economical solution for providing water foam solution to firefighting systems. The system is completely independent from external power sources and relies only on firefighting water pressure.

Water that flows into the mixer is partially deviated into the tank, pressurising and squeezing the bladder. Foam concentrate is then ejected and directed towards the injection point where a metering orifice allows for a precise concentrate injection into the water stream. The unit works continuously till water is shut off or the foam concentrate quantity runs out.

When used in a single configuration, the bladder tank proportioning system may be economical but presents some limitations. For example, during maintenance activities single bladder tank systems go out of service until the bladder tank is restored. Similarly, when the system requires refilling after activation.

To overcome these limitations, the 2 x PSLV was developed merging two equally sized tanks with one in-line foam mixer. With this solution, one tank is kept in service while the other is a stand-by unit. In case

of maintenance or system activation, the mixer may be swapped to the second tank meanwhile repairs or refilling work are terminated. The swap option may also be automatic by providing the system with remote controlled valves.

The 2 x PSLV bladder tanks configuration may be used also to cope with large fire systems requiring large tanks. In this case, the 2 x PSLV configuration allows the tanks to be easily coupled together to meet foam concentrate stock quantity requirements. Customised configurations with 3 x PSLV are also available.

### BLADDER TANK PSLO SERIES

The principle of operation of the horizontal bladder tank is very similar to that of the vertical models. The different





geometry allows for larger tank construction and for installation where the top openings of the bladder tank may be obstructed, making it difficult to do maintenance operation such as the bladder extraction.

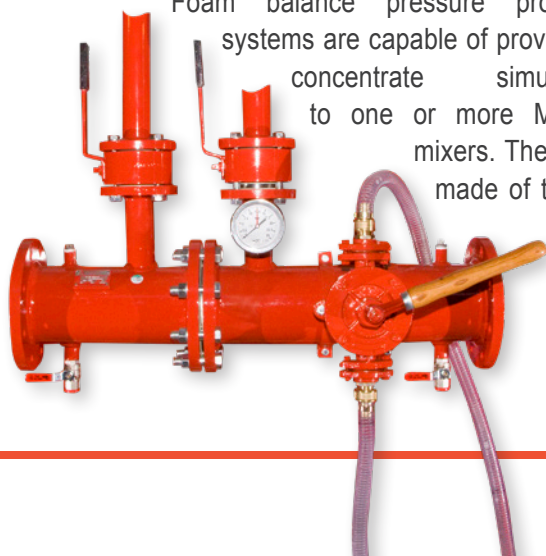


#### IN-LINE MIXER

The in-line mixer for bladder tanks is made of two bodies coupled together. In between them an orifice plate is located, designed to create a negative pressure downstream of the disc in correspondence with the foam concentrate injection zone. In the first part of the in-line mixer the water coming from the main supply is deviated in the tank, causing its pressurisation. In the second part of the mixer body, the foam concentrate injection takes place, passing through a foam metering orifice that injects the foam in the water stream. The two orifices are calibrated to keep a foam concentrate flow rate of injection strictly dependent on the water flow rate and therefore keeping the mixing ratio constant. The in-line mixer can be calibrated over a wide range of water flows and therefore may be used successfully to provide foam solution for more systems with different flow requirements.

#### BALANCED PRESSURE PROPORTIONING SYSTEMS

Foam balance pressure proportioning systems are capable of providing foam concentrate simultaneously to one or more MPV foam mixers. The system is made of three main



components: the foam pump(s), the foam tank and the pressure balanced proportioner(s) MPV. The foam pumping station is made of a gear pump which may be driven either by an electric or a diesel motor. On each pumping unit a control panel is installed to control the start and stop of the pump as well as to monitor the valve status. The pumps are used to provide foam concentrate at a constant pressure directly in the (MPV) pressure balanced foam proportioner foam inlet. Depending on the water which flows in the main supply, and therefore on the foam concentrate needed, the pumps regulate the concentrate pressure by means of a recirculation valve that opens and closes, keeping the pressure at the MPV inlet always equal to the design pressure. The MPV is a modified Venturi coupled to an automatic metering valve which opens or closes a metering orifice, according to the water flow that is sensed in the main supply. This system self-regulates the foam concentrate injection in relation to the water flow and pressure that are sensed in the main supply, granting a perfect mixing ratio of water and concentrate over an extremely wide range of flow rates. Every unit is manufactured according to client specifications and may be designed to meet a wide range of pressure and flow demands. The units are available with single, double or triple pumping stations driven by an electric or diesel motor. For electric versions, pumps, panels and control instruments are available also for hazardous area installation.



The pressure balanced proportioning system is a very reliable and accurate method for metering foam concentrate in firefighting systems. The system can feed one or more MPVs providing foam for multiple systems. Available in several configurations with MPV and pumps in SS AISI 316 or Bronze.

#### FOAM INJECTION PROPORTIONER PR SERIES

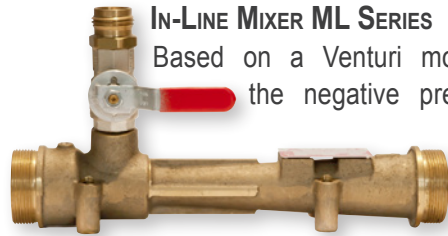
Foam injection proportioners are used to inject foam concentrate into firefighting pipelines. The PR proportioner receives foam concentrate at a pressure roughly 2 bar higher than that of water and



meters the foam injection through a bronze valve and an orifice plate. The concentrate passes through the PR and is delivered into a pipe directly in the water stream. The concentrate flow can be factory calibrated for 3 or 6 % injection.

**IN-LINE MIXER ML SERIES**

Based on a Venturi modified tube, it works on the negative pressure principle which is generated when water passes through different piping sections. When in operation, the ML



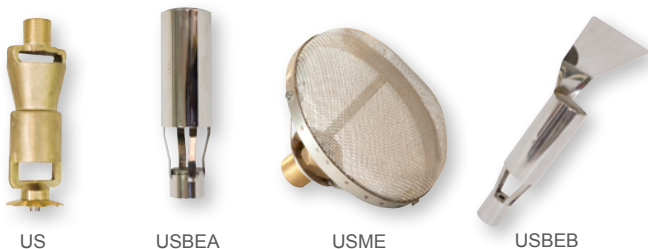
proportioners move foam concentrate from an atmospheric storage tank into the Venturi water stream, providing 1, 3 or 6% water/foam solution. Mixers are available in bronze with a shut off valve that allows foam induction to be stopped. Lightweight and flexible, they can be used for portable foam equipment or in small fixed applications.

**LOW EXPANSION COMPONENTS**

**NOZZLES US SERIES**

Low expansion nozzles are manufactured in Bronze and Stainless Steel and calibrated on a wide range of flow rates with connection from 1/2" to 1" threaded NPT or BSP. US, USBE & USME nozzles are often used to protect hazards such as loading racks, process pumps or combustible warehouses.

EN 13565-1 Compliant



**LOW EXPANSION FOAM MAKER LSBEF SERIES**

Low expansion foam makers are designed for the protection of dike areas where combustible spills may cause pool fires. They are available in two versions: The LSBEF Type A and Type B.

The LSBEF Type B is a foam maker which includes in its terminal a deflector that allows the foam to be orientated on the burning liquid. This configuration allows for a direct mounting on the perimeter of the dike with no need to employ a pourer. The LSBEF Type A, instead, is a standard foam maker which may be installed remotely from the hazard but requires a foam pourer type VS to



direct the foam on the burning liquid.  
EN 13565-1 Compliant

**HIGH BACK PRESSURE FOAM MAKER LSAC SERIES**

High back pressure foam makers have been developed to deliver foam in sub surface applications for fixed cone tanks. Foam solution is delivered to the LSAC maker that allows air to be withdrawn from the outside into the stream to generate foam. The foam is then delivered to the tank bottom and injected into the combustible product.

Due to the lightweight of the foam generated, the foam travels to the top creating a foam blanket that separates combustible liquid from surrounding oxygen with consequential fire extinguishment.

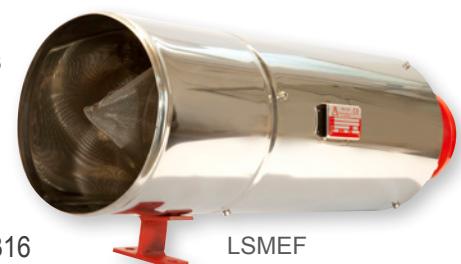
EN 13565-1 Compliant



**MEDIUM EXPANSION FOAM MAKER LSMEF SERIES**

Medium expansion foam makers are used to protect hazards such as dike areas or pumps.

The LSMEF makers are equipped with a built-in support for installation on dikes and are manufactured in stainless steel AISI 316 to guarantee high resistance from aggressive chemicals in acidic atmospheres.  
EN 13565-1 Compliant





GSAE

### HIGH EXPANSION FOAM GENERATOR GSAE SERIES

High expansion foam generators are used in total flooding applications such as hangars, tyre warehouses or LNG pumping stations.

When in operation, the generator GSAE discharges foam solutions at high velocity from its multiple nozzles that withdraw air and expand rapidly in the generator. Foam produced with this technique may achieve an expansion ratio

that goes up to 1:800.

Available with two flow settings, the GSAE series meet the requirements of EN 13565-1.

## Fixed Cone and Floating Roof Tanks Specific Applications

### FOREWORD

Fire in fixed cone or floating roof tanks containing combustible liquids represents one of the major risks relating to storage tank facilities. Regardless of the causes starting fires, every tank shall be equipped with a fixed firefighting system. The system shall be designed to act quickly and fight a fire outbreak reducing the consequential damages to a minimum. In this respect, international standards such as NFPA 11 or EN 13565-2 recommend the installation of foam systems. These systems act by discharging foam onto the ignited liquid creating a blanket which separates the combustible liquid from the surrounding oxygen and therefore results in extinguishment. Foam is a mixture of water and concentrate that is mixed by the foam station and then is delivered to the discharge devices such as:

- Foam Chambers CS and Pourers VS (for the fixed cone or covered with internal floating roof tanks)
- Foam Makers LSBEF and pourers VS (for open top floating roof tanks)

Before discharging, air is introduced into the stream causing the foam to expand rapidly. This increases its volume and reduces its density to become floating lightweight foam. Once generated the foam is discharged by the pourers into the tank to suppress the fire by separating the combustible from the surrounding oxygen.

### AVAILABLE KITS

Depending on the tank which is to be protected, SA Fire has prepared two solution packages developed to help build compliant and efficient fixed fire suppression systems for the storage industry. The two solutions are related to

the protection of fixed cone and open top floating roof tanks by means of low expansion foam systems.

Among others, these solutions are developed to offer advantages to tank manufacturers or owners such as:

1. Designed in full compliance with EN 13565-1 or NFPA 11
2. Several material options to face any outside environmental conditions
3. Integrated protection in the air aspiration inlet avoiding the possibility of obstructing the firefighting lines
4. Proven performance
5. Cost effective design



### FIXED CONE TANK FC KITS

For fixed cone or tanks covered with internal floating roof, SA Fire proposes an FC kit for low expansion foam systems made of a Foam Chamber series CS, including a built-in Foam Maker, coupled to a pourer series VS.

The foam chamber is installed on the outside of the tank shell meanwhile the pourer faces the tank liquid surface on the internal side of the shell. The CS series Foam Chambers are all equipped with a breakable type seal (compliant with EN 13565-1) which avoids vapours present in the tank entering the firefighting system pipe work. If required, the frangible seal may be made of materials resistant to aggression by specific chemicals or their combinations.

With a compact design, the CS series integrates a calibrated orifice on the base that avoids the need of installing further in-line foam makers.



**PRINCIPLE OF OPERATION: FIXED CONE – FC KIT**

Upon firefighting system activation, the water/foam solution is metered in the mixing station and then pumped towards the CS Foam Chambers. Once the stream approaches the Foam Chambers, it passes through a metered orifice that accelerates its motion creating a negative pressure that attracts air into the chamber. This air is mixed into the stream and allows the solution to initiate the expansion process.

Due to the seal, the foam discharge is delayed until the pressure rises to the seal setting point where it breaks and opens the chamber. With the seal broken, the foam is free to discharge in the Foam Chamber that, due to its geometry, facilitates the foam expansion and decreases the flow velocity. Connected to the Foam Chamber outlet, on the internal side of the tank shell, the VS pourer allows the foam to be gently delivered towards the internal side of the shell avoiding direct contact with the burning liquids. Once the foam has descended onto the burning liquid surface it acts by separating the oxygen from the combustible liquid suffocating the fire till suppression is achieved. The foam blanket that remains on the fire after extinguishment prevents any possibility of re-ignition.

**OPEN TOP FLOATING ROOF TANK – FR KIT**

For open top floating roof tanks, SA Fire propose an FR kit for low expansion foam systems made of a Foam Maker series LSBEF and a foam pourer series VS. Both items are coupled together and installed in-line on top of the floating roof tank together with the foam shields.

**PRINCIPLE OF OPERATION:****OPEN TOP FLOATING ROOF – FR KIT**

Upon firefighting system activation, the water/foam solution is metered in the mixing station and then pumped towards the LSBEF Foam Makers. Once the stream approaches the Foam Makers, it passes through a metered orifice that accelerates its motion creating a negative pressure which

attracts air into the stream.

The air is drawn into the stream and allows the solution to initiate the expansion process.

The mixture of water, foam concentrate and air starts to expand. Meanwhile the stream reaches the VS foam pourer. Once the solution approaches the VS pourer, the stream impacts with its body waterways and therefore undergoes a mechanical agitation which expands its volume expansion and reduces its velocity.

The foam comes out of the pourer and it is directed towards the foam shield where it will gently continue descending towards the rim seal.

Once on the burning liquid surface the foam separates the oxygen from the combustible liquid suffocating the fire till suppression is achieved.

The foam blanket that remains on the fire after extinguishment prevents the possibility of re-ignition.

**GENERAL TECHNICAL CHARACTERISTICS:**

Both kit components are available in several versions and each of these is developed to satisfy every requirement of flow rate settings, installation environmental conditions and mechanical process connections.

**KITS AVAILABLE IN:**

Carbon Steel; Stainless Steel AISI 304 or AISI 316; Flanged ANSI or UNI /DIN;

Standard design for both kits allows operation up to 16 bar at external temperatures ranging from -20° to +60°C.

The Foam Makers LSBEF, Foam chamber CS and their VS pourers can be provided hot dip galvanised or painted red RAL 3000.

Other materials or surface treatments are available upon request.

Each component has an optimum performance with all kinds of foam concentrates commonly used in the chemical and petrochemical industries such as FP, AFFF, FFFP and their AR combinations.