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FOGMAKER

Fire suppression for engine compartments

TRIPLE ACTION³

with high-pressure water mist

THE CHALLENGE

The complexities, dangers and physical aspects of engine fires.

It is well-known that the increased demands on reduced emission levels, such as EuroVI and EPA, have led to higher fuel pressures and increasing temperatures in engine compartments. Combined with time-critical service demands for bus operators, the risk of a fire starting in the engine compartment has increased dramatically.

Statistics show that 40-60% of all bus fires start in the engine compartment. A figure that has been on the increase for many years. **Electrical failure** is the predominant cause, and **oil or fuel spillage** have resulted in several fires; together these three account for 75% of all **bus fires.**[1]

Bus operators are extremely sensitive to unscheduled **downtime**. A fire in the engine compartment of a bus can be devastating, as every minute of operation counts. A fire that flares up very quickly may also have devastating effects on the immediate surroundings with properties having to be evacuated, roads being closed resulting in traffic queues and fire alarms going off at local businesses. From what started with for example electrical failure or a ruptured hydraulic hose in an engine compartment, the end results may have **financial and operational consequences,** something that all bus operators and manufacturers want to avoid.

Consideration must also be given to a bus company's **employees and passengers** who may be exposed to great danger in the event of a fire.

A fire in an unprotected engine compartment is hard to detect in time and often develops in intensity extremely quickly. This type of fire is almost impossible to fight with a portable fire extinguisher. Because of this, the need for safety regulations that insist on the installation of completely automatic and permanent fire suppression systems in buses has increased. This has spread to more and more countries, insurance agencies and bus manufacturers/operators throughout the world.

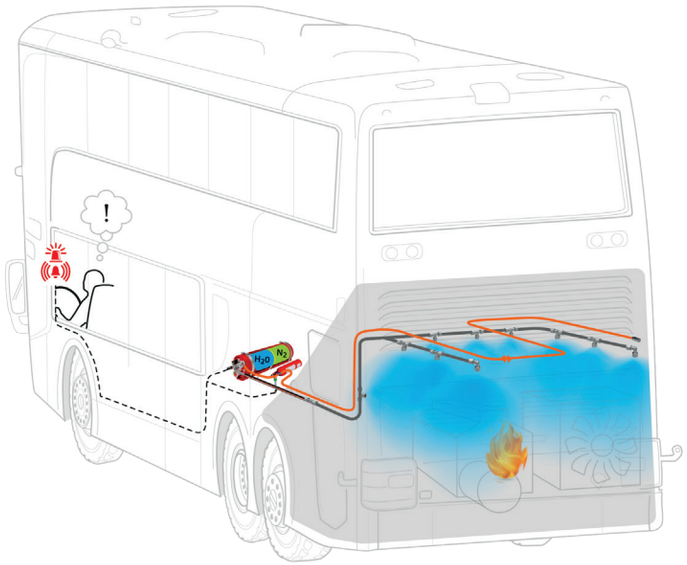
But an important point to bear in mind is what **the physical aspects** of a fire are.

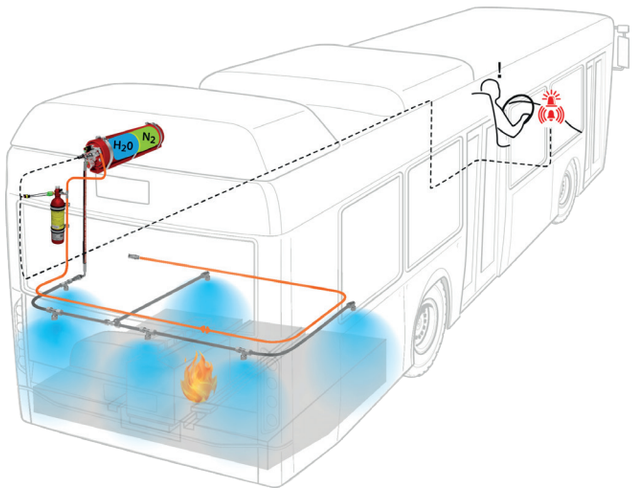
The impact of the heat, oxygen and fuel, all need to be anticipated and dealt with accordingly. These three elements of a fire are often symbolised by the fire triangle. Removing one side of the triangle may be sufficient to extinguish a fire, but because of the complicated nature of a fire in the engine compartment there are no guarantees, re-ignition may still occur. That is why a fire suppression system with a so-called **triple effect that attacks all three sides of the triangle at the same time** is the safest and most logical method that can be used to minimise downtime, improve service continuity and protect human life.

At the same time, the fire suppression system must always be ready to operate independently of human interaction, the vehicle's location and how the vehicle is being used.

Fogmaker's technology, using high-pressure water mist provides the right conditions to combat a possible fire that may develop in the engine compartment.

[1] *Buses and Fire safety January 2016, Sveriges Bussföretag (Sweden's Bus Companies), www.transportforetagen.se, http://www.transportforetagen.se/Nyheter/2016/Rapport-Hog-brandsakerhet-for-svenska-bussar/, Stockholm, Sweden, in 2016.*





WHY FOGMAKER?

- **Triple Action**[3] – *attacks all three sides of the fire triangle*
- **Simplicity** – *no power supply, position independent, low weight, minimal obstruction*
- **Low service cost** – *annual inspection, 5 year service, minimal clean up after the system has been triggered*
- **System monitoring** – *activity, low pressure and fire alarm*
- **Automatic engine shutdown** *optional*
- **Single cylinder** *approved for up to 6.2m³ (R-107)*
- **Product development** *in-house*

FOGMAKER

A Triple Action³ Fire Suppression System

Fogmaker's fire suppression system uses the purest form of extinguishing agent – water. The combination of high-pressure water mist and a small amount of foam additive simultaneously attack all three components of the chain reaction that cause a fire – heat, oxygen and fuel.

HEAT - *Cooling*
Cooling is by far the most important factor when breaking the fire's chain reaction and water is a superior medium for this purpose. During the evaporation process, the water mist cools the fuel gases and the hot parts in the engine compartment.

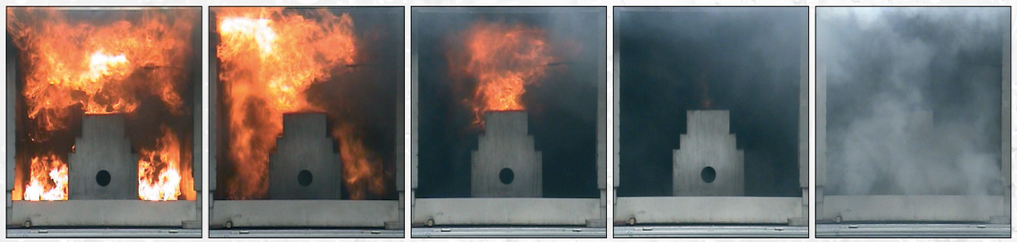
When the liquid runs through the spray nozzles, a normal size droplet which is 1 mm in diameter is split into as many as 8,000 micro-droplets. The droplets evaporate easily, taking up the energy from the fire and cooling the fumes in the engine compartment

OXYGEN - *Oxygen displacement*
During evaporation, up to 1,700 litres of water vapour is generated from one litre of water. This means that from a single 7.5 litre Fogmaker cylinder, up to 12 m^3 of water vapour are generated, providing an effective displacement of oxygen atoms in the air, supporting a "knockdown effect" on the fire.

FUEL - *Smothering*
The small amount of AFFF surfactant creates a smothering effect on the fire thus preventing oxygen from coming into contact with hot surfaces or fuel. The fire is also prevented from reigniting.

That is how Fogmaker's Triple Action³ suppresses a fire.

"From 870 °C to 136 °C in 10 seconds!"



+870 °C
0 sec

5 sec

+136 °C
10 sec

Unique cooling effect, temperature reduction of 734°C in 10 seconds!

Fire suppression test in a simulated engine compartment with a volume of 2,5 m^3. The fire source consists of four 20x40 cm trays filled with diesel. Diesel spray is also applied at a rate of 2 litres per minute at a pressure of 5 bar, which showers the engine. The heat effect reaches approximately 1,600kW. The pictures are taken with 2 second intervals. During the whole interval, 10 seconds, approximately 5 dl of extinguishant is used.

TRIPLE ACTION³

All three components of the fire triangle are attacked using Fogmaker's fire suppression system

	HEAT	OXYGEN	FUEL
Triple application	*Evaporation*	*Water vapour*	*AFFF*
Triple effect	*Cooling*	*Displacement of oxygen*	*Smothering*
Triple protection	*Thermal barrier*	*Vapor containment*	*Reduced re-ignition*

Fogmaker – the first fire suppression system to receive R107 approval!

New European regulation for fire suppression systems in buses

Besides being established in Sweden, Fogmaker is already represented in major cities such as Berlin, London, Washington DC, Sydney, Istanbul, Hong-Kong and Singapore. The opportunity is now opening up for an even greater dissemination of Fogmaker's technology to protect vehicles, capital and above all, human life.

As of **1 January 2019** all new coaches and double-decker buses throughout the European Union must have a permanently installed fire suppression system fitted in the engine compartment. From year 2021, it will also apply to long-distance and city buses.

The regulations are subject to **UNECE R-107,** and the requirements for the type of fire suppression systems are based on a test method developed by SP Technical Research Institute of Sweden. The fire suppression systems are tested in a rig designed to emulate the conditions in a real engine compartment in buses, with different fire sources, and under different conditions, for example by varying the fan speed. Fogmaker became the first manufacturer to implement the official tests with successful results.

What size system does your vehicle require?

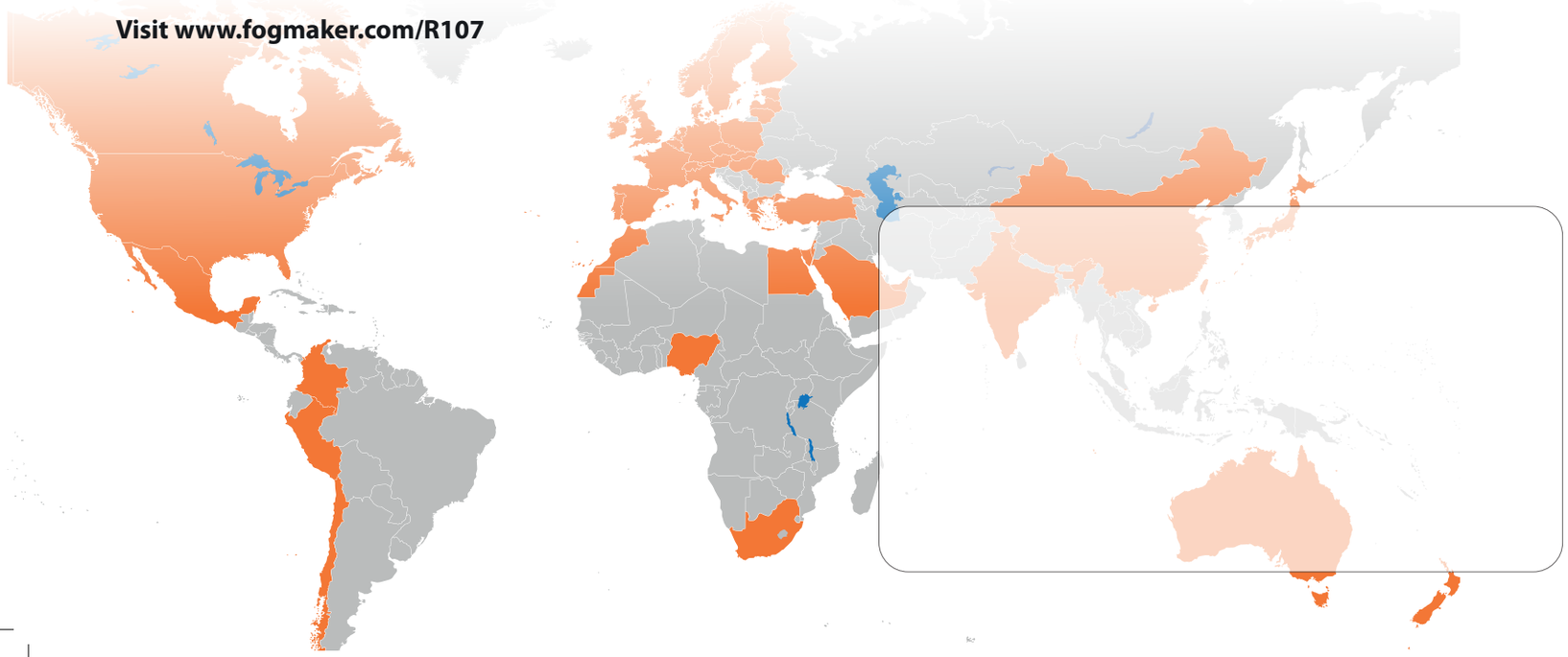
Visit www.fogmaker.com/R107

A proven fire suppression solution

Fogmaker is the holder of several qualification certificates and approvals. **We provided the first fire suppression system ever approved for UNECE Reg. 107 (Europe).** Fogmaker also holds the following certifications: AS-5062 (Australia), SBF-128 (Scandinavia), UL listed (UL 1384) and FM pending (FM 5970). Through our work processes, we ensure that we maintain the highest possible standards during the development of our products. Furthermore, following the latest re-certification of ISO 9001:2015 and 14001:2015 with a pending IATF 16949 certification, our organisational structure will be able to grow successfully.

This provides a stable foundation for our organisation's growth through our global network of distributors and partners so that we can offer a complete service wherever our customers are. Today we are represented in more than 55 countries in Europe, North and South America, Africa, the Middle East, Asia and Oceania.

But first of all we are proud of the trust our customers around the world have shown us. Fogmaker's fire suppression system first saw the light of day in 1995. Today, more than 140,000 vehicles are equipped with Fogmaker's high-pressure water mist system.



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UNECE 107 R - 06001
United Nation Economic Commission for Europe

AS-5062
Australian Standard

UL-1384 (UL listed)
Underwriter´s Laboratories

SBF-128
Swedish Fire Protection Association

...and FM-5970 pending!
Factory Mutual

Buses EN Ed-20
Art. no.: 8050-01-002

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