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FOGMAKER

Fire suppression for engine compartments

TRIPLE ACTION^3

with high pressure water mist

THE CHALLENGE

The complexity, dangers and physical aspects of engine fires

It is well-known that the increased demands on reduced emission levels, as TIER 4F and EPA 2013, have led to higher fuel pressures and increased temperatures in the engine compartment. In combination with the time-critical industry demands, the risk for fires to start in the engine compartment has risen dramatically.

Statistics show that nearly 55% of all fires in mines originate in a vehicle fire. This has been a rising figure over many years. Out of these, **hot surfaces** is the dominating cause, and also **overheating** lead to several fires. Together, these two are the cause of more than **50% of all vehicle fires in mines.**[1]

Mining operations are extremely sensitive to unscheduled **downtime.** An engine fire above or underground can be devastating, as every minute of operation counts. Due to the typically large quantities of diesel and hydraulic oil, often operating under high pressures in the immediate area, an ignited engine fire could lead to a rapid and **disastrous series of events.** The end result in form of **financial and operational consequences,** in the event that started with e.g. a leaking fuel line or ruptured hydraulic hose, all machine operators want to prevent.

Still the most important resource of any company is the **human workforce,** whom is also put at great danger, in the event of a fire.

Most fires start in the engine compartment. A fire in an engine compartment is hard to detect and has often a very intense course of event. It is almost impossible to suppress with a portable extinguisher. The safety requirement for automatic fire suppression system in vehicles exist in many places around the world since several years, and more and more countries, insurance companies and operators, are being added to the list.

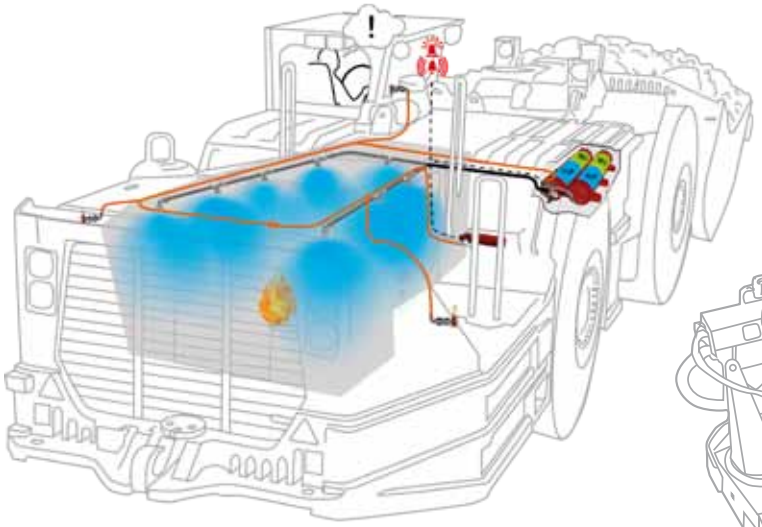
But an important question to keep in mind is what **the physical aspects of a fire** are.

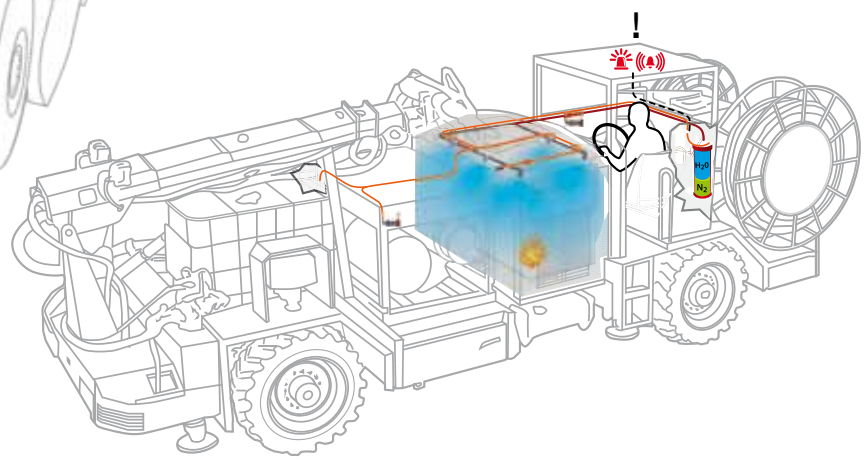
Heat, oxygen and fuel all must be foreseen and attacked. These triple elements of a fire are often symbolized with the fire triangle. Only taking out one corner of the triangle can be sufficient to kill a fire. However the complex nature of a vehicle engine fire does not leave guarantees. Re-ignition, or re-flash, of fires occur. Therefore, **a triple action fire suppression system attacking all three elements simultaneously** is the safest and most logic method for minimizing of equipment downtime, business continuity and protecting human lives.

At the same time, the fire suppression system must constantly be ready to act, independent of human interaction, vehicle position and vehicle activity.

These complex circumstances are **all covered by Fogmaker** high pressure water mist technology.

[1] [Annual Report, Gramko Fire Commitee, www.svemin.se, Sweden, 2013 & Safety Bulletin No: SB13-05, www.resources.nsw.gov.au/safety, NSW, Australia, 2013]





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** – *5 year service, minimum clean-up after actuation*
- **System monitoring** – *Activity, Low pressure and Fire warning*
- **Automatic shut-down** *option with Override*
- **Single cylinder** *sufficient for up to 8m*^{3}
- **Product development** *in-house*

FOGMAKER

A Triple Action³ Fire Suppression System

The Fogmaker system uses the most pure kind of extinguishant – water. In combination with the high pressure and a small amount of foam additive, all three components of the chain reaction that causes a fire – heat, oxygen and fuel – are attacked simultaneously.

HEAT - *Cooling*
Cooling is the far-most important factor when breaking the chain reaction, and water is the supreme agent for the purpose. In the evaporation process the water mist cools the burnt gases and hot parts in the engine compartment.

When the liquid runs through the spray nozzles, one normal size droplet of 1 mm diameter becomes as many as 8000 micro-droplets. The droplets will easily evaporate, taking up the energy from the fire and cools the smoke gas temperature of the compartment.

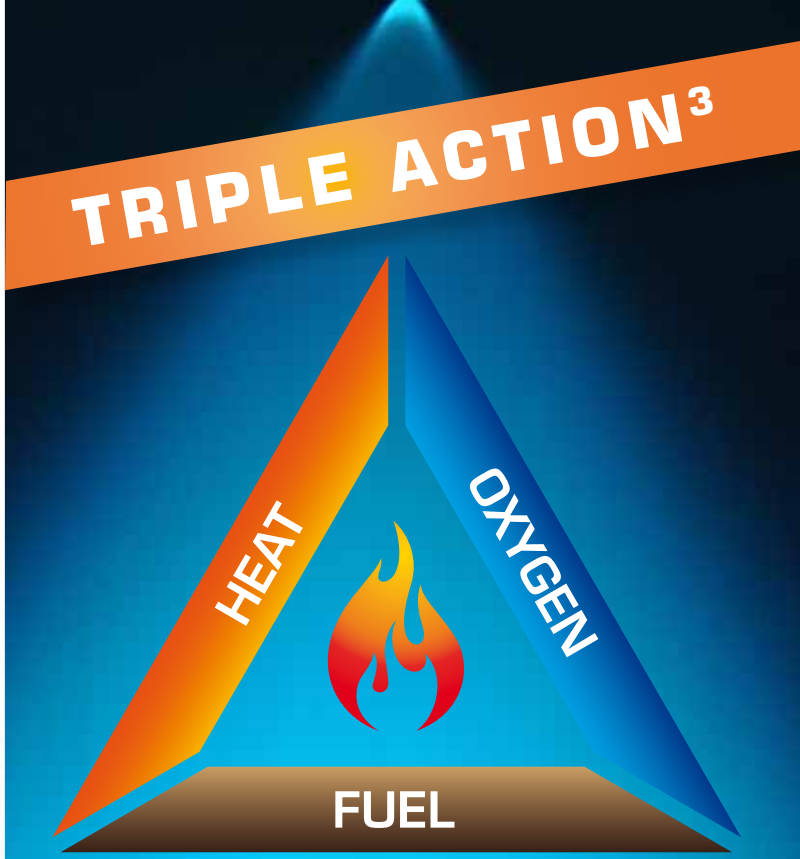
OXYGEN - *Oxygen displacement*
During the evaporation, from one single liter of water, up to 1700 L of steam is generated. This means that from one single 7.5 L Fogmaker extinguisher, up to 12m³ of steam is generated, causing oxygen displacement, and supports the knockdown effect on the fire.

FUEL - *Smothering*
With a small amount of AFFF surfactant, a coat blanket is created, preventing hot surfaces or fuel contact with oxygen. Therefor the fire is also prevented from reigniting. Thus, the Fogmaker suppression agent is from the same source a Triple Action³ Fire Suppression System.

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

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 m³. The fire source consists of four 20 x 40 cm trays filled with diesel. Diesel spray is also applied at a rate of 2 liters 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 sec intervals. During the whole interval, 10 seconds, approximately 5 dl extinguishant is used.



All three components in the fire triangle are attacked with the FOGMAKER fire suppression system

	HEAT	OXYGEN	FUEL
Triple application	*Evaporation*	*Steam*	*AFFF*
Triple effect	*Cooling*	*Inert gas*	*Smothering*
Triple protection	*Thermal barrier*	*Vapour containment*	*Reduced reflash*

A proven fire suppression solution

Fogmaker is holder of qualified certifications and approvals, such as AS-5062 (Australia), SBF-127 (Scandinavia), is UL listed (UL 1384) and FM pending (FM 5970). Through the processes of achieving them, we ensure to keep highest possible standards and develop our products. Further following the latest ISO, with an ISO-TS pending, our organization structure is allowed to grow with strength.

This lays a solid ground for our extended organization through our global network of distributors and partners, offering full service wherever our customers are. Today we are covering more than 55 countries in Europe, North & South America, Africa, the Middle East, Asia and Australia.

But first and foremost we are proud over the trust our customers around the world have given us. The Fogmaker fire suppression system first saw daylight in 1995. Today, more than 120 000 vehicles are equipped with Fogmaker High Pressure Water Mist.

"LKAB iron ore mine has worked systematically with fire vehicles protection over the last 10 years... The functionality and reliability of Fogmaker made us keep to it. ...Fogmaker shown a willingness to drive development forward... Besides function have also the cost aspects been of importance, for which Fogmaker proved to be far ahead over competitors…"

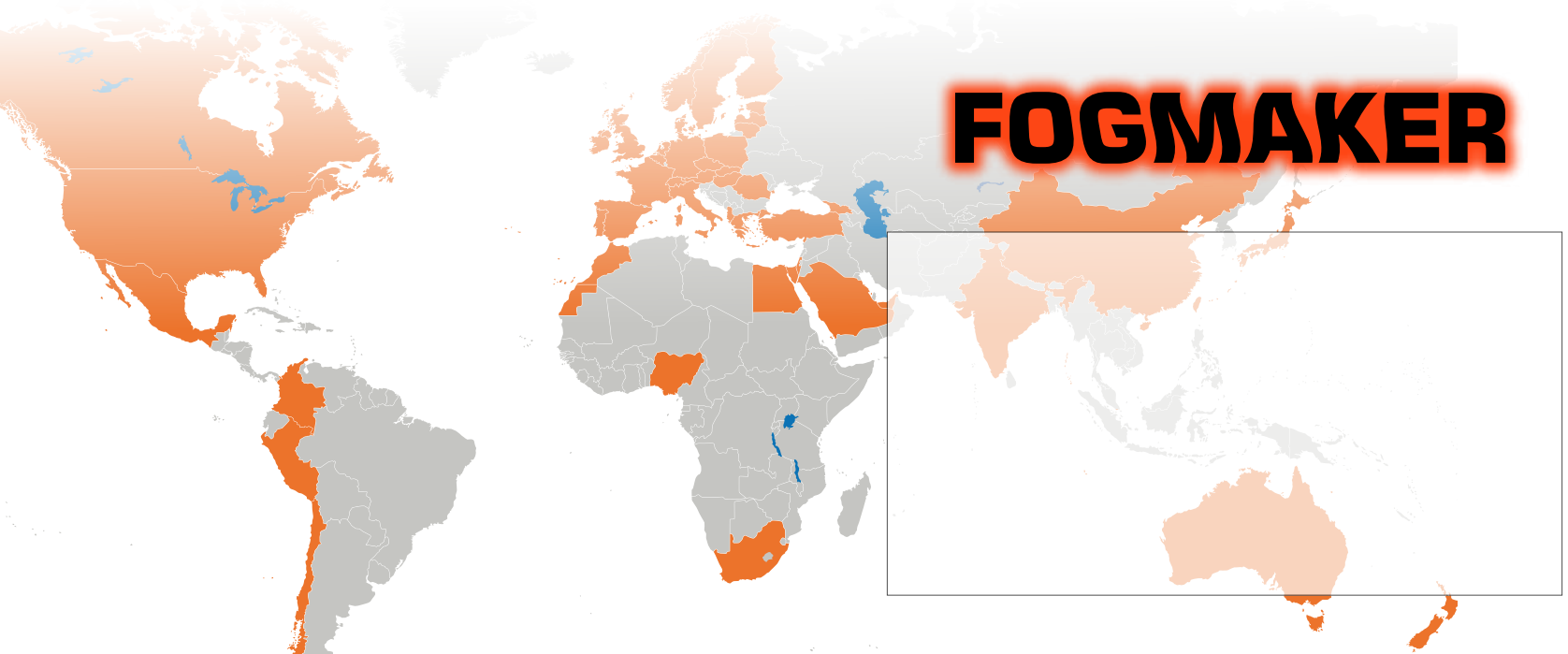
Ronnie Hansson, Section Manager Fire, LKAB, Kiruna, Sweden

"Fogmaker system have been our preferred option for the last 10 years. Over that time they have proven to be an extremely robust and reliable product. The compact nature and versatility of the Fogmaker system means lower install cost, less ongoing maintenance and has significant advantages across many equipment models and applications".

Tim O´Meara, NSW Business Unit Manager, Westrac Caterpillar, Australia

"The Bloomfield Group has been utilising the Fogmaker fire suppression system on large mobile earthmoving equipment for several years. Due to Fogmaker weight and suitable machine mounting positions, the compact design has proven to be a sound fire suppression option. We have found the Fogmaker system to be a reliable, low maintenance cost and simple system that provides us comfort that our assets are protected from the potential of fire."

David Worboys, Plant & Equipment Manager, Bloomcoll, The Bloomfield Group, Australia



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AS-5062
Australian Standard

UL-1384 (UL listed)
Underwriter´s Laboratories

SBF-127
Swedish Fire Defense Ass.

...and FM pending!
Factory Mutual

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