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The Swedish pioneers of modern water mist technology

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The objective of this paper

- ✓ Give credit to the people that pioneered the modern high-pressure technology long before the commercial break-through of water mist technology in the beginning of the 1990's.

- ✓ Hopefully, this paper will inspire others to document the history of water mist technology in other parts of the world.

Two separate companies involved

- ✓ **Electrolux Euroclean AB (later HTC i Åmål AB).**
  Key people: Omar Vestli, Håkan Ungerth, Sten Hansen and Bengt Créner.

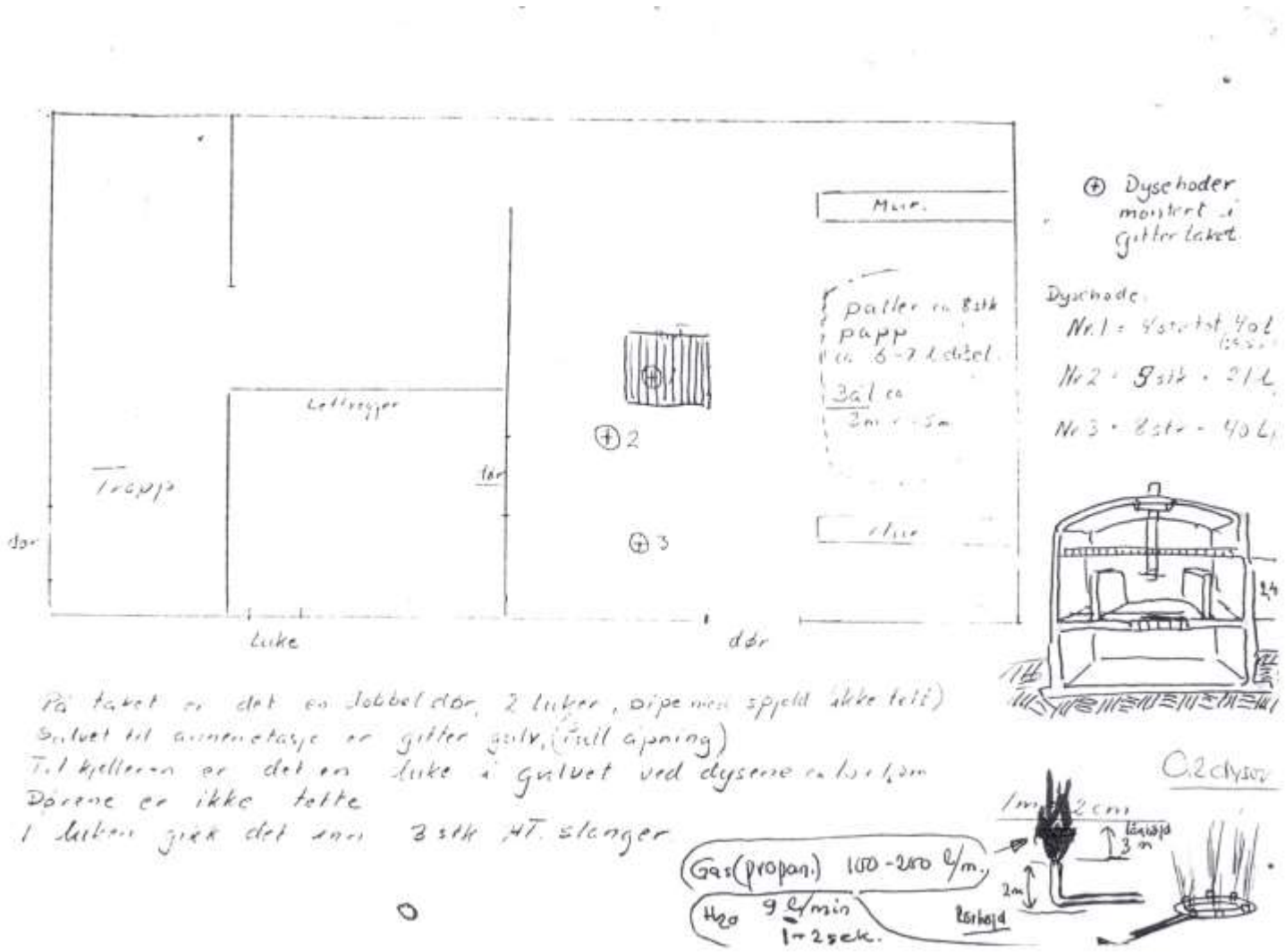
- ✓ **GIRO-Brand AB (later ULTRA FOG AB)**
  Key people: Krister Giselsson and Mats Rosander

The development by Electrolux Euroclean AB (later HTC i Åmål AB)

Omar Vestli had a background as a ship's officer and Håkan Ungerth is a Naval Architect.

Electrolux Euroclean AB were specialist in high-pressure cleaning equipment.

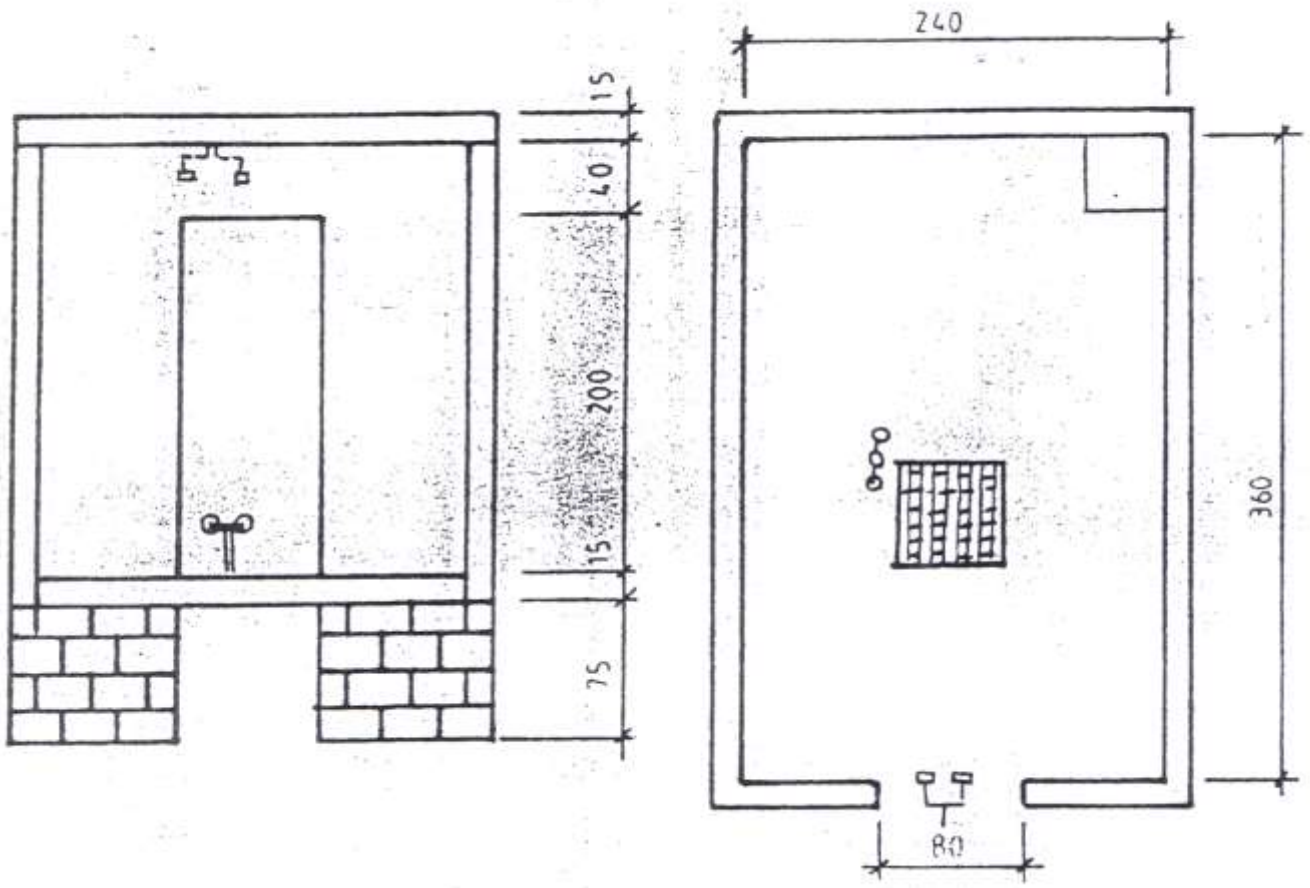
Fire tests at the Norwegian Fire Protection Training Institute in 1981



Conclusions from the test in 1981

- ✓ The fires were rapidly suppressed but not completely extinguished.
- ✓ Water droplets and water vapour suspended in the air prevented the fire from re-developing, even after system shut-off.
- ✓ When the door to the test compartment was opened and air allowed to enter the compartment, the fire re-developed.

Fire tests at SP in 1983



Conclusions from the tests at SP in 1983

- ✓ The Class A wood crib fire was suppressed but the fire was not fully extinguished.
- ✓ Water only had limited effect on the gasoline pool fire.
- ✓ The use of AFFF with the water significantly improved the efficiency of the system against the pool fire.

Patent application in 1985

11 8602211-8 A62C 35/10

SVERIGE (A) ALLMÄNT TILLGÄNGLIG

(22) ANS DAT 86-05-15 (21) ANS NR 8602211-8 1987 -12- 21
ROTEL 422
(51) KLASS B08B 3/02
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(41) OFF DAT 87-11-16 (74) OMBUD HAGELBÄCK E

(71) SÖKANDE AB ELECTROLUX
105 45 STOCKHOLM SE

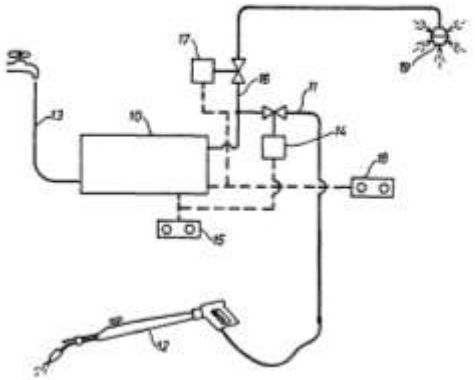
(72) UPPFINNARE O. VESTLI . ÅMÅL

(30) PRIORITETSUPPGIFTER

(54) BENÄMNING BRANDBEKÄMPNINGSSYSTEM

(57) SAMMANDRAG

Föreliggande uppfinning avser en anordning för att under högt tryck påföra vatten på en yta varvid anordningen innefattar ett intag för vatten vilket är kopplad till inloppssidan på en högtryckspump vars utloppssida via en slang eller dylikt står i förbindelse med ett eller flera rengöringsmunstycken för påläggning av vatten under högt tryck på ytor som skall rengöras. Utloppssidan hos sagda pump står via en rörledning eller dylikt även i förbindelse med ett eller flera munstycken (19) som är permanent placerade i närheten av sådana punkter i lokaler och utrymmen där brand kan tänkas uppstå eller förorsaka skada varvid de permanent anbringade munstyckena är så utformade att de vid vattnets strömning genom munstyckena finfördelar vattnet till en vattendimma som begränsar brandens utveckling.



The formation of HTC i Åmål AB in 1987

After some years with no or limited economical return Electrolux Euroclean AB decided not to develop the water mist fire protection technology any further.

A separate company was formed in 1987, HTC i Åmål AB.

The development of nozzles (automatic)

The development of nozzles (open)

The system was given the name the “Micro-Fog system”

Fire tests at SP in 1991

- ✓ Tests in the ISO 9705 “Room-corner test” compartment, furnished to simulate a passenger ship cabin or a hotel room.
- ✓ An authentic ventilation system was installed.
- ✓ An automatic nozzle was installed at the ceiling.
- ✓ The nozzle had a standard response glass bulb with a nominal operating temperature of 68°C
- ✓ 6 liter/min at 100 bar.

Fire tests at SP in 1991

Fire tests at SP in 1991

Fire tests at SP in 1991

Fire tests at SP in 1991

Conclusions from the fire tests at SP in 1991

- ✓ The gas temperatures were rapidly reduced with minimal fire and water damage.
- ✓ The fires were not completely extinguished.
- ✓ It was recommended that the nozzle be fitted with a fast response glass bulb in order to further decrease the activation time.

Fire tests conducted at SP in 1993

- ✓ Cabin and corridor fire tests.
- ✓ Automatic nozzles with a fast response 3 mm glass bulb, having a nominal operating temperature of 68°C.
- ✓ 8,7 liters/min at 100 bar.
- ✓ The system performed at an equivalent level or better than traditional sprinklers, with a fraction of the water flow rate.

Epilogue

Due to low returns on development costs, HTC i Åmål AB went out of business in 1993.

In 1994, Håkan Ungerth patented an automatic (with glass bulb) high-pressure multi-orifice water mist nozzle similar to the type of nozzle tested at SP in 1993.

The rights for the nozzle were sold to YAMATO PROTEC in Japan.

During the 1990's Håkan Ungerth continued the development of both high- and low-pressure water mist nozzles together with the Swedish company SweFire AB.

Epilogue

The development by GIRO-Brand AB (later ULTRA FOG AB)

Key people: Krister Giselsson and Mats Rosander.

Krister Giselsson graduated as a fire protection engineer in 1969 and after a number of years at different fire departments, he was given a position as a teacher at the Swedish Fire School in Stockholm in 1974.

Mats Rosander graduated as a fire protection engineer in 1977 and established collaboration with Giselsson in the company GIRO-Brand AB that was started in 1978. Rosander also received employment as a teacher at the Swedish Fire School in Stockholm, responsible for active fire-fighting.

Investigating of flashover and fire spread phenomena

The lecture book “Fundamentals of fire”

Giselsson and Rosander wrote the lecture book “Fundamentals of fire”, published in its first edition in 1978.

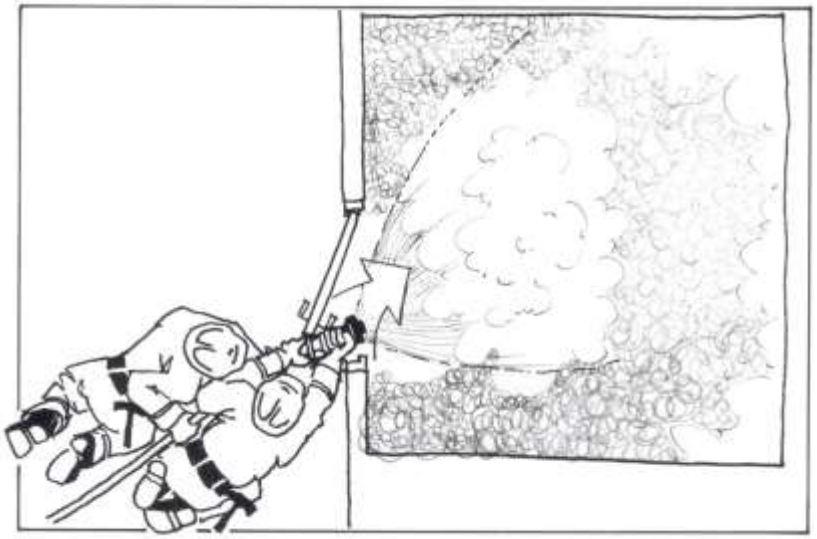
“In the future a liquid, e.g. water, atomized to drops smaller than powder grains will be the most important extinguishing agent against flames indoor, so-called fine mist” .

Lecture videos

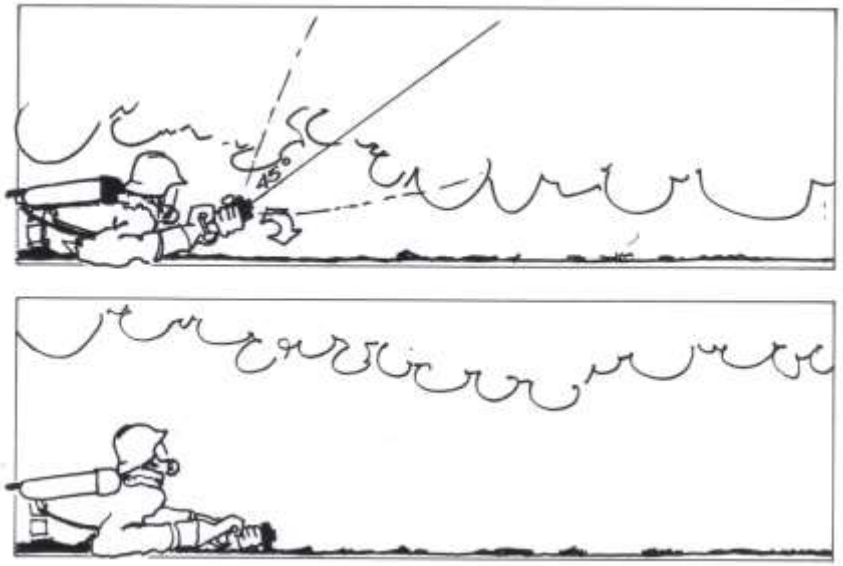
The Fogfighter® nozzle (introduced in 1982)

175 or 450 liters/min at 6 bar

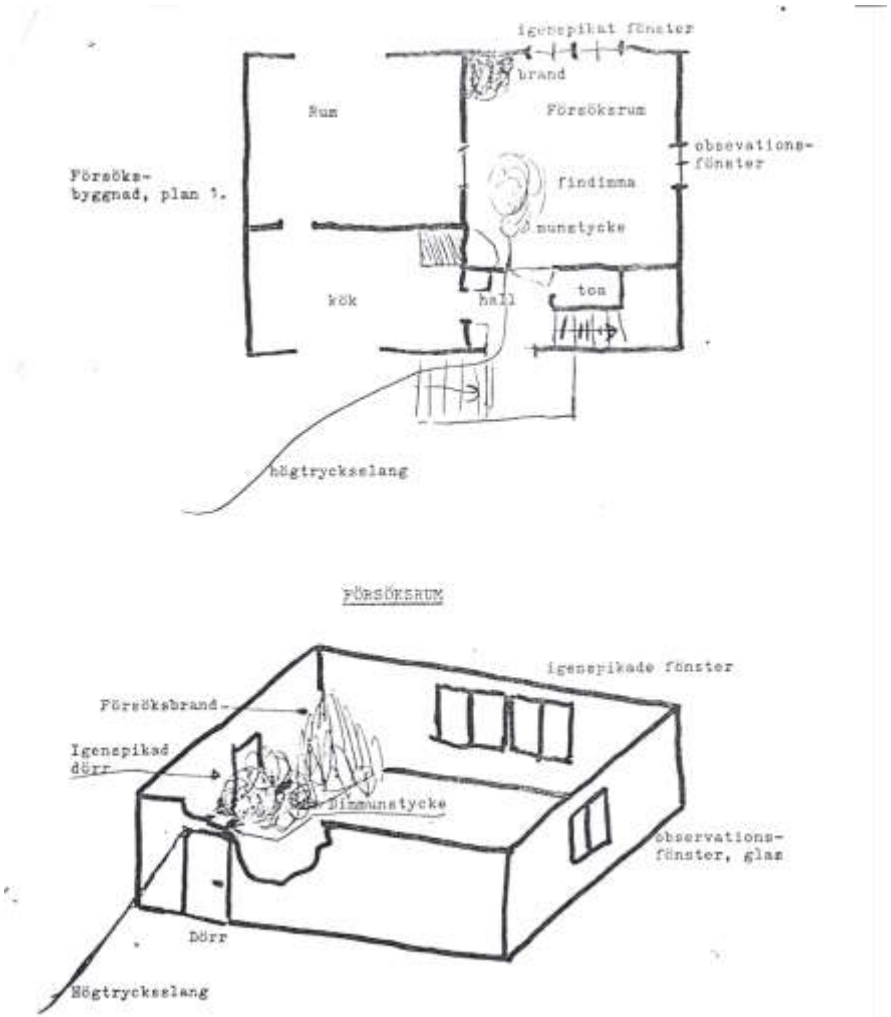
“Offensive fire-fighting”



Effective cooling of the combustion gases in the overhead without disrupting the thermal balance or creating large volumes of scalding steam.



Fire demonstration tests in Sollentuna in 1982



Conclusions from the tests in Sollentuna in 1982

- ✓ It is likely that a system using finely atomized water (7,5 liters/min) can be an alternative to traditional sprinklers.
- ✓ 7,5 liters/min was not sufficient to extinguish a severe Class A fire inside a ventilated room, i.e. with a large opening factor.
- ✓ The use of finely atomized water mist inside a compartment threatened by fire can prevent fire spread for a long period of time.

The formation of ULTRA FOG AB

In January 1990, Giselsson formed the company ULTRA FOG AB together with two other persons: Sven Brutsner and Stefan Forsström.

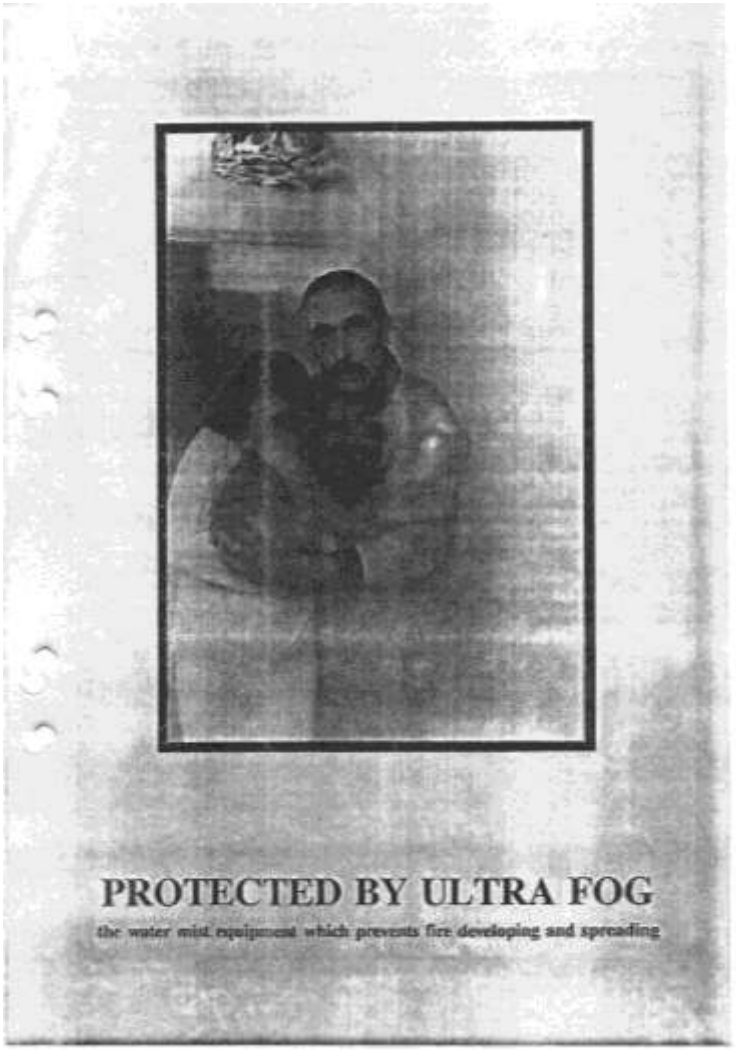
Stefan Forsström had been working as a sales representative for Electrolux Marine AB, a subsidiary of Electrolux AB and was familiar with water mist development work at Electrolux Euroclean AB.

The “Scandinavian Star” fire, April 7, 1990

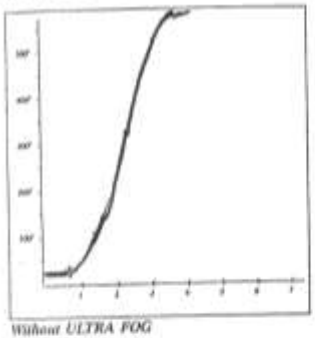
Arsonist fire.
158 people lost their lives.

Fire demonstration tests in Bålsta in June 1990

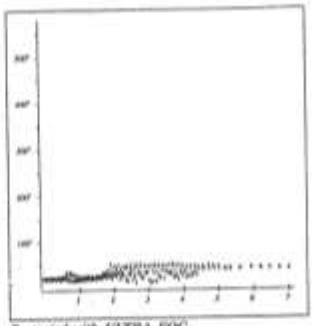
Marketing of the ULTRA FOG system (mid-1990)



ULTRA FOG - THE NEW WAY TO USE OF WATER FOR FIRE SUPPRESSION



Without ULTRA FOG



Protected with ULTRA FOG

Installing ULTRA-FOG systems will prevent fire spreading and flashovers in all normal-sized rooms. Research is being carried out to develop similar systems for larger buildings such as restaurants and cinemas.

ULTRA-FOG does everything fire-fighting should do. It not only attacks the initial fire, but its main effect is to protect the surroundings and prevent the fire spreading. People in the burning room have a much better chance of escaping, and people in adjoining rooms are much more likely to be completely safe.

ULTRA-FOG uses very little water, and so there is no water damage at all. In a small room ULTRA-FOG uses less than two litres per minute.

ULTRA-FOG is specially designed for boat rooms, ships' cabins and the passenger cabin and toilet compartments in aircraft.

Installation is simple. 10 mm stainless steel pipes, magnetic valves, a high-tech nozzle and a dual detector system are all that is required. In small rooms only one nozzle is needed - only large areas require multiple nozzles.

Water is provided by a high-pressure pump, preferably above 2000 psi. Ships already have the pumps for cleaning. Just connect the piping and the ship is much safer!

Without ULTRA FOG

Protected with ULTRA FOG

Marketing of the ULTRA FOG system (mid-1990)

HOW ULTRA FOG WORKS

The ULTRA-FOG extinguishing system resulted from research carried out by the Swedish fire engineer, *Krister Giselsson*. He developed the basic theory about the behaviour of indoor fires.

1. EXTINGUISHING FLAMES

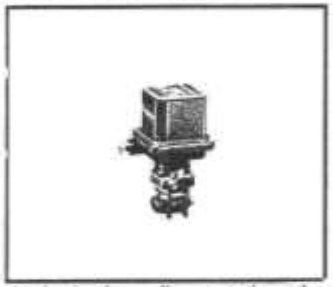
When a cold particle moves into a flame, it puts out the flame in a zone approximately 1 mm thick around its cold surface.

Dry powder extinguishers use this form of cooling. Every grain of powder is surrounded by a zone where the flame cannot burn. All these zones together put out the flame.

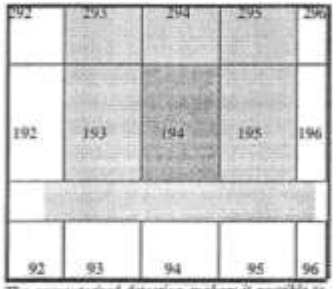
Water is ten times more heat-absorbent than dry powder and drops of water can act as cold particles.

If very small water droplets can be brought into the flame frequently enough, the flame will go out. It takes 20 million droplets per cubic metre of flame to do this. The high pressure and the precision engineered nozzles solve the problem of splitting the water flow into so many droplets. Unlike dry powder, water cannot be ground up in advance.

Even when the droplets are unable to extinguish a deep-seated smouldering fire, they kill the flames, and prevent the fire spreading.



An electric valve supplies water to the nozzle.



The computerized detection makes it possible to give advance protection to adjoining areas and isolate the dangerous area.

2. PREVENTING FLASHOVER AND THE SPREAD OF FIRE

Initially a fire inside a building looks just like a fire in the open air. With indoor fires, however, large quantities of hot combustion gases containing unburnt fuel are quickly built up. These accumulated gases can ignite, causing various types of flashover and fire gas explosions.

A fire inside a room can either develop into flashover or consume the oxygen and die down to a smouldering fire. Which it will do depends on the flammability of the gases, the degree of cooling and the amount of moisture in the room.

The addition of small water droplets to the combustible gases dramatically reduces their flammability. Particularly in the early stages of a fire the flammability of the gases is dependent on the quantity of energy released. The vaporization heat of the water droplets acts quickly to reduce the small amount of energy involved.

This ensures that the fire is reduced to smouldering. There will be no flashover and the fire will not spread.

The gases that do spread into other rooms contain water droplets and vapour, and this makes them non-flammable. No gases will ignite in any other room, and the area of the fire is limited until it can finally be extinguished.

The specially designed nozzle, one to each cabin, provides approx. 2 litres/min, and protects up to 40 sq m.

The high-pressure pump is a vital part of the system. It must be able to provide the necessary pressure and flow, even after a long period of use.

Fire tests at SP in 1992

Cabin, corridor and public space fire tests.

3,0 or 4,5 liters/min at a pressure of 180 bar. Activation via smoke detectors.

Epilogue

The first ULTRA FOG system was installed on the ro-pax ferry M/S Stena Danica in 1992.

Due to economical problems, ULTRA FOG AB went out of business in 1993.

The company was re-started with new owners and without the involvement of Krister Giselsson soon after.

The company is still active and one of the world-leaders in this area.

ULTRA FOG® AB
FIRE EXTINGUISHING SYSTEM

Conclusions

- ✓ The very first commercial, fixed high-pressure water mist systems were developed in Sweden during the late 1970's and early 1980's.
- ✓ Very early, the companies saw the potential and benefits of water mist technology.
- ✓ The companies had limited commercial success due to low initial returns on high investments.
- ✓ The pioneers of high-pressure water mist technology have not often been given the credit they deserve. In actual fact they were at least ten years ahead of the companies that we see in the market place today and their efforts underline the truism that "if your are too early you are wrong".

Acknowledgement

- ✓ Mr Håkan Ungerth.
- ✓ Mr Sten Hansen.
- ✓ Mr Mats Rosander.
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- ✓ FOGTEC Brandschutz GmbH & Co. KG, especially the efforts and input by Mr Max Lakkonen.

Thank you!


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