

**Innovative technical advances in detection and suppression  
of fires inside high-value electronic cabinets and enclosures at risk**

Joachim Gensel, Minimax

IT-systems which once used the space of a large computer center today fit into a single high-tech IT rack system. As society demands increasing speed and volume of data transmitted at any time, anywhere, worldwide, telecommunications and server facilities are being installed everywhere in all kinds of conditions requiring innovative design features to protect the smaller electronic shelters and cabinets. These features require efficient space use while being flexible and portable. Minimizing the space required for a fire protection system within the protected cabinet is the challenge for these “IT Worlds”. At the same time, the clean agent solutions used for such protection must not be susceptible to future regulatory risk.

Fire suppression designs for other enclosures like ATM machines, small transport container for hazardous goods, control cabinets used for automation of technical processes etc., very often also fail due to limited space for installation for the fire suppression components.

This presentation is about a development of two unique technological breakthroughs that resolve these challenges.

One involves an innovative 1 unit (1U) modular design using a non-conventional clean container and delivery system allowing for the protection of a single cabinet or extend as a manifold system to protect multiple cabinets. Discussion centers on the features of this technology in how it takes advantage of the low vapor pressure of clean agent FK-5-1-12 to efficiently use space while using a patented delivery system that incorporates an innovative and reliable delivery method that is self-monitored for integrity.

1. Flat 19-inch unit for high-value electronic cabinets

Innovative heart of this system is flat rectangular fire extinguishing agent container made of aluminum. The containers height is 40mm (1,6in.) and thereby can be installed in a 1U standard rack (44.5 mm/1.75 in). The empty volume amounts to. approx. 2200ml/0.50gal with a length of 500mm/19,7in. The container filling volume amounts to e.g. 3.2kg/7,05lb clean agent FK-5-1-12. Other fire extinguishing agents are likewise possible. The maximum permissible protection volume of the system is approx. 3.0m<sup>3</sup>/106ft<sup>3</sup>.

An electrical impulse releases the system and the ignition of an pyrotechnic load of the propellant gas cylinder. The load pierces the closure membrane of the propellant cylinder. The stored propellant is 7,5g/0,27oz. helium with a pressure > 600 bar/8700psi. Via pressure reducing orifices the propellant flows into the control box and operates a piston. The piston opens for the propellant into the container. The fire extinguishing agent flows to the nozzle, Using FK-5-1-12 the nozzle pressure is approx. 12bar/175psi.

The fire extinguishing agent is distributed via the nozzle that is placed in the front of the unit. The advantage of this arrangement with no obstructions is an optimal spray pattern. Contrary to this arrangement the distribution of the fire extinguishing agent on the devices backside is obstructed by the wiring. The pressure of the propellant is constantly high during the entire flooding time so that the fire extinguishing agent is brought out with high dynamic, evaporates quickly and is distributed homogeneously.

The extinguishing agent container is dimensioned for an operating pressure of 16bar/230psi, the test pressure amounts to 25bar/360psi and the burst pressure is > 50bar/725psi. The container consists of standard aluminum box section and is additionally strengthened with welded ribs. An integrated sensor monitors the level of agent in the container and signals a fault if the specified level falls below around 10%.

An aspirating system with two smoke sensors detects a developing fire fast and reliably. A high performance fan sucks air samples into the measuring chamber - also with very high velocity of the cooling air inside an enclosure.

## 2. Monolithic unit for enclosures

The second unit incorporates a monolithic computer-driven design consisting of an agent container, leakage indicator, programmable electronic, power supply and an innovative nozzle.

The agent container is milled from a solid aluminum block and is also used as a sub-rack for the control board and electric connectors. No additional housing is needed for operation. The unit is designed for vertical installation, inside cabinets typical at the front door, back- or side panel of an enclosure. The empty volume amounts to approx. 1100ml/0.25gal, with a length of 370mm/14.6 in., width 280mm/11.0 inch, height 170mm/6.7 inch. The container filling volume amounts to approx. 1.9kg/4.2lb clean agent FK-5-1-12.

Heart of this system is an innovative design of a valve/nebuliser unit. This unit mainly operates with a vacuum aspirating effect. After detecting the fire a strong electric motor activates a valve to open the agent container and a valve for ventilation of the container by centrifugal force. In the same moment a flat disk (nebuliser) starts to rotate, thereby with the effect of low pressure difference to the agent container. Due to low pressure the agent is sucked onto the surface of the rotating nebuliser.

The effect of fast rotating nebuliser with approx. 30.000 rpm is a strong centrifugal force. The agent is shredded to very small droplets thrown everywhere into the enclosure. The agent evaporates quickly and is distributed homogeneously.

The electric motor to drive the valves and the agent distribution disk is powered by a strong lithium-polymer battery. This battery also supplies the unit in case of power failure for at least 60 minutes.

Fire detection is with an external detector (smoke, heat etc.) which is connected to the integrated control board via a standard interface to fit different detectors. For status control and parameter adjustment the unit has a web interface.