

FM-200[®] FIRE EXTINGUISHING AGENT

In response to the impending production phase-out of Halon fire extinguishants, Kidde Fire Protection can offer the GX20 System using FM-200[®] (Heptafluoropropane) as a replacement for Halon 1301 in applications requiring a clean, environmentally acceptable fire extinguishing agent, suitable for use in manned areas.

Performance

FM-200 extinguishes fires primarily by physical means. It has properties which function well with traditional Halon 1301 equipment. It is a colourless gas at standard conditions, exhibiting a boiling point of -16.4°C as compared to a boiling point of -57.8°C for Halon 1301.

Through the use of properly designed equipment, FM-200 will mix well in a protected enclosure to provide a homogenous mixture in air. Since Halon 1301 is typically super-pressurised to either 25 bar or 42 bar for fire suppression applications, FM-200 is super-pressurised to achieve rapid discharge into the protected environment.

The liquid density of Halon 1301 at 21 °C is 1.32 kg/L and for FM-200 is 1.17 kg/L. The characteristic that determines the amount of agent that can be safely stored in a given cylinder is the maximum fill density.



Kidde Fire Protection advises that the maximum fill density for a cylinder of FM-200 pressurised with nitrogen to 360 psi is 1.15 g cm⁻³. Accordingly, the storage capacity for FM-200 is around 1.5 times that of Halon 1301, the closest of all viable replacement agents.

Toxicity

In determining a safe exposure level to any agent intended for use

in occupied spaces, the potential of the agent to cause cardiac sensitisation should be determined. FM-200 has been evaluated for this condition via test protocols approved by the US Environmental Protection Agency, and has been cleared for use in occupied areas at the normal design concentration.

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TECHNICAL SPECIFICATION

	HALON 1301	FM-200®
Chemical Formula	CF ₃ Br	C ₃ F ₇ H
Ozone Depletion Potential	16	0
Molecular Weight	148.9	170.03
Boiling Point	-57.8°C	-16.4°C
Critical Temperature	67.0°C	102.0°C
Extinguishing Concentration, Heptane Cup Burner (% by volume)	3.5%	5.8%
Inerting Concentration (Explosion Sphere, 70 joules ignition energy) - Methane	4%	8%
Vapour Pressure at 21°C	214 psia	68.8 psia
Acute Toxicity (LC50-4hr)	800,000 ppm	>800,000 ppm

Ozone Depletion Potential (ODP)

As the concerns over stratospheric ozone protection have developed in recent years, it is clearly understood that any agent that is expected to be available for use in the market on a long term basis would have to offer zero ODP. Since FM-200 contains no chlorine or bromine and does not possess the properties associated with the compounds thought to damage stratospheric ozone it has an ozone depletion potential of zero.

Global Warming Potential

Biodegradability of chemical compounds in the environment is also a paramount concern. Long-lived compounds are thought to pose greater risks of contributing to global warming. Determination of the atmospheric lifetime of FM-200, indicates a lifetime of only 31 to 42 years. This lifetime has been considered as acceptable for fire extinguishing compounds by the US Environmental Protection Agency's Significant New Applications Programme (SNAP).

Compatibility

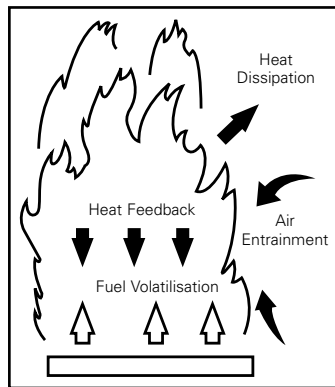
FM-200 is a very stable compound and in the absence of excessive moisture is not expected to react with common construction materials such as metals and polymers. Tests show that elastomers such as some EPDM materials and nitrile compounds perform well with FM-200.

HOW FM-200 WORKS

Introduction

In order for a fire to be sustained, the three components fuel, oxygen and heat, must be present in sufficient quantities, and at sufficient levels.

If one of the three elements is removed the fire will be suppressed.

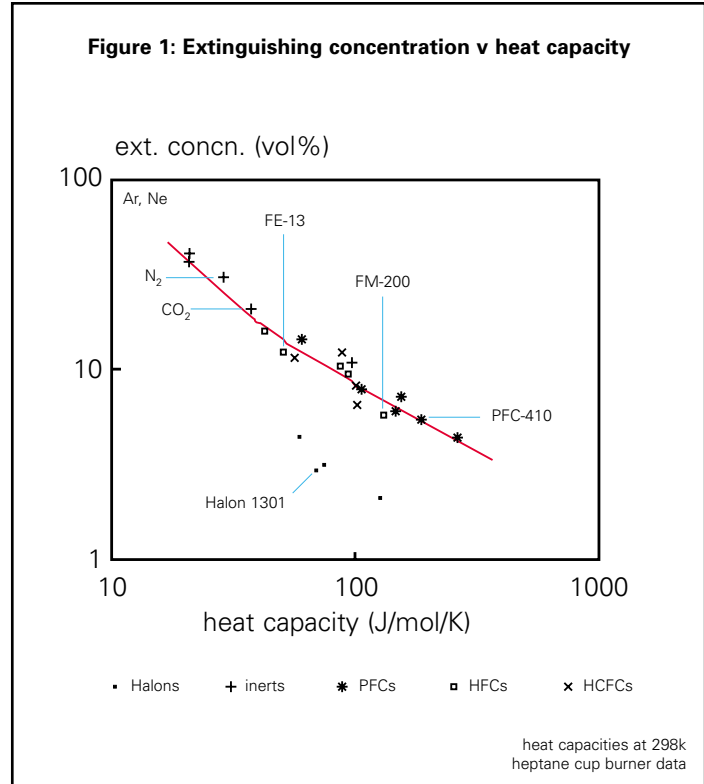


The Theory of Combustion

Fire is the physical manifestation of a series of high heat-releasing chemical reactions between fuel and oxygen. While a proportion of the heat is dissipated to the surroundings, sufficient heat must be returned to the fuel in order for it to vaporise and continue the combustion process. Physically-acting extinguishing agents act by absorbing heat and disturbing this dynamic energy balance.

Introduction of sufficient agent into the fire gases reduces the flame temperature to a limiting value below which flame propagation cannot occur.

In figure 1, the minimum extinguishing concentration (using



the n-heptane cup burner test) of various agents is plotted against their heat capacity.

FE-13, FM-200, and PFC-410 have progressively higher heat capacities*, consequently their required extinguishing concentrations become progressively lower.

Agent	Extinguishing Concentration
FE-13	13.0%
FM-200	5.8%
PFC-410	5.5%
Halon 1301	3.0%

Halon 1301 is a more efficient extinguishant despite having poorer heat absorbing qualities than FM-200.

This is because in addition to the heat absorption effect, the bromine in Halon 1301 catalyses removal (through recombination) of the flame propagating radicals and so suppresses the fire by chemical means.

It is the bromine in Halon 1301 which causes depletion of the Ozone Layer and has led to Halons being phased out under the Montreal Protocol.

Although PFC-410 is slightly more efficient than FM-200, it has a higher global warming potential and is therefore preferred for special applications only.

FM-200 works by physical action, the molecules absorb heat so that



the temperature of the flame falls to a point below which it cannot propagate, and the fire is extinguished. The oxygen depleting effect is minimal as only small quantities of the gas are used.

Inerting Gases

The inerting gases, such as nitrogen, argon and carbon

dioxide, are very poor heat absorbers (refer to figure 1) and high concentrations are needed to suppress fires. Consequently the oxygen concentration in an atmosphere becomes severely depleted, typically around 12%.

Atmospheres where the oxygen level is below 16% are considered a potential health hazard. Carbon dioxide is also toxic at

concentrations above about 8%.

* Heat capacity is the amount of heat energy absorbed by a unit of a compound in raising its temperature by 1°C. Normally it is quoted per g of compound or, as in Figure 1, for a fixed number of molecules (ie per g mol).

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ENGINEERING SPECIFICATION

Description

FM-200 is an environmentally acceptable fire extinguishing system which uses FM-200 and is therefore safe for use in both occupied and unoccupied areas. The system has been specially developed by Kidde Fire Protection.

FM-200 (heptafluoropropane) is a fluorinated alkane manufactured by Great Lakes Chemical Corporation, which meets the strict US EPA criteria required of a gas to replace Halon 1301.

FM-200 Extinguishing System Specification

FM-200 System

The FM-200 fire extinguishant shall be stored in welded mild steel FM-200 cylindrical containers which are designed, manufactured and tested to DoT (HSE) 4BW500 for FM-200 use, and pressurised with dry Nitrogen to 25 bar at 20°C.

The extinguishant storage containers shall be capable of configuration into modular or central storage installations. Every container shall be fitted with a GCV valve to enable the contents to be discharged through system pipework and nozzles within 10 seconds.

A discharge pressure switch shall be fitted to the distribution pipework via a pilot loop. The pressure switch has a manual reset facility and shall be wall mounted.

Normally the FM-200 system shall be switched to automatic mode. However, subject to local regulations, it may be necessary for the system to be switched to manual mode when the area is occupied. A pre-discharge alarm is to be sounded on system operation to alert anyone still in the area.

All FM-200 flow calculations shall be supported by a Kidde Fire Protection approved computer program and print-out.

FM-200 Valves

The valve shall be manufactured from a hot brass stamping to give a strong porous-free structure and corrosion resistance and shall be fitted with a pressure gauge. Connection to a manifold shall be by flexible hose and check valve.

Various valve control heads and actuators shall be available for 24V DC, manual or pneumatic activation. All shall be detachable for safe system installation and full functional checking during maintenance.

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FM-200 Containers

243L, 142L and 81L containers may be fitted with contents monitoring to check the amount of extinguishant in each container via a permanently fitted indicator. These containers should not have to be disconnected from the distribution pipe during contents monitoring.

Containers shall be painted red. A label shall be affixed to each container showing the correct contents.

FM-200 Distribution Pipework

Distribution pipework shall be carbon steel supplied in galvanised or black finish, painted red after installation and testing.

FM-200 Control Heads

Actuation of the FM-200 system shall be by a 24V DC control head directly mounted to the container valve. If multiple containers are required, a master and slave principle may be adopted.

The control head shall have a local manual release facility and preferably a visual indication of "released" and "set" conditions. A micro switch shall also be incorporated for remote monitoring of "released" and "set" if required.

FM-200 Nozzles

Discharge nozzles shall be FM-200 type, manufactured from brass and specifically designed for use with FM-200.

FM-200 Warning Notices

All entrances to the protected area shall have a warning notice displayed. All system manual release points shall have a cautionary notice adjacent to them. All notices shall be from the standard FM-200 range of equipment and manufactured from corrosion resistant materials.

FM-200 Compatible Accessories

All FM-200 systems are to be built from system compatible components approved for use by the supplier and certified to BS5750 Parts 1 and 2.

Further Information

The FM-200 System is part of the Kidde family of fire protection components designed and manufactured to the highest standards of quality and reliability.

Both fire detection and controls are available from the Kidde range of smoke detectors, heat detectors and control units, employing the latest developments in electronic technology.

Further information on the Kidde product range is available from your local sales office and direct from the address below.

Customer Support

Kidde Fire Protection equipment is designed to meet local and international standards.

Systems are designed and installed by fully trained fire protection engineers. Component supply and refill service is available from a worldwide network of Agents.

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