Kidde Fire Protection

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 1.12 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.

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

Technical specification

	HALON 1301	FM-200®
Chemical Formula	CF_3Br	C_3F_7H
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

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

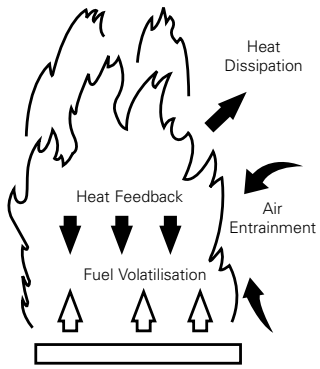
FM-200 is a very stable compound and in the absence of excessive moisture is not expected to react with common construction materials such as metals and polymers. Tests show that elastomers such as some EPDM materials and nitrile compounds perform well with FM-200.

How FM-200 works

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 oygen.



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 overleaf, 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.

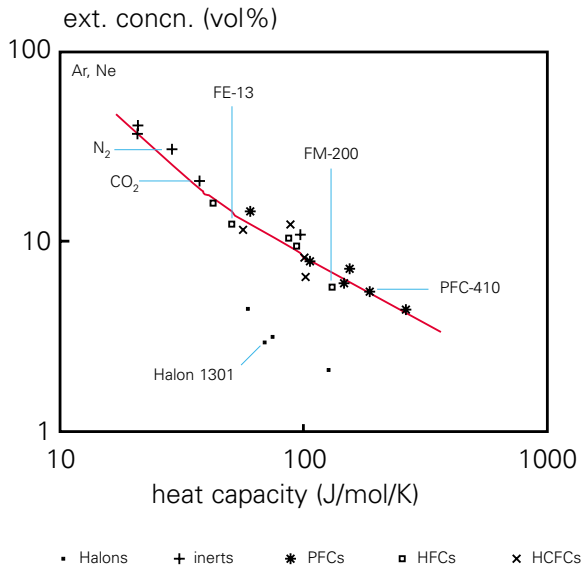
Although PFC-410 is slightly more efficient than FM-200, it has a higher global warming potential and is therefore preferred for special applications only.

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%.

Figure 1: Extinguishing concentration v heat capacity



heat capacities at 298k
heptane cup burner data

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).

BS EN ISO9001
FM00215

Approved

Kidde Fire Protection
UK Sales Office – Head Office
Thame Park Road, Thame, Oxfordshire OX9 3RT, UK.
Tel: +44 (0)1844 265003. Fax: +44 (0)1844 256156. E-mail: info@kfp.co.uk Web: www.kfp.co.uk
UK Sales Office
Unit 12, Atley Way, North Nelson Industrial Estate, Cramlington, Northumberland NE23 1WA UK
Tel: +44 (0)1670 713455. Fax: +44 (0)1670 735553
International Offices
Dubai: Tel: +971 4 337 2498. Fax: +971 4 337 5088
Hong Kong: Tel: +852 2195 3688. Fax: +852 2743 7477
Singapore: Tel: +65 424 7979. Fax: +65 424 7978
Australia: Tel: +61 3 9765 3850. Fax: +61 3 9765 3800

E9832-008 03/03