

GX-20/FM-200

Fire Extinguishing System



Halon fire extinguishants were regarded for many years as the most effective fire suppressants for a wide range of applications. Amendments to the Montreal Protocol of 1987 focused on the manufacture of Halons, however, and their production has now ceased in recognition of their virulent destruction of the ozone layer. In addition, new European legislation requires that Halon systems within the EU must be removed by the end of 2003.



As a result, recent years have seen a substantial reappraisal of approaches to fire protection. Kidde Fire Protection is at the forefront of new technologies in fire safety, offering a range of state-of-the-art fire extinguishing systems.

Kidde Fire Protection offers GX-20 systems containing FM-200®, a gaseous agent manufactured by Great Lakes Chemical Corporation, which has emerged as a viable alternative to the Halons on the basis of extensive trials. FM-200 is fast and effective with a low space/weight characteristic which is also environmentally-acceptable and safe for human exposure.

FM-200 has been adopted by the majority of the world's fire protection companies and is the most widely used Halon replacement, with tens of thousands of systems installed across the globe.

Benefits

- Fast and effective against a wide range of Class A, B and electrical fires
- Safe for occupied areas
- Non-corrosive and electrically non-conductive
- No post-discharge residue and clean-up
- Environmentally-acceptable
- 25 bar system
- Engineered and pre-engineered systems available
- Range of system release options
- Low installation and maintenance costs
- Computer design maximises effectiveness of system
- FMRC/LPCB approved components with ULI listed systems available on request
- Marine systems available



Asset protection

It is a chilling statistic that of companies suffering an accidental fire event, 43% never re-open and a further 29% close within three years. Ensure that your business is adequately protected and does not yield to this fate.

What is FM-200?

FM-200 is a colourless, odourless gas containing only carbon, hydrogen and fluorine, thereby lacking the ozone-depleting presence of bromine atoms. Highly penetrative and achieving an homogeneous dispersion in the hazard zone, it acts on fires largely by physical means, lowering the temperature of the flame and fuel to a point at which combustion reactions cannot be sustained. There is no significant obscuration on discharge and this non-corrosive and electrically non-conductive agent causes no damage to sensitive equipment with no post-discharge clean-up required.

The environment

FM-200 has a zero ozone-depletion potential and a short atmospheric lifetime. When used in a fire event, FM-200 mitigates the effects of an uncontrolled fire and at the end of the lifetime of the system, the gas can be readily recovered and recycled.

System design

The GX-20 range comprises a versatile line of cylinders, valves and related components which have been selected for use with FM-200 and have been subject to stringent testing procedures. Flexibility, quality and reliability make the Kidde Fire Protection GX-20 range the world's finest in fire safety and the equipment carries third party listing through the Factory Mutual Research Corporation and the Loss Prevention Certification Board. Systems are UL1066 compliant.



Pressure Operated Control Head



Electric Control Head



Electric & Cable Operated Control Head



Lever Operated Control Head



Lever & Pressure Operated Control Head

Safety to personnel

A significant body of toxicity data has been obtained for FM-200 from over 70 studies. The US Environmental Protection Agency and the UK Halon Alternatives Group accepts the use of FM-200 in occupied spaces up to 9% concentration without mandated egress times and at up to 10.5% with mandated evacuation times. Since the agent does not act by oxygen-depletion in the hazard zone, it poses no human asphyxiation threat.

Both engineered and pre-engineered systems are available. The pre-engineered systems offer a low engineering/design cost option with defined maximum design parameters. Engineered systems offer optimum designs for the defined risks with reduced pipe sizes, unbalanced flows and common room and void protection possible.



Electric Control Head (Stackable)

GX-20 cylinders

A wide range of sizes is available, offering a choice of fill capacities to meet specific requirements and ensure maximum economy in installation. Each cylinder is manufactured from high strength alloy steel. The larger cylinders have an optional liquid level device for ease of contents monitoring and improved system maintenance.

GX-20 valves

GX-20 valves are designed for optimum system performance, reducing pipe sizes and lowering installation costs. The fast-opening valves are available in a range of sizes and are manufactured from tough, corrosion-resistant brass under stringent quality control standards. The valve design enables the Kidde worldwide network of factory-trained distributors to recharge the cylinders without the need for replacement parts. An easy-to-read gauge on the valve permits the convenient visual inspection of the cylinder pressure. GX-20 valves are actuated by one of the following means:

- Electric solenoid
- Pneumatic
- Local manual release at the control head
- Manual release at a remote pull box

All related components from discharge nozzles to control heads are designed to be compatible, allowing a complete system to be configured using FMRC and LPCB approved Kidde Fire Protection equipment.

Nozzles

A range of custom-designed nozzles is available including 180° wall-mounted and 360° ceiling-mounted types.

System space requirements

System space and weight are usually at a premium in industrial and commercial premises. FM-200 is stored as a liquid in nitrogen-pressurised containers at 25 bar, leading to minimal storage requirements comparing favourably with all other viable gaseous agents.

Approvals

Kidde FM-200 systems are FM listed, meet the criteria of UL1058A and carry LPCB design manual and component approval.

Applications

GX-20 systems are ideally suited to the protection of high value assets from both loss by fire damage and the accompanying catastrophic plant down-time. Applications include:

- Computer suites, EDP facilities and telecommunications hardware
- Control rooms such as railway signalling centres and air traffic management centres
- Stores and archives
- Heritage sites such as art galleries and museums
- Medical and laboratory equipment
- Petrochemical plant, offshore oil and gas installations, pipeline pumping stations
- Ship machinery spaces, rail locomotives and rolling stock

Assured reliability

Kidde Fire Protection systems are designed to conform to NFPA 2001 and BFPSA Code of Practice requirements. An empirically-verified windows-based computer program is used to model two-phase agent flow and ensure that the correct concentration of agent is achieved within 10 seconds throughout the protected zones as required by the NFPA Standard and BFPSA Code.





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

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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

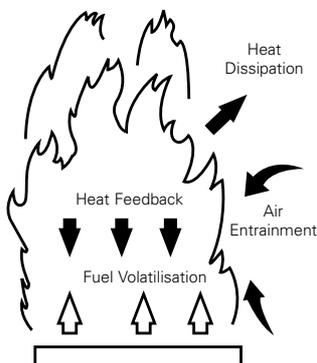
Fire is the physical manifestation of a series of high heat-releasing chemical reactions between fuel and oxygen.

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 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.

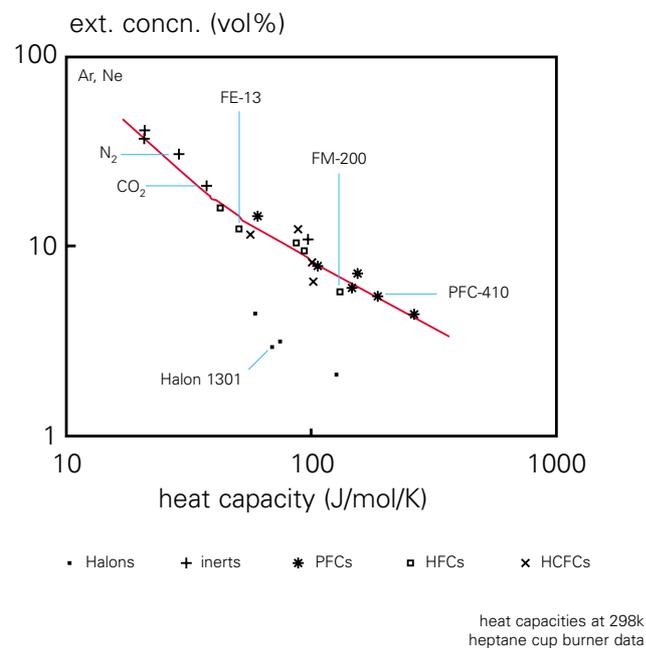
Although PFC-410 is slightly more efficient than FM-200, it has a higher global warming potential and is therefore preferred for special applications only.

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



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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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

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