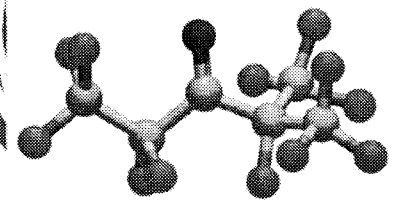


청정 소화 기술 : Novec 1230

박대순*

Fluoroketone
A breakthrough in fire protection science!




1,1,3,3,3M™ Novec™ C₈ F-Ketone Protection Fluid -one

3M Novec™ 1230
Fire Protection Fluid

Requirements for a Clean Agent
For fire protection of special hazards


- Must be effective -- fire performance
- Must be safe to use -- low in toxicity
- Must leave no residue -- electrically non-conductive
- High compatibility, non-corrosive
- Must be environmentally sustainable



3M Novec™ 1230
Fire Protection Fluid

The "Next Generation" Halon Replacement
Meeting industry concerns for safety, performance and the environment

- Zero Ozone Depletion Potential
- Very low GWP / Short atmospheric lifetime
- Low toxicity
- Effective for flooding & streaming
- Safe for sensitive, valuable assets



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Fire Protection Fluid

A long term, environmentally sustainable solution...

Properties	Novec™ 1230	halon 1301	HFC-227ea	HFC-23
Ozone Depletion Potential	0.0	10.0	0.0	0.0
Global Warming Potential	1	6900	2500	12000
Atmospheric Lifetime (years)	0.014	65	35	260
SNAP Approval	Yes	No	Yes	Yes

Significant greenhouse gas emission reductions!

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Fire Protection Fluid

GWP of Various Compounds

Compound	GWP (100 Yr E1H)	Category
CO ₂	1	Naturally occurring compounds
N ₂ O	296	
CH ₄	23	
CF ₃ CH ₂ F (HFC-134a)	1,300	
CF ₃ CF ₂ CF ₃ (HFC-227ea)	3,500	HFCs
CF ₃ I (HFC-23)	12,800	
C ₂ F ₆	11,800	PFCs
C ₂ F ₄ , C ₃ F ₈ , C ₄ F ₁₀	8,600 - 9,000	
SF ₆	22,200	
C ₂ F ₅ OCHF ₃ (HFE-7100)	520	HFEs
C ₂ F ₅ O ₂ CF ₃ (HFE-7200)	55	
C ₂ F ₅ OC ₂ F ₅ CF ₃ (HFE-7300)	1	

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Environmental Footprint Comparison

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* 박대순: 한국쓰리엠(주)

Highest Safety Margin for Flooding Agents

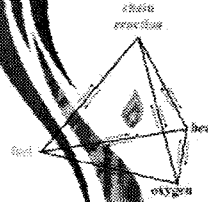
Agent	Use Conc.	NOAEL*	Safety Margin
Novec™ 1230	4 - 6%	10%	67 - 150%
halon 1301	5%	5%	—
HFC-227ea	7.5 - 8.7%	9%	3 - 20%
Inert Gas	30 - 40%	43%	7 - 13%
CO ₂	30 - 75%	<5%	10th @ design conc.

*No Observed Adverse Effect Level

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Extinguishing Mechanism

The Fire Tetrahedron

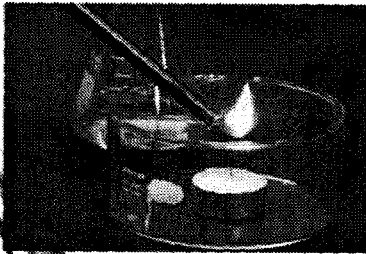


Removing one of the required components for fire or disrupting the balance between them can cause a fire to extinguish

Novec 1230 fluid extinguishes primarily via cooling - removing heat from the fire

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Fire Protection Fluid

Fluid - Gas Demonstration



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Cylinders needed for typical Class A Total Flooding System



Halon 1301 HFC-227ea Novec 1230 CO₂ Inert Gas
3M Novec™ 1230
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Easy to fill, easy to transport

- Boiling point 49°C (Liquid @ room temp)
- Can be shipped by air
- Low vapor pressure
- Simple fill station requirements
- Multiple uses (includes streaming & flooding)



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Fire Protection Fluid

Typical Physical Properties

Chemical formula	C ₈ F ₁₇ CO ₂ CF ₃
Molecular weight	316.64
Boiling point @ 1 atm	49°C (120.2°F)
Freezing point	-108°C (-162.4°F)
Density, sat. Liquid @ 25°C	1.60 g/ml (99.9 lbm/ft ³)
Density, gas 1 ATM @ 25°C	0.0136 g/ml (0.852 lbm/ft ³)
Specific volume, 1 ATM @ 25°C	0.0733 m ³ /kg (1.17 ft ³ /lb)
Liquid viscosity @ 25°C/30°C	0.11/0.55 centipoises
Heat of vaporization @ BP	88 kJ/kg (37.9 BTU/lb)
Solubility of H ₂ O in Novec 1230 @ 25°C	<0.001% by wt.
Vapor pressure @ 25°C	0.40 bar (5.87 psig)
Dielectric strength (rel. to N ₂ at 1 atm)	2.3

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Fire Protection Fluid

Elastomer Compatibility

Compatibility of "O" Rings with Novec 1230

Elastomer Type	Exposure Time (hr)	Type	Change in Property	
			Shore A Hardness	Volume
Niprene	25	1 Week	-0.5	-0.5
	100	1 Week	-2.2	+0.8
Butyl rubber	25	1 Week	-2.7	+0.7
	100	1 Week	-6.9	+6.2
Fluoro elastomer	25	1 Week	-0.2	+0.0
	150	1 Week	-12.8	+16.6
EPDM	25	1 Week	-4.7	+0.7
	150	1 Week	-5.7	+2.4
Silicone	25	1 Week	-	+2.8
	150	1 Week	-5.4	+1.1
Nitrile	25	1 Week	-0.7	-0.9
	150	1 Week	+2.0	+0.7

Novec 1230 fluid is compatible with normal materials of construction

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Fire Protection Fluid

Metals Compatibility

Effects of Boiling C₈F₁₇CO₂CF₃ on Various Metals

Product C ₈ F ₁₇ CO ₂ CF ₃ Ketone	
Boiling Point	(49°C)
Metals (10 days minimum exposure)	
Aluminum Alloy 6262 T6511	A*
Brass Alloy UNS C36000	A
AISI Type 304L stainless steel	A
AISI Type 316L stainless steel	A
Copper UNS C12200	A
ASTM A 516, Grade 70 carbon steel	A

* A* = no discoloration or deterioration of fluid or metal at temperature indicated

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