



Safety
Products

Ansul

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COMPARISON OF CLEAN AGENTS

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The following information is the best available as of the date of publication. For certain items, where information has not been immediately available, reasonable estimates have been made where appropriate.

<u>Basic Agent Information</u>	Halon 1301	INERGEN®	FM-200™	FE-13™	CEA-410	NAF-S-III
NFPA Identification (ASHRAE Class)	Halon 1301	IG-541	HFC-227ea	HFC-23	FC-3-1-10	HCFC Blend 'A'
Manufacturer	various	Ansul	Great Lakes Chemical	E. I. DuPont	3M	North American Fire Guardian
Type	Synthetic - Halon	Natural	Synthetic - HFC	Synthetic - HFC	Synthetic - PFC	Synthetic - HCFC's
Chemical Name	Bromotrifluoromethane	Mixture of Atmospheric Gases	Heptafluoropropane	Trifluoromethane	Perfluorobutane	Blend of HCFC's
Chemical Formula	CF ₃ Br	52% Nitrogen 40% Argon 8% Carbon Dioxide	CF ₃ CHFCF ₃	CHF ₃	C ₄ F ₁₀	4.75% CHCl ₂ CF ₃ 82% CHClF ₂ 9.5% CHClFCF ₃ 3.75% Isopropenyl -1 - Methylcyclohexane
Notes:					By-product from a principal production processes. Details not available at present.	An HCFC blend that is already subject to mandatory reductions in production. Phase out to be 35% in year 2004 and 99.5% in year 2020 in USA under the Clean Air Act.

Environmental	Halon 1301	INERGEN®	FM-200™	FE-13™	CEA-410	NAF-S-III
EPA "SNAP" Status	discontinued per Montreal Protocol	accepted, subject to use conditions	accepted, subject to use conditions	accepted, subject to use restrictions	accepted, subject to use restrictions	accepted, subject to use conditions
Special Restrictions					Per EPA: Agent may not be used if other agents are technically feasible	
Ozone Depletion Potential (CFC-11 = 1)	16	None	None	None	None	0.044
Global Warming Potential (CO₂ = 1)	5,600	None	2,050	9,000	5,500	1,600
Atmospheric Life Time	65 years	Derived from atmosphere	31 to 42 years	235 to 280 years	2,600 years	16 years
Testing and Training Allowed ?	No	Yes	No	No	No	No
Release of Agent Allowed During Service/Maintenance ?	No, must be recovered	Yes	No, must be recovered	No, must be recovered	No, must be recovered	No, must be recovered
Countries where installations have never been permitted, or where the sale or importation of the agent or the installation of new systems has been discontinued or severely restricted.	all countries that are signatories to the Montreal Protocol	Available internationally without environmental restriction	Germany Denmark Switzerland Sweden United Kingdom Japan	Germany Denmark Switzerland Sweden United Kingdom Japan	Germany Denmark Switzerland Sweden United Kingdom Japan	Germany, Denmark, Switzerland, Sweden, United Kingdom, Japan and all other European Economic Community countries (with the exception of Italy).
Environment Canada Status	No new installations. (Essential use exempted). No mandatory removal dates at present. Subject to "Federal Halocarbon Regulations"†	Accepted	Accepted * Subject to "Federal Halocarbon Regulations"†	Accepted * Subject to "Federal Halocarbon Regulations"†	Accepted * Subject to "Federal Halocarbon Regulations"†	Accepted * Subject to "Federal Halocarbon Regulations"†

* An international consensus on Climate Change may result in future restrictive regulations beyond the Federal Halocarbon Regulations which are pending..

† Pending regulations, called the "Federal Halocarbon Regulations" will require mandatory record keeping, annual reporting on ownership, service only by certified companies, recovery of the agent, and reporting of any discharge within 24 hr. Owner of the system is held responsible. (Expect regulations to be in place by March 1997 and applicable to federal government installations at that time.)

Health and Safety	Halon 1301	INERGEN®	FM-200™	FE-13™	CEA-410	NAF-S-III
Tested on Humans	Yes	Yes	No	No	No	No
Toxicity (LC₅₀)	> 800,000 ppm	Non-toxic	> 800,000 ppm	> 650,000 ppm	> 800,000 ppm	> 320,000 ppm
Cardiac Sensitization (NOAEL)	5.0%	No sensitization at any concentration	9.0%	30%	40%	to be determined
Cardiac Sensitization (LOAEL)	7.5%	not applicable	10.5%	50%	> 40%	to be determined (expect 14%)
Physiological Effects for Inert Gas Agents (NOAEL)	not applicable	NOAEL = 43% @ 12% O ₂	not applicable	not applicable	not applicable	not applicable
Physiological Effects for Inert Gas Agents (LOAEL)	not applicable	LOAEL = 52% @ 10% O ₂	not applicable	not applicable	not applicable	not applicable
Thermal Decomposition, Levels from independent tests ‡	low, possible to exceed safe levels	none	very high, likely to exceed safe levels	high, likely to exceed safe levels	high, likely to exceed safe levels	very high, likely to exceed safe levels
Obscuration during discharge	20% for 4 minutes or longer	None	100% for 4 minutes or longer	50%+ for 30 seconds	50%+ for 2 minutes	100% for 4 minutes or longer
Minimum Allowable O₂ in the protected space (per EPA-SNAP)		10%	16%	16%	16%	16%
Maximum Allowable CO₂ in the protected space (per EPA-SNAP)		5%	not applicable	not applicable	not applicable	not applicable

‡ Based on test reports from USCG, USNRL, NRC-Canada and LPC (U.K.)

<u>Design, Approvals, Testing</u>	Halon 1301	INERGEN®	FM-200™	FE-13™	CEA-410	NAF-S-III
NFPA Standards	NFPA 12A (no new commercial installations)	NFPA 2001 accepted for normally occupied areas	NFPA 2001 accepted for normally occupied areas	NFPA 2001 accepted for normally occupied areas	NFPA 2001 accepted for normally occupied areas	NFPA 2001 accepted for normally occupied areas
Suppliers	Ansul, Kidde, Chemetron, Fike, others	Ansul	Kidde, Fike, Chemetron	Kidde	Pem-All	Cease-Fire
Approvals	ULC / UL / FM	ULC / UL / FM	ULC / UL / FM	ULC / UL / FM	ULC / UL / FM	ULC
Principal Extinguishment Mechanism	80% chemical interruption / 20% physical cooling	Oxygen reduction	80% physical cooling, 20% chemical interruption	80% physical cooling, 20% chemical interruption	80% physical cooling, 20% chemical interruption	80% physical cooling, 20% chemical interruption
Discharge Times for 95% of agent in room	10 seconds	60 seconds	10 seconds	10 seconds	10 seconds	10 seconds
Temperature on discharge (from approx. 20°C.)	9.3°C (49°F.)	15.2°C (60°F.)	-0.8°C (31°F.)	-5.6°C (22°F.)	-1.2°C (30°F.)	-20.5°C (-5°F.)
Thermal Decomposition of Agent (Level / Effect on Equipment & Contents)	Low / Corrosion	None	Very High / Corrosion	High / Corrosion	High / Corrosion	Very High / Corrosion
Cup Burner Values (n-heptane)	2.9%	29.1%	5.9 to 6.6%	12%	5%	9.9%
Minimum Design Concentration per ULC	5.0%	37.5%	7.0%	14.4%	6.0%	8.6%
Design Concentrations in use in recent test programs	5.0%	37.5%	7.0 to 10.1%	14.4 to 18.0%	6.0 to 7.3%	8.6 to 12.0%
LPC (U.K.) Test Results Number of Fires Extinguished	All	All	6 out of 8 @ 7.0% 6 out of 6 @ 8.6%	All	All	5 out of 6 @ 12%
Density of Protected Atmosphere, relative to air	1.34	1.04	1.37	to be determined	to be determined	to be determined
Boiling Point	-72°F. (-58°C.)	-195°C (-320°F.)	-16°C. (2.6°F.)	-82°C. (-116°F)	-2°C. (28.4°F.)	-38°C. (-37°F.)
Vapour Pressure at 25 deg.C. (77 deg.F.)	1,620 kpa (235 psia)	15,170 kpa (2,200 psia)	460 kpa (66 psia)	4,730 kpa (686 psia)	290 kpa (42 psia)	to be determined
Superpressurization of cylinders:	nitrogen	not required	nitrogen	not required	nitrogen	nitrogen

Design, Approvals, Testing (continued)	Halon 1301	INERGEN®	FM-200™	FE-13™	CEA-410	NAF-S-III
Cylinder storage Pressures (nominal)	2,482 to 4,137 kPa (360 or 600 psig.)	15,000 kPa (2,175 psig.)	2,482 kPa (360 psig.)	4,137 kPa (600 psig.)	2,482 kPa (360 psig.)	2,482 kPa (360 psig.)
Temperature Range, Protected Area	-40 to 93°C. (-40 to 200°F)	-40 to 93°C. (-40 to 200°F) (approx. span of 90°F)	-12 to 93°C. (10 to 200°F.) (span t.b.a.)	-40°C to 54°C (-40°F to 130°F) (span t.b.a.)	to be advised	to be advised
Temperature Range, Cylinders	0 to 54°C. (32 to 130 °F.)	0 to 54°C. (32 to 130 °F.)	0 to 54°C. (32 to 130 °F.)	-40°C to 54°C (-40°F to 130°F)	to be advised	to be advised
Pressure venting required	yes	yes	yes	yes	yes	yes
Engineered Design	yes	yes	yes	to be advised	to be advised	no
Estimated / Nominal Distribution Pipe Distances	25 m. (80 ft.)	110 m. (360 ft.)	18 m. (60 ft.)	12 m. (40 ft.)	27 m. (90 ft.)	to be determined
Distribution Pipe	Sch.40, 150/300 lb. fittings	Sch.40, 300 lb. fittings (Cylinder Manifold is Sch 80, 2000 lb. fittings)	Sch.40, 300 lb. fittings	Sch.40, 300 lb. fittings	Sch.40, 300 lb. fittings	Sch.40, 300 lb. fittings
Vertical Flow Separations	no	yes	no	no	no	no
Floor Foot Print for cyliners (based on halon =1 and assuming halon cylinders are approx. 200 kg. capacity)	1	3.6	1.8	1.9	2.0	1.9

- Note: ULC / UL and FM approvals do not consider:
- ù thermal decomposition of the agent and effects on people and equipment / contents
 - ù environmental considerations beyond US-EPA "SNAP" approval
 - ù temperature change in the protected space

Costs, Availability	Halon 1301	INERGEN®	FM-200™	FE-13™	CEA-410	NAF-S-III
Availability of the agent	recycled agent only, no imports allowed	commercially available (produced at 12 sites across Canada)	commercially available (imported)	commercially available (imported)	Uncertain as of December 1996	commercially available (imported)
Relative Cost of Systems, based on halon cost = \$1 (assumes FM-200 is supplied at 8.6% to provide enhanced fire performance and reduced HF)	\$1.00	\$2.00	\$2.00	unknown	unknown	\$1.60
Relative Cost of Recharge based on halon = \$1	\$1.00	40¢	\$2.00	unknown	unknown	\$1.60
Multiple Hazards Protected via Selector Valve Arrangements	yes	yes	no	no	no	no