

Propellants

by Chemours

Helps You Meet the Challenge

Product Information

With help from Chemours, the world's aerosol industry has resolved the environmental challenges of the past decade—especially the issues of ozone depletion and volatile organic compounds (VOCs).

A new challenge, however, of climate change faces the aerosol industry.

Chemours is once again leading the drive to meet this challenge. In the following pages, you will find all you need to know about our range of aerosol propellants designed to help meet your challenges head-on—safely, profitably, and responsibly.

Vapor Pressures

Vapor pressures of HP DME, HP 152a, and Freon™ 134a are shown on page 4. When blended with hydrocarbon propellants or low-boiling solvents, higher or lower pressures can be reached if required.

Wide Range of Solubility

Because they are soluble in each other, with hydrocarbon propellants and with a wide variety of common aerosol solvents and products, propellants from Chemours can be blended to provide effective delivery of water- or solvent-based products. HP DME is exceptional in terms of its water solubility.

Our Propellants Portfolio

HP DME

Dimethyl Ether, CH_3OCH_3

HP 152a

1,1-Difluoroethane, CHF_2CH_3

Freon™ 134a

1,1,1,2-Tetrafluoroethane, CHF_2CF_3

Our propellants range also includes blends of two or more of these products. Depending on the application, they may also be blended with other compounds, such as hydrocarbons. The best choice for a given application depends on the desired combination of properties.

Current Applications of Propellants from Chemours

The range of applications for these products as aerosol propellants is already extensive and growing every day. Some of the industry-proven developments and applications are shown below.

	HP DME	HP 152a	Freon™ 134a
Haircare	▪	▪	
Shaving cream		▪	
Deodorants	▪		
Antiperspirants	▪	▪	
Baby care		▪	
Insulating foams	▪	▪	▪
Paints	▪	▪	
Adhesives	▪		
Insecticides	▪		
Perfumes	▪		
Air fresheners	▪		
Safety critical applications			▪

Can I use propellants from Chemours in my formulation?

HP DME

Solubility in water

Can reduce formulation costs by allowing substitution of water for more expensive solvents, such as alcohol.

- Decreases foaming of water-based aerosols.
- Some water-based formulations, are less viscous than those containing hydrocarbons.
- Can provide single-phase formulations, where use of other propellants would result in two-phase formulations.

Solubility in organics

- High solvency of polymeric resins (for example, hairsprays, adhesives, etc.).

Aerosol flammability

- Although flammable, HP DME allows the formulation of nonflammable aerosols with water.

Medium-high vapor pressures

- Produces medium-high pressure dry sprays when used alone or in blends.
- Produces low-pressure sprays when formulated with solvents.

Hydrolytic stability

- Remains stable over a broad pH range.

HP 152a

Medium-high vapor pressure

- Produces medium-high pressure dry sprays when used alone or in blends.
- Produces low-pressure sprays when formulated with solvents.

Hydrolytic stability

- Remains stable over a broad pH range.

Aerosol flammability

- Although flammable, HP 152a can be used to formulate aerosols (posing a lower flammability hazard to the user).

Freon™ 134a

Chemours does not support the use of Freon™ 134a as a propellant in high-volume aerosol personal products. We sell Freon™ 134a into limited commercial applications.

Long-term, we view it being used in aerosol products that recently used CFCs or HCFCs, because of legitimate concerns about the flammability of the product.

Aerosol flammability

- Freon™ 134a is nonflammable.

Propellant blends

The optimum propellant for a given aerosol formulation is often a mixture of two or more propellants from Chemours or one of our propellants and hydrocarbons. Information on the physical properties of a large number of blends for a variety of formulations is available from Chemours.

Azeotropes

Propellants from Chemours azeotropes and their weight percent are:

HP DME/Propane	(18/82)
HP DME/152a	(46/54)
HP DME/134a	(51/49)
HP 152a/Propane	(46/54)
HP 152a/Isobutane	(75/25)
HP 152a/n-Butane	(85/15)
Freon™ 134a/Propane	(64/36)
Freon™ 134a/Isobutane	(80/20)
Freon™ 134a/n-Butane	(88/12)

The vapor pressure of the HP DME/152a is nearly identical to that of its components. The hydrocarbon-based azeotropes of HP 152a and Freon™ 134a have vapor pressures significantly higher than either of the components forming them.

Because the vapor pressures of HP DME and HP 152a are essentially identical, compositions far removed from that of the azeotrope do not undergo fractionation, even during vapor-phase discharge.

Non-azeotropic mixtures

The liquid composition of standard (non-azeotropic) mixtures of propellants from Chemours remains essentially constant, as the aerosol product is discharged through a standard valve by liquid phase delivery. Non-azeotropic mixtures can fractionate, however, resulting in preferential loss of the lower-boiling (that is, higher vapor pressure) component when using vapor tap valves, during accidental spills, or through vapor phase loss of the propellant in storage. Detailed information is available from Chemours.

Propellants from Chemours and the environment

Chemours offers products and services to help the aerosol industry meet environmental challenges safely.

Ozone depletion

The current propellants from Chemours, as listed in this bulletin, has an ozone depletion potential (ODP) of zero.

Photochemical reactivity

The issue of volatile organic compounds (VOCs) has been an environmental challenge for the aerosol industry in the USA. It will most likely become a challenge to be faced in many other countries.

Propellants from Chemours are either non-VOC (HP 152a and Freon™ 134a) or help in meeting the VOC challenge (HP DME and water).

The table below compares the ODP of various propellant products as well as their CO₂ global warming potential (GWP) and their VOC status.

	HP DME (DME)	HP 152a (HFC 152a)	Freon™ 134a (HFC 134a)	Butane
ODP	0	0	0	0
GWP (100 yr Integrated Time Horizon)	Negligible	124	1,430	Negligible
VOC	Yes	No	No	Yes

Properties of propellants from Chemours

Physical properties

The basic physical properties of our three Freon™ propellants, detailed in the table below, can be summarized as follows:

HP DME is a medium-high pressure propellant with a high degree of solubility in water (weight percent at autogenous pressure) and high solvency. It is miscible with most conventional solvents. Its lower explosive limit (LEL) in air is higher than that of hydrocarbon propellants.

HP 152a is similar to HP DME in vapor pressure; but, has a low water solubility, is a moderately weak solvent, and is flammable but similar to HP DME, and has a LEL about twice that of hydrocarbons.

Freon™ 134a is our only nonflammable propellant. It has low water solubility and is a poor solvent.

Stability

Propellants from Chemours are stable when used alone or with conventional aerosol solvents (for example, alcohols, esters, and ketones) under general aerosol storage and use conditions. As is industry practice for new aerosol formulations, storage testing is recommended.

HP DME is not prone to peroxide formation in the pure state or in aerosol formulations.

Propellants from Chemours are hydrolytically stable over a broad pH range.

Solubility

Propellants from Chemours cover the range of Kauri-butanol values from about 8-60. They are miscible with each other, with hydrocarbon propellants, and with a variety of common aerosol solvents, such as alcohols.

HP DME has high solubility in both polar and non-polar solvents. It has 35 wt% solubility in water and is the only liquefied gas aerosol propellant that allows formulation of single-phase products with large amounts of water. Formulations of HP DME with water and alcohol are of particular interest, because the addition of a small amount of alcohol causes complete miscibility of HP DME and water in all proportions.

HP 152a has low solubility in water, but tolerates a few percent water in propellant/alcohol formulations with no phase separation.

Toxicity

Extensive animal studies have shown that propellants from Chemours pose no hazard to man relative to systemic toxicity, carcinogenicity, mutagenicity, or teratogenicity at or below an occupational exposure limit (8-hr TWA) of 1,000 ppm, the highest value allowed for organic compounds. More detailed information on the toxicity of our propellants is available from Chemours.

Liquid density

HP DME has a liquid density similar to that of hydrocarbon propellants. The density of the other propellants from Chemours ranges from 1.4-1.9 times greater, resulting in heavier container fill weights that can enhance consumer appeal.

Flammability of propellants from Chemours

Product safety has always been an important issue in the aerosol industry.

HP DME and HP 152a are flammable. Freon™ 134a is nonflammable.

However, the flammability of a pure propellant may not reflect the flammability of the total formulation of which it is a part. Therefore, tests should be run on final formulations to measure the hazard they may pose to the user. More detailed information is available from Chemours.

Physical Properties of Propellants from Chemours

	HP DME Dimethyl Ether, CH ₃ OCH ₃	HP 152a 1,1-Difluoroethane, CHF ₂ CH ₃	Freon™ 134a 1,1,1,2-Tetrafluoroethane, CH ₂ FCF ₃
Molecular Weight	46.1	66.1	102.0
Boiling Point, °C	-24.8	-25.0	-26.1
°F	-12.7	-13.0	-14.9
Vapor Pressure at 20°C, bar	4.09	4.16	4.67
at 50°C, bar	10.55	10.79	12.22
Vapor Pressure at 70°F, psig	63	63	71
at 130°F, psig	174	177	199
Liquid Density at 20°C, g/cc	0.66	0.91	1.22
at 50°C, g/cc	0.61	0.83	1.10
Liquid Density at 70°F, g/cc	0.66	0.91	1.22
at 130°F, g/cc	0.60	0.82	1.08
Solubility in Water at 20°C, wt%	35	1.7	0.95
at 70°F, wt%	35	1.7	0.95
Water Solubility in Propellant at 20°C, wt%	6	0.17	0.095
at 70°F, wt%	6	0.17	0.095
Solubility Parameter	7.3	7.0	6.6
Kauri-Butanol Number	60	11	8
Flammability Limits in Air, vol %	3.3-18.0	3.9-16.9	None

Can I use propellants from Chemours in my equipment?

Packaging

Chemours offers the following general recommendations for guidance, but recommends that packaging decisions be made jointly with component suppliers.

Valve stem and cup gaskets

Laboratory linear swell data for elastomers in the liquid phase of our propellants is available from Chemours. Swelling data can serve as a useful guide in selecting elastomers. However, other factors, such as the amount of extraction, tensile strength, and degree of hardness of the exposed elastomer, must be considered. Final gasket choice also depends on the gasket material's compatibility with all of the formulation ingredients, including the actives. Storage tests on final aerosol formulations are required to ensure that the correct material has been chosen. Consultation with valve suppliers is also recommended before final choice.

Valves

Special care must be taken when using vapor tap valves. With a formulation containing a single propellant or an azeotrope, an oversize tap can result in propellant loss before all the container contents have been discharged. With a non-azeotropic propellant blend or a high solvent-to-propellant ratio, fractionation could occur, causing a change in pressure.

Containers

Formulations that contain water may require corrosion inhibitors, which should be chosen on the basis of storage stability tests.

HP DME should be thoroughly tested before packaging in lined containers, because of the high solvency of the propellant.

Handling

All national, local, and other regulatory agency requirements must be satisfied before a new storage and loading facility is brought into service. Some suggestions are given here based on Chemours experience to date. They are not intended to exhaust the subject. Additional information can be obtained from Chemours.

Chemours offers a safety audit inspection of the customer's storage and loading facilities by technical specialists in conjunction with the first delivery of HP DME to the customer's premises.

Electrical equipment

Freon™ 134a is nonflammable when used alone and, thus, requires no explosion-proof equipment. But, when it is blended with other propellants from Chemours or with hydrocarbons, the blend should be handled in explosion-proof equipment.

HP DME, HP 152a, and blends containing these products should be handled in explosion-proof equipment.

A separate loading facility is recommended for flammable propellants. All equipment must be explosion-proof and of the proper electrical rating.

Flammable-gas detectors are recommended. Infrared or sensing flame devices can be used with all propellants from Chemours. Hot wire detectors are not recommended for use with halogenated propellants. Additional information is available from Chemours.

Equipment seals

For HP 152a and Freon™ 134a, seals of Neoprene W are recommended. For HP DME, Kalrez® is the only elastomer known that shows good resistance to swelling in laboratory immersion tests. However, mechanical factors in actual plant use could influence material selection. Silicone O-rings encapsulated in Teflon™ are recommended generally for HP DME, including undercap filling machines. Chemours should be contacted for specific information.

Where are propellants from Chemours produced, and how are they distributed?

Launched by DuPont laboratories in the United States in the early 1980s, propellants from Chemours are today rapidly becoming some of the most widely used propellants in aerosols.

Worldwide manufacture and supply

HP 152a and Freon™ 134a are today manufactured only in the United States. HP DME is produced in the United States and Europe.

Our propellants are shipped to the customer by the fastest possible method, depending on the destination and the customer's storage facilities. HP DME can be in road tankers, ISO containers, and ton containers, by road or rail.

For more information about propellants from Chemours, visit [Chemours.com/Propellants](https://chemours.com/Propellants)

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