



3M

Novec™
Engineered Fluid
HFE-8200

Product
Information

Introduction

3M™ Novec™ Engineered Fluid HFE-8200 is a clear, colorless, low-odor fluid intended to replace 1,1,1-trichloroethane and perchloroethylene in film cleaning applications. Its physical properties are compared with other film cleaning solvents in Tables 1 and 2.

This fluid has zero ozone depletion potential and low global warming potential (GWP); is not a volatile organic compound (VOC)*; and is listed as a Clean Air Solvent by California's South Coast Air Quality Management District. More information on the environmental properties of Novec fluid HFE-8200 can be found in Table 2. It is low in toxicity, with a time-weighted exposure guideline of 200 ppm (eight-hour average).

Novec fluid HFE-8200 has a higher boiling point than most CFCs, HCFCs and HFCs, reducing evaporative losses. The low surface tension and increased solvency of HFE-8200 fluid, coupled with its chemical and thermal stability, nonflammability, and excellent compatibility with film substrates, make it an ideal film cleaning solvent.

*HFE-8200 has been excluded by the U.S. Environmental Protection Agency from the definition of a VOC on the basis that this compound has negligible contribution to tropospheric ozone formation.

3M™ Novec™ Engineered Fluid HFE-8200 Physical Properties – Table 1

Data compiled from published information

Not for specification purposes

Properties	HFE-8200	1,1,1-TCA	Perc
Molecular Weight	264	133	166
Boiling Point °C	76	74	121
Freeze Point °C	-138	-38	-9
Liquid Density, g/ml @ 25°C	1.43	1.32	1.62
Surface Tension, dynes/cm @ 25°C	13.6	25.5	31.8
Solubility of Solvent in Water, ppmw	<20	700	150
Solubility of Water in Solvent, ppmw	92	400	105
Vapor Pressure, mm Hg @ 25°C	109	121	20
Viscosity, cps @ 25°C	0.61	0.79	0.84
Heat of Vaporization, cal/g @ b.p.	30	54.4	50

Environmental Properties and Exposure Guidelines – Table 2

Data compiled from published information

Not for specification purposes

Properties	HFE-8200	1,1,1-TCA	Perc
Ozone Depletion Potential ¹ , ODP	0	0.1	0.006
Global Warming Potential ² , GWP	55	140	N/A ³
Atmospheric Lifetime, years	0.8	4.8	N/A ³
Flash Point	None	None	None
Flammability Range in Air	2.4-12.4%	7.5-15%	None
Exposure Guidelines, ppm (8 hr. time-weighted average)	200	350	25 ⁴
Hazardous Air Pollutant	No	Yes	Yes
VOC Designation ⁵	No	No	Yes
Annual Reporting (EPCRA 313) (SARA)	No	Yes	Yes
OSHA List of toxins/carcinogens	No	No	Yes
CA SCAQMD Clean Air Solvent	Yes	No	No

¹CFC-11=1.0 ²GWP–100 year Integrated Time Horizon ³N/A: Not Available ⁴100 ppm STEL

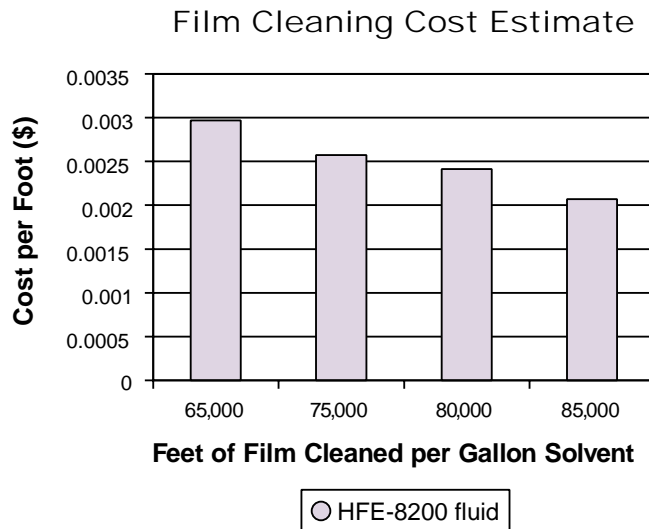
⁵HFE-8200 fluid has been excluded by the U.S. EPA from the definition of a VOC

Lipsner-Smith has designed their newest film cleaning machine, the CF-8200, to optimize system performance with Novec fluid HFE-8200. The increased ultrasonics and high-speed buffers result in excellent cleaning performance without leaching plasticizer from the film. The improved vapor recovery leads to greater efficiency.

Lipsner-Smith has designed retrofit packages for models CF-3000 Mark VI and higher. It is recommended that HFE-8200 fluid be used only in Lipsner-Smith's CF-8200 or upgraded Lipsner-Smith film cleaning equipment. See your local Lipsner-Smith representative for details.

Performance Results

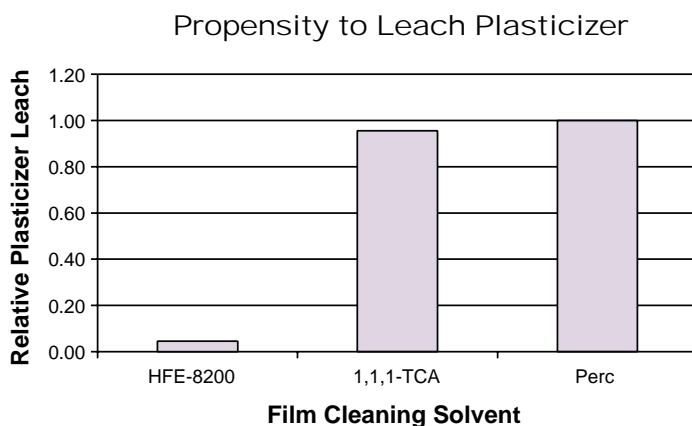
When used in Lipsner-Smith CF-8200 and retrofitted equipment, cleaning results comparable to perchlorethylene and 1,1,1-trichloroethane can be achieved. This equipment will typically allow for running speeds in excess of 220 feet per minute and can achieve cleaning efficiency in the range of 75,000 to 85,000 feet per gallon, making costs competitive with those seen with 1,1,1-trichloroethane, as seen in the table below.



3M™ Novec™ Engineered Fluid HFE-8200 Materials Compatibility

3M™ Novec™ Engineered Fluid HFE-8200 demonstrates compatibility with a wide range of metals, plastics and elastomers. As with most fluorinated liquids, Novec fluid HFE-8200 will absorb into fluorinated plastics and elastomers over longer exposures. Data compatibility with specific substrates is available upon request.

In addition, HFE-8200 fluid exhibits excellent compatibility with acetate and Estar™ film substrates. Kodak tested the relative propensity of film cleaning solvents to leach plasticizer from Eastman Color Negative (ECN) and Eastman Color Intermediate (ECI) film. This data is for comparison purposes only. Results are shown below with the amount leached by perchloroethylene equal to 1.00.



Estar™ is a trademark of Eastman Kodak Company

Environmental Policy

3M will continue to recognize and exercise its responsibility to prevent pollution at the source wherever and whenever possible; develop products that will have a minimal effect on the environment; conserve natural resources through the use of reclamation and other appropriate methods; assure that its facilities and products meet and sustain the regulations of all federal, state and local environmental agencies; assist, wherever possible, governmental agencies and other official organizations engaged in environmental activities.

Safety and Handling

Before using this product, please read the current product Material Safety Data Sheet (available through your 3M sales or technical service representative) and the precautionary statement on the product package. Follow all applicable precautions and directions.

Novec fluid HFE-8200 is nonflammable and does not exhibit flammability characteristics under normal operating and storage conditions. This fluid is highly resistant to thermal breakdown and hydrolysis in storage and during use. Recommended handling procedures are provided in the Material Safety Data Sheet.

Packaging and Availability

Novec fluid HFE-8200 packaging can be quickly connected to Lipsner-Smith equipment. HFE-8200 fluid may be ordered in the following container sizes:

- 5-gallon pail
- 30-gallon drum

3M™ Novec™ Engineered Fluid HFE-8200 Regulatory Status

3M™ Novec™ Engineered Fluid HFE-8200 has been accepted for commercial use by regulatory agencies in the United States, Canada (less than 10,000 lbs./yr.), Japan, Phillipines (less than 2,000 lbs./yr.), and Europe. The components of HFE-8200 fluid have been nominated to China's draft chemical inventory.

Novec fluid HFE-8200 has been approved under the Significant New Alternatives Policy (SNAP) of the U.S. EPA. Novec fluid HFE-8200 has been excluded by the U.S. EPA from the definition of a VOC on the basis that this compound has negligible contribution to tropospheric ozone formation. In addition, the South Coast Air Quality Management District (SCAQMD) has certified HFE-8200 fluid as a Clean Air Solvent.

Contact your local 3M representative regarding the regulatory status of HFE-8200 fluid in other countries.

Toxicity Profile

The toxicological testing completed on Novec engineered fluid HFE-8200 shows the overall toxicity is low. The material is practically non-irritating to the eyes, minimally irritating to the skin and is not a mutagen. This material is rated “practically non-toxic” through inhalation. Twenty-eight day inhalation studies have helped establish a recommended exposure guideline of 200 ppm for eight-hour average worker exposure per day.

Toxicological Test Results

Properties	HFE-8200
Acute Lethal Inhalation Concentration	>92,000 ppm (4 hour)
Oral	Practically non-toxic (>5g/kg)
Eye Irritation	Minimally irritating
Skin Irritation	Non-irritating
Skin Sensitization	Not a skin sensitizer
Inhalation (28 day study)	200 ppm exposure guideline ¹ Detailed results are available
Developmental Toxicity	Detailed results are available
Mutagenicity	Not a mutagen
Cardiac Sensitization	No signs at exposure up to 20,000 ppm
Ecotoxicity Testing	Complete—low aquatic toxicity

¹Exposure Guideline set by the 3M Medical Department

Used Fluid Return Program

3M offers a program for free* pickup and return of used 3M specialty fluids in the U.S. through Safety-Kleen Corp. A pre-negotiated handling agreement between users and this service provider offers users broad protection against future liability for used 3M product. The fluid return program is covered by independent third-party financial and environmental audits of treatment, storage and disposal facilities. Necessary documentation is provided. A minimum of 30 gallons of used 3M specialty fluid is required for participation in this free program.*

Safety-Kleen Corp. has a network of 156 branch service centers in the U.S. This large fleet will provide timely, economical fluid disposal service.

For additional information on the 3M Used Fluid Return Program, contact Safety-Kleen at this toll-free line: 1.888.932.2731. Contact your local 3M representative for fluid return programs outside the U.S.

* Must have a 30 or more gallon purchase to participate in the 3M paid program. Used product of 5-30 gallons can be returned through Safety-Kleen at the user's expense.

Resources

3M™ Novec™ Engineered Fluid HFE-8200 is supported by global sales, technical and customer sales resources, with fully-staffed technical service laboratories in the U.S., Europe, Japan, Latin America and Southeast Asia. Users benefit from 3M's broad technology base and continuing attention to product development, performance, safety and environmental issues.

For additional technical information on Novec fluid HFE-8200 in the United States, call 3M Performance Materials Division, 800.833.5045.

For information on additional 3M fluids, coatings, and other chemical products for the electronics industry, visit our web site at www.3m.com/fluids

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Important Notice to Purchaser: The information in this publication is based on tests that we believe are reliable. Your results may vary due to differences in test types and conditions. You must evaluate and determine whether the product is suitable for your intended application. Since conditions of product use are outside of our control and vary widely, the following is made in lieu of all express or implied warranties (including the warranties of merchantability or fitness for a particular purpose): 3M's only obligation and your only remedy is replacement of product that is shown to be defective when you receive it. In no case will 3M be liable for any special, incidental, or consequential damages based on breach of warranty or contract, negligence, strict tort, or any other theory.



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