

# 3M™ Novec™ 71DA Engineered Fluid

## Introduction

3M™ Novec™ 71DA Engineered Fluid is a hydrofluoroether, Methyl Nonafluorobutyl Ether (C<sub>4</sub>F<sub>9</sub>OCH<sub>3</sub>), in an azeotrope formulation with trans-1,2-dichloroethylene (t-DCE) and ethanol. This mixture is a true azeotrope, with constant vapor and liquid composition at its boiling point.

Novec 71DA fluid is ideal for defluxing and degreasing tasks and is intended to replace ozone-depleting materials in many applications as well as certain aqueous cleaning processes and solvent coating applications. This Novec product has zero ozone depletion potential and other favorable environmental properties (see Table 2). Novec 71DA fluid has a recommended time-weighted average exposure guideline of 750 ppm for the 3M™ Novec™ 7100 Engineered Fluid component (eight hour average), 200 ppm for trans-1,2-dichloroethylene (t-DCE) and 1000 ppm for ethyl alcohol. These exposure guidelines suggest there is a large margin of safety for use of Novec 71DA fluid in its intended cleaning applications.

The increased solvency and low surface tension, nonflammability and constant composition during boiling of Novec 71DA fluid make it ideal for immersion defluxing and degreasing applications. The ethanol component of Novec 71DA fluid provides enhanced removal of ionic contaminants.

For information on other applications, contact your 3M representative or 3M authorized distributor.

## Applications

- Cleaning, rinsing and drying agent; coating solvent
  - Cleaning of oils, greases, waxes, handling oils and solder flux residue
  - Precision coating of silicones and other lubricants

## Material Description

Ingredients	3M™ Novec™ 71DA Engineered Fluid
Methyl Nonafluorobutyl Ether (C <sub>4</sub> F <sub>9</sub> OCH <sub>3</sub> )	52.7% by weight
Trans-1,2-dichloroethylene (t-DCE)	44.6% by weight
Ethanol	2.7% by weight
Appearance	Clear, colorless

<sup>1</sup>Novec 71DA fluid (C<sub>4</sub>F<sub>9</sub>OCH<sub>3</sub>) consists of two inseparable isomers with essentially identical properties. These are (CF<sub>3</sub>)<sub>2</sub>CF<sub>2</sub>OCH<sub>3</sub> (CAS No. 163702-08-7) and CF<sub>3</sub>CF<sub>2</sub>CF<sub>2</sub>OCH<sub>3</sub> (CAS No. 163702-07-6).

## Typical Physical Properties

**Table 1**

Properties	3M™ Novec™ 71DA Engineered Fluid	Freon® TE	Gensolv® 2004	AK-225 AES	4310-SMT
Formulation	Azeotrope <sup>1</sup>	Azeotrope 96% C <sub>2</sub> Cl <sub>3</sub> F <sub>3</sub> 4% Ethanol	Azeotrope 96% CCl <sub>2</sub> FCH <sub>3</sub> 4% Methanol	Azeotrope 96% C <sub>3</sub> Cl <sub>2</sub> HF <sub>5</sub> 4.5% Ethanol	Azeotrope <sup>2</sup>
Boiling Point (°C)	40	45	29.4	52	37
Freeze Point (°C)	-29 <sup>3</sup>	-42	N/A	-138	NA
Liquid Density (g/ml)	1.33	1.50	1.22	1.49	1.35
Surface Tension (dynes/cm)	16.4	17.7	18.5	16.8	15.5
Kauri-Butanol Value	33	40	76	41	N/A
Vapor Pressure (mmHg)	381	362	527	414	486
Viscosity (cps)	0.45	0.65	0.45	0.61	0.49
Heat of Vaporization (cal/g @ boiling point)	50	43	62	41	50

<sup>1</sup> 52.7% 3M™ Novec™ 7100 Engineered Fluid (C<sub>4</sub>F<sub>9</sub>OCH<sub>3</sub>), 44.6% trans-1,2-dichloroethylene and 2.7% ethanol

<sup>2</sup> 52.9% HFC-4310 (C<sub>3</sub>H<sub>2</sub>F<sub>10</sub>), 43% trans-1,2-dichloroethylene, 4% methanol, 0.1% stabilizer

<sup>3</sup> Critical Solution Temperature

N/A-Not Available

Data compiled from published information.

Not for specification purposes. All values @ 25°C unless otherwise specified.

## Environmental and Safety Properties

**Table 2**

Properties	3M™ Novec™ 71DA Engineered Fluid	Freon® TE	Gensolv® 2004	AK-225 AES	4310-SMT
Ozone Depletion Potential—ODP <sup>1</sup>	0.00	0.77	0.11	0.03	0.00
Global Warming Potential <sup>2</sup>	170	5800	670	400	900
Flash Point	None	None	None	None	None

<sup>1</sup> CFC-11=1.0

<sup>2</sup> GWP—100 year ITH, CO<sub>2</sub> = 1.0

<sup>3</sup> Vol % by ASTM E681-94 @ 100°C

## Regulatory Status

The U.S. Environmental Protection Agency (EPA) has listed all components of 3M™ Novec™ 71DA Engineered Fluid as “acceptable,” without restrictions, under the EPA’s Significant New Alternatives Policy (SNAP) program.

## Regulations on Chlorine-Containing Solvents

**Table 3**

Regulation	Trans-1,2-dichloroethylene	Trichloroethylene	Perchloroethylene	Methylene Chloride
VOC Designation	Yes	Yes	Yes	No
Reportable Quantity for Accidental Release	1000 lbs. (2240 lbs. in Novec 71DA)	100 lbs.	100 lbs.	1000 lbs.
Regulated if Emitted into Water	Yes	Yes	Yes	Yes
Hazardous Air Pollutant	No	Yes	Yes	Yes
Annual Reporting (EPCRA 313) (SARA)	No	Yes	Yes	Yes
OSHA List of Toxins/Carcinogens	No	Yes	Yes	Yes

Data compiled from published information.

Not for specification purposes.

### Regulations and Reporting

Because of its favorable health and environmental properties, trans-1,2-dichloroethylene (t-DCE) is less regulated in the areas noted compared to the other chlorinated solvents in Table 3. Regulations affecting Novec 71DA fluid include VOC emissions of t-DCE and ethanol and reporting requirements if t-DCE is emitted into water or if a spill of 2240 lbs. or more of Novec 71DA fluid occurs. t-DCE is not considered a Hazardous Air Pollutant (HAP) and is not subject to annual reporting requirements.

### 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

Novec 71DA fluid 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. Before using this product, please read the current 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.

### Packaging and Availability

Novec 71DA fluid may be ordered in the following container sizes:

- 1-gallon pail
- 5-gallon pail
- 55-gallon drum

## Recycle and Disposal Options

### Used Fluid Return Program

3M offers a program for free pickup and return of used 3M specialty fluids in the U.S. A pre-negotiated handling agreement between users and our authorized 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.

For additional information on the 3M Used Fluid Return Program, contact your local 3M representative or call 3M Customer Service at 800.810.8513.

### Resources

3M™ Novec™ Engineered Fluids are supported by global sales, technical and customer service resources, with 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 3M™ Novec™ 71DA Engineered Fluid in the United States or for the name of a local authorized distributor, call 3M Electronics Markets Materials Division: **800 810 8513**.

### The 3M™ Novec™ Brand Family

The Novec brand is the hallmark for a variety of patented 3M products. Although each has its own unique formula and performance properties, all Novec products are designed in common to address the need for safe, effective, sustainable solutions in industry-specific applications. These include precision and electronics cleaning, heat transfer, fire protection, lubricant deposition and several specialty chemical applications.

3M™ Novec™ Engineered Fluids • 3M™ Novec™ Aerosol Cleaners • 3M™ Novec™ 1230 Fire Protection Fluid • 3M™ Novec™ Electronic Coatings • 3M™ Novec™ Electronic Surfactants

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