



Fluorinert™

Electronic Liquid

FC-77

Product Information

Introduction

3M™ Fluorinert™ Electronic Liquid FC-77 is a thermally stable, fully fluorinated liquid (perfluorocarbon) that has long been used as a heat transfer fluid in a variety of industries.

The inertness of Fluorinert FC-77 liquid permits its use as a direct contact single and two-phase coolant in supercomputers and sensitive military electronics. Its high dielectric strength and electrical resistivity are ideal for applications in high voltage transformers and power electronics.

In the semiconductor manufacturing industry, its wide liquid range makes Fluorinert FC-77 liquid ideal for cooling ion implanters, dry etchers and CVD machines. Its low pour point also permits its use in thermal shock and test equipment.

Typical Physical Properties (Not for Specification Purposes)

All values determined at 25°C unless otherwise specified

Average Molecular Weight	415
Appearance	Clear, colorless
Boiling Point, 1 atm	97°C
Vapor Pressure	5610 Pa
Density	1.78 g/cm ³
Coefficient of Expansion	0.0014 1/°C
Viscosity, Kinematic	0.72 cSt.
Viscosity, Absolute	1.28 cP
Specific Heat	1.05 J/g-°C
Latent Heat of Vaporization, 1 atm	84 J/g
Thermal Conductivity	0.063 W/m-°C
Refractive Index	1.28
Critical Temperature, Calculated	495 K
Critical Pressure, Calculated	1.58 MPa
Dielectric Strength	40 kV, 0.1" gap
Electrical Resistivity	1.9x10 ¹⁵ ohm-cm
Dielectric Constant	1.86
Ozone Depletion Potential	0

Heat Transfer Properties

The following formulas can be used to calculate the specific heat, thermal conductivity and density of 3M™ Fluorinert™ Electronic Liquid FC-77 at various temperatures.

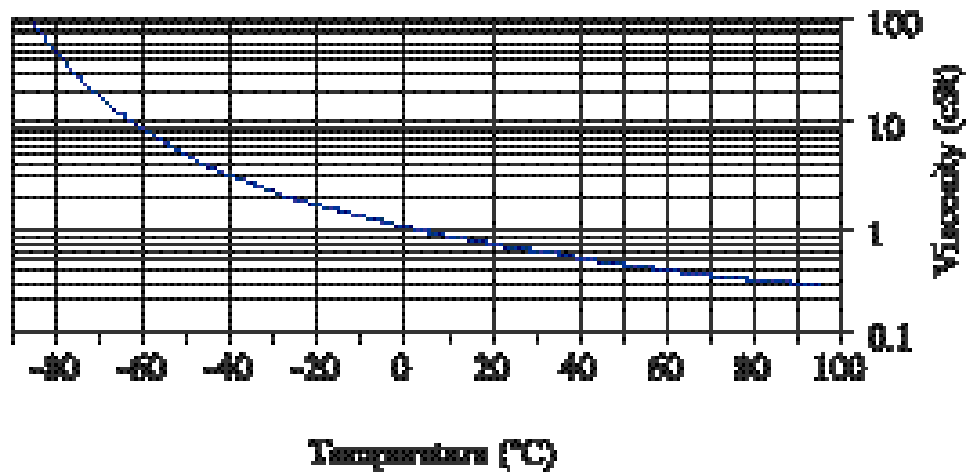
$$\text{Specific Heat (J/g-}^\circ\text{C)} = 1.014 + 0.001554 (T^\circ\text{C})$$

$$\text{Thermal Conductivity (W/m-}^\circ\text{C)} = 0.065 - 0.00008 (T^\circ\text{C})$$

$$\text{Density (g/cm}^3\text{)} = 1.838 - 0.00245 (T^\circ\text{C})$$

The following graph can be used to determine the viscosity of Fluorinert FC-77 liquid at temperatures ranging from -80°C to 100°C

**Fluorinert FC-77 Liquid
Viscosity versus Temperature**



Materials Compatibility

3M™ Fluorinert™ Electronic Liquid FC-77 is compatible with most metals, plastics and elastomers.

Toxicity Profile

Fluorinert FC-77 liquid is non-irritating to the eyes and skin, and is practically non-toxic orally. The product also demonstrates very low acute and sub-chronic inhalation toxicity. It is not a mutagen or cardiac sensitizer. A Material Safety Data Sheet is available upon request.

Safety and Handling

Fluorinert FC-77 liquid is nonflammable, and is highly resistant to thermal breakdown and hydrolysis in storage and during use. Recommended handling procedures are given in the Material Safety Data Sheet, which is available upon request.

Environmental

Fluorinert FC-77 liquid has zero ozone depletion potential. The material is not defined by the U.S. EPA, nor is it regulated, as a volatile organic compound (VOC). FC-77 liquid does not contribute to ground-level smog formation.

Fluorinert FC-77 liquid, a perfluorocarbon (PFC), has a high global warming potential and a long atmospheric lifetime. As such, its use should be carefully managed to minimize emissions.

3M recommends that users of 3M™ Fluorinert™ Electronic Liquid FC-77 further limit emissions by employing good conservation practices, and by implementing recovery, recycling and/or proper disposal procedures. 3M offers a program for used fluid return. Specific guidelines for the safe handling and use of 3M products are provided in the Material Safety Data Sheets.

Environmental Policy

3M will 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
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Resources

For additional technical information on 3M™ Fluorinert™ Electronic Liquid FC-77, contact our 3M Heat Transfer Representative Steve Pignato at 800.607.2724.

For information on additional 3M Specialty Fluids, visit our web site at: www.3m.com/fluids

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.



Specialty Materials

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