

3M™ Performance Fluid PF-7600

Product Description

3M™ Performance Fluid PF-7600 is a non-flammable fluid with very low global warming potential for use in heat transfer applications. Performance Fluid PF-7600 shares many of the inerting and dielectric properties of perfluorocarbons (PFCs) and perfluoropolyethers (PFPEs), and is a viable option for replacing them in a wide array of applications. Performance Fluid PF-7600 has been developed as a low-GWP alternative to perfluorocarbon and perfluoropolyether heat transfer liquids. Performance Fluid PF-7600 is also non-ozone-depleting.

Applications

Semiconductor Fabs

3M™ Performance Fluid PF-7600 can be used for thermal management in semiconductor fab tools including steppers, ion implanters, dry etchers and CVD equipment.

Test Equipment

The fluid may be used for thermal management in semiconductor thermal shock and test equipment.

Electronic Cooling

Due to its compatibility with most electronic components and dielectric strength, Performance Fluid PF-7600 can be used in single and two-phase cooling of supercomputers, sensitive military electronics and also high voltage transformers and power electronics.

Industrial/Pharmaceutical

Performance Fluid PF-7600 is not manufactured under Good Manufacturing Practices (GMP) but it may be used as an alternative to commonly used heat transfer fluids in pharmaceutical and chemical manufacturing processes, such as freeze drying and reactor cooling, where the fluid is completely removed from the device, equipment or product prior to the regulated use.*

*See the 3M EMSD Medical Device Policy on page five of this document.



Typical Physical Properties

Note: The following technical information and data should be considered representative or typical only, and should not be used for specification purposes.

Properties	3M™ Performance Fluid PF-7600
Boiling Point @ 1 atm (°C)	131
Pour Point (°C)	-98
Molecular Weight	346
Vapor Pressure (kPa)	0.96
Liquid Density (kg/m ³)	1545
Coefficient of Expansion (K ⁻¹)	0.00114
Latent Heat of Vaporization @ 1 atm. (kJ/kg)	116
Surface Tension (dynes/cm)	17.7
Kinematic Viscosity (cSt)	1.1
Critical Temperature (°C)	260
Critical Pressure (MPa)	1.67
Solubility of Fluid in Water (ppm by weight)	<10
Solubility of Water in Fluid (ppm by weight)	410
Dielectric Strength, 2.54 mm gap (kV)	31
Volume Resistivity (ohm-cm)	3 x 10 ¹⁰
Dielectric Constant	6.4

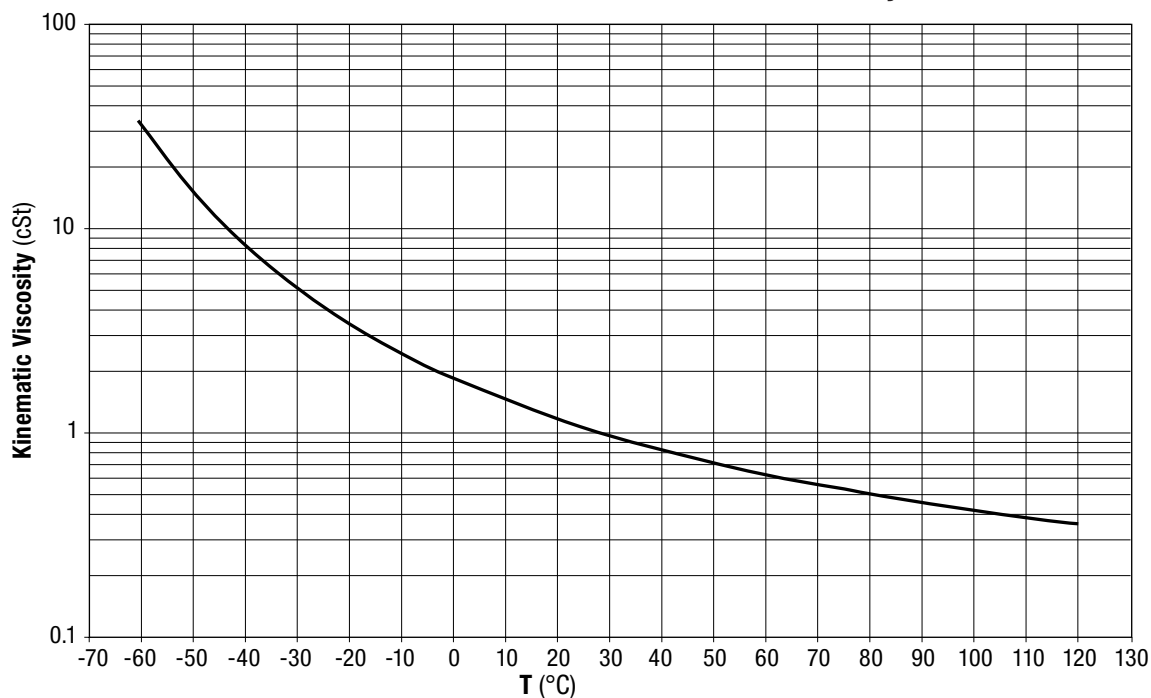
Note:

All values @ 25°C unless otherwise specified.

Typical Heat Transfer Properties

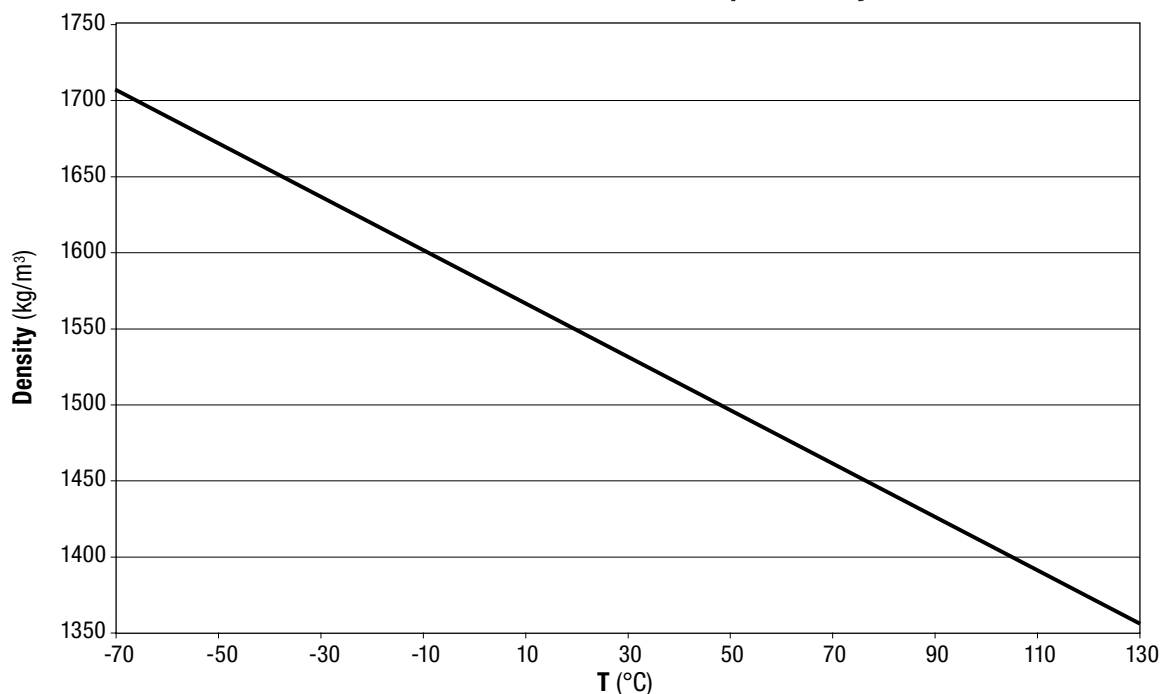
The following graphs and formulas can be used to determine the viscosity, density and thermal conductivity of 3M™ Performance Fluid PF-7600 at various temperatures.

3M™ Performance Fluid PF-7600 Kinematic Viscosity

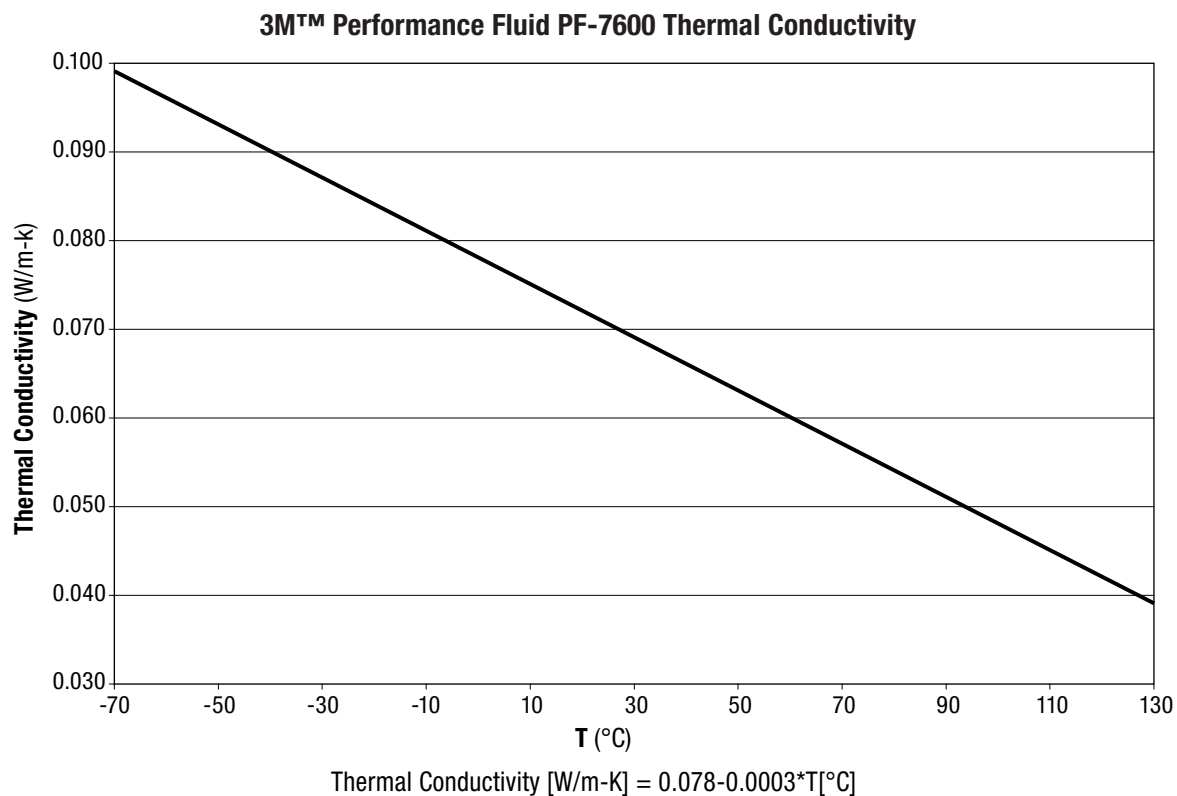


$$\text{Kinematic Viscosity, centistokes} = \text{EXP} (464.4/(T[^\circ\text{C}]+133))-2.881$$

3M™ Performance Fluid PF-7600 Liquid Density



$$\text{Liquid Density [kg/m}^3\text{]} = 1538.8-1.755 \cdot T[^\circ\text{C}]$$

Typical Heat Transfer Properties (continued)**Materials Compatibility**

Performance Fluid PF-7600 differs somewhat from PFCs and PFPEs in its ability to dissolve certain oils. This means that Performance Fluid PF-7600 is more likely to extract plasticizers from elastomeric materials. For this reason, flexible hose/tubing, O-ring and seal materials should be limited to those that contain a low amount of plasticizer. For seals, EPDM, EPR and butyl rubber typically fall into this category. 3M engineers can suggest appropriate compounds or assist with test procedures.

Heater Selection

The critical heat flux of 3M™ Performance Fluid PF-7600 lies in the range of 15 W/cm² to 20 W/cm² when boiling from a horizontal 0.5 mm diameter platinum wire in a quiescent pool of saturated fluid. The maximum heat flux obtainable in forced convection applications is significantly higher, depending largely on the geometry and flow conditions. A safety interlock between the pump and heater is strongly recommended in applications with heat fluxes approaching 15 W/cm².

Medical Device Policy

3M™ Performance Fluids are intended for use as process solvents in applications, such as cleaning and coating, that historically used chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs). They are not intended, nor approved, for incorporation into medical devices or for use in pharmaceuticals. 3M will not support applications such as lung perfusion or blood substitutes, that involve temporary or permanent implantation of the 3M fluids.

[Read a complete statement](#) of 3M Electronics Materials Solutions Division's Global Policy regarding the sale and use of products for medical and pharmaceutical applications.

Toxicity Profile

3M™ Performance Fluid PF-7600 indicates very low overall toxicity. The LD50 (rodent) is greater than 2000 mg/kg and the results of a 28-day repeated dose oral toxicity study in rodents also indicate low repeat dose toxicity.

Performance Fluid PF-7600 is expected to be minimally irritating to the eyes and skin and was negative in the two mutagenicity studies conducted. An 8-hour time weighed average (TWA) exposure guideline for 3M™ Performance Fluid PF-7600 of 11 ppmv has been established by 3M.

Safety and Handling

Before using this product, please read the current product 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.

3M™ Performance Fluid PF-7600 is nonflammable and is resistant to thermal breakdown and hydrolysis during storage and use. Recommended handling procedures are provided in the Safety Data Sheet, which is available from your local 3M representative upon request.

Environmental Properties

3M™ Performance Fluid PF-7600 has a Global Warming Potential of 700, which is more than 90% lower than typical perfluorocarbon (PFCs) or perfluoropolyethers (PFPEs) used in heat transfer applications.

Note: The following technical information and data should be considered representative or typical only, and should not be used for specification purposes.

Properties	3M™ Performance Fluid PF-7600
Ozone Depletion Potential–ODP ¹	0.0
Global Warming Potential ²	700
Atmospheric Lifetime (years)	9
Flammability	Non-flammable
Flammability Range in Air	2.9 - 8.8%

Notes:

¹ CFC-11 = 1.0

² GWP–100 year ITH, CO₂ = 1.0

Regulatory Status

The components of this product are in compliance with the chemical notification requirements of the United States (TSCA) and European Union (ELINCS).

3M™ Performance Fluid PF-7600 has been approved by new chemical notification authorities in both Japan and Korea.

Contact your local 3M representative regarding the regulatory status of Performance Fluid PF-7600 in other countries.

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™ Performance 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™ Performance Fluid PF-7600 in the United States, or for the name of a local authorized distributor, call 3M Electronics Materials Solutions Division: 800-810-8513.

Technical Information

The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.

Product Use

Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. Given the variety of factors that can affect the use and performance of a 3M product, user is solely responsible for evaluating the 3M product and determining whether it is fit for a particular purpose and suitable for user's method of application.

Warranty, Limited Remedy, and Disclaimer

Unless an additional warranty is specifically stated on the applicable 3M product packaging or product literature, 3M warrants that each 3M product meets the applicable 3M product specification at the time 3M ships the product. 3M MAKES NO OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY IMPLIED WARRANTY OR CONDITION ARISING OUT OF A COURSE OF DEALING, CUSTOM OR USAGE OF TRADE. If the 3M product does not conform to this warranty, then the sole and exclusive remedy is, at 3M's option, replacement of the 3M product or refund of the purchase price.

Limitation of Liability

Except where prohibited by law, 3M will not be liable for any loss or damage arising from the 3M product, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including warranty, contract, negligence or strict liability.



Electronics Materials Solutions Division

3M Center, Building 224-3N-11
St. Paul, MN 55144-1000
1-800-810-8513
www.3M.com/electronics

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