

3M

Novec™

Engineered Fluids for Pharmaceutical and Chemical Processing

Finding the right
heat transfer
fluid can be a
chilling
prospect...



Traditionally, materials like chlorofluorocarbons (CFCs), trichloroethylene (TCE), methylene chloride or silicone oils were used as heat transfer fluids to maintain temperatures in pharmaceutical and chemical processing. Unfortunately, these fluids have a number of serious limitations. Some are flammable and may constitute fire hazards. Others are unacceptable because of their high toxicity and potential for user harm. Still others are restricted in their use due to unfavorable environmental profiles.

Now
3M offers you
some cool solutions

The unique low temperature properties of 3M™ Novec™ Engineered Fluids allow them to provide good heat transfer performance to ensure uniform product quality in a variety of processes.

Just as important, however, is the fact that Novec engineered fluids have been designed for the “Human Environment”—meaning these unique materials were designed to balance stringent performance requirements with environmental responsibility and worker safety. They are nonflammable, have low toxicity, zero ozone depletion potential, short atmospheric lifetimes and low global warming potentials. In addition, they do not contribute to the formulation of photochemical smog. 3M™ Novec™ Engineered Fluid HFE-7100 and 3M™ Novec™ Engineered Fluid HFE-7200 are exempt from the U.S. EPA definition of a VOC.

Are we compatible?

Testing of 3M™ Novec™ Engineered Fluids demonstrates their compatibility with a wide range of metals, plastics and elastomers—most of the materials typically used in heat transfer applications.¹

Metals

- Copper
- Iron
- Zinc
- Stainless Steel
- Aluminum
- All common metals

Hard Polymers

- Polyethylene
- Polypropylene
- Phenolic
- ABS
- Nylon
- Ryton™
- Polyvinylchloride (PVC)
- Polycarbonate (Lexan™)
- Polyetheretherketone (PEEK)
- Acrylic (Plexiglass™)
- Rulon™
- Thermoplastics
- PTFE (Teflon™)
- Polysulfone
- Epoxies

Elastomers

- Nitrile
- Butyl
- Stillman SR634-70
- Bay Seal Co. B0612-70
- Fluorosilicone
- Chloroprene
- Polyacrylate
- Silicone
- Fluorocarbon
- Stillman TH1387
- Natural Rubber
- Polysulfide
- Polyurethane
- Styrene Butadiene
- Ethylene Propylene (EP or EPDM)
- Stillman SR721-80
- Parker EPR 540-80
- Parker EPR E515-80
- Jackson Flex. Prods. EPR E3450-80
- Newman EPDM 2107
- International Seal E480

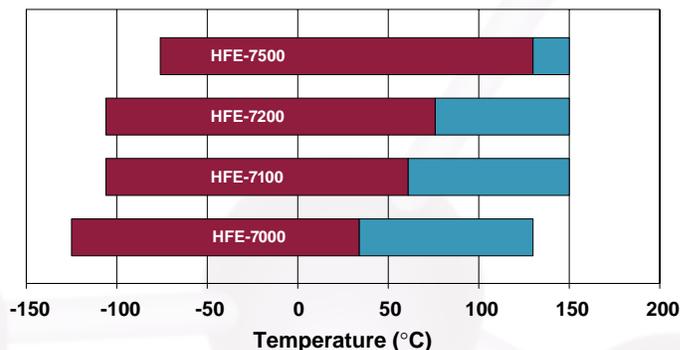
Hoses

- Tygon™
- C-544-A I.B. polyurethane
- Tygon™ 3370 I.B. silicone
- Flexfab™ 5521 silicone
- Nalgene™
- 290 PUR polyurethane
- TFE
- Parker Parflex 550
- Aeroquip FC373
- PFA

¹ Proper system design procedures are described in: P. E. Tuma, "Using Segregated HFEs as Heat Transfer Fluids—Avoiding Problems in System Design," *Chemical Processing*, February 2001, pp. 47-50.

3M™ Novec™ Engineered Fluids are nonflammable and are not regulated for transport, storage or use.

Useful temperature ranges of 3M™ Novec™ Engineered Fluids



Lower limit dictated by 30cst viscosity.

Upper limits dictated by boiling point and thermal stability limits.

*Commercialization pending at the time of publication

Steam-sterilized lyophilizers

Freeze drying, or lyophilization, is a common method of preserving pharmaceutical products before sale. The lyophilizers used to dry these products are sophisticated and must perform to exact specifications. Several Novec fluids have been qualified for use in lyophilizers. 3M™ Novec™ Engineered Fluid HFE-7500, with a boiling point of 130°C, is well-suited for production or pilot-scale lyophilizers that are steam-sterilized. 3M™ Novec™ Engineered Fluid HFE-7100 and 3M™ Novec™ Engineered Fluid HFE-7200 have very low viscosities, but their lower boiling points make them more suited for R&D lyophilizers or any steam-sterilized unit that can tolerate the vapor pressure.

Case study: Lyophilization Technology, Inc.

Novec fluid HFE-7500 was installed in a two square foot Hull Model 2FS8C pilot-scale lyophilizer. Although more volatile Novec fluids might perform more proficiently, Novec fluid HFE-7500 was used because its 130°C boiling point is above common steam sterilization temperatures. Three distinct tests were run: shelf uniformity, cool down rate and heat up rate. Comparisons were made to TCE data measured on the same lyophilizer.

Shelf uniformity results at various temperatures between -50°C and 50°C showed that HFE-7500 fluid shelf temperature ranges were, on average, about 0.17°C higher than TCE. The controlled cool down rate (0.5°C/min) for HFE-7500 fluid between 20°C and 5°C was 0.53°C/min. Between 5°C and -25°C it was 0.48°C/min. The maximum warm-up rate for HFE-7500 fluid from -50°C to 50°C was, at 0.65°C/min, very similar to TCE. The maximum cool down rate between 20°C and -50°C was 0.87°C/min, 27% lower than TCE.

Jacketed reactors

The fluids typically used to cool jacketed reactor vessels suffer the same limitations as those used in lyophilizers. An additional constraint is added by the ever-increasing demand for lower temperatures. More and more frequently, these processes require temperatures of -100°C and lower. Very few fluids are useful at these temperature extremes.

When using silicone oil in reactor cooling applications at temperatures lower than -80°C to -90°C, for example, it becomes difficult to maintain turbulent flow with manageable pressure drops and pumping power. Novec fluids, in comparison, function well at temperatures as low as -120°C with respectable heat-transfer coefficients and very reasonable pumping power demands. Novec fluid HFE-7100 and HFE-7200 have been used in processes well below -80°C, and 3M™ Novec™ Engineered Fluid HFE-7000 has been successfully used below -115°C.



Going

the extra mile...

3M style

When you choose 3M™ Novec™ Engineered Fluids for your pharmaceutical and chemical processing applications, you get more than a great product, you get the technical and customer support of a global partner.

Recycling programs

In the U.S. and Puerto Rico, 3M has teamed with Safety Kleen, Inc. to offer a free used fluid return program to those companies that purchase a qualifying amount of 3M product. All Novec fluid packaging is returnable in the U.S. as well.

Committed to the future

While it's difficult to forecast the exact nature of legislation, it's a good bet that it will continue to evolve in favor of environmental stewardship. 3M's Novec fluids are well positioned to meet regulations today and into the foreseeable future.

3M is committed to improving our technologies, with continuous new product research and development.

Contact us

If you have any questions about Novec fluids for use in pharmaceutical and chemical processing, please contact your local 3M representative, or call 3M Performance Materials Division, **800 810 8513**.

For information on additional 3M fluids, coatings and other chemical products, visit our web site at: **www.3m.com/fluids**

Working with 3M helps give you and your company greater control in today's changing business world. You can benefit from 3M's leadership in technology, regulatory affairs and industry involvement through unmatched technical and customer service.

United States

3M Specialty Materials
3M Center, Building 223-6S-04
St. Paul, MN 55144-1000
800 810 8513
800 810 8514 (Fax)

Europe

3M Specialty Materials
3M Belgium N. V.
Haven 1005, Canadastraat 11
B-2070 Zwijndrecht
32 3 250 7521

3M Canada Company

Specialty Materials
P.O. Box 5757
London, Ontario
N6A 4T1
800 364 3477

Sumitomo 3M Limited

33-1, Tamagawadai 2-chome
Setagaya-ku, Tokyo
158-8583 Japan
813 3709 8250

Asia Pacific and Latin America

Call (U.S.) **651 736 7123**

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Specialty Materials

3M Center, Building 223-6S-04
St. Paul, MN 55144-1000

www.3m.com/fluids

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