

Enhancing performance with safe, sustainable chemistry.

Lubricant and silicone deposition for medical applications using 3M™ Novec™ Engineered Fluids

Introduction

With everything we have learned about the effects of various chemicals on the human body and the environment, it's no longer enough for chemical solutions to be effective. New regulations make it more challenging than ever to find cost-effective solutions that meet your performance needs without compromising worker safety or our environment.

That's where we can help. 3M™ Novec™ Engineered Fluids are a proprietary class of materials, developed to provide safe, effective and sustainable alternatives to conventional process solvents. They have proven to be effective for the deposition of a wide variety of coatings and lubricants, including silicone, PTFE and heparin, on many types of medical devices – including hypodermic needles, surgical and cutting blades, catheters and filter media. They combine proven performance with an outstanding environmental and safety profile. They are non-flammable, low in toxicity, have zero ozone depletion potential and low global warming potential.

Novec fluids are compatible with many types of surfaces – including metals, plastics and elastomers. Their very low surface tension provides excellent coating uniformity. And because they dry quickly, without leaving a residue, the use of Novec fluids can speed up your drying process. Our expert global technical teams can help you match the right Novec fluid to your specific solubility and surface compatibility needs.

Figure 1. Deposition with 3M™ Novec™ Engineered Fluids in medical applications

Materials	Substrates	Applications
Lubricants	Stainless steel	Needles
- Silicones	Titanium	Catheters
- Fluorochemicals	Polycarbonate	Blades
Heparin	Silicone rubbers	Blood filters
	Foams	Tubing
	Non-wovens	Plungers
	Metals	Filters
	PVC	Staples
	Plastics	Bags

Solubility

3M has tested the solubility of many common medical device lubricants and silicones in our Novec fluids. In general, we've found that it's best to use our neat fluids like 3M™ Novec™ Engineered Fluids 7100 and 7200 with heparin. Figure 2 shows silicone solubilities when used with select Novec fluids. Our labs can assist you with any specialty materials and provide analysis and reports of solubility with various Novec fluids. We can also provide you with samples for your own analysis.

Bath preparation

It is important to keep the system as free from water as possible. Coating defects are possible if standing water floating on top of the coating bath interferes with or pre-wets the substrate. Even small amounts of dissolved water in moisture cure or reactive silicone coating baths could cause the material to hydrolyze and gel out of solution. 3M technical experts can help you optimize your process through technical discussions, material compatibility testing and equipment recommendations.

Application

Lubricants dissolved in Novec fluids can be applied to substrates in many ways – including dip, spray and cascade application processes. For instance, needles may be put together in larger blocks with the entire block immersed into the coating solution. Alternatively, sometimes coatings need specific application to only one location or side of a part, which can be accommodated through precision spray or liquid dispensing equipment. The low surface tension, low viscosity and high vapor pressure of Novec fluids allows easy application to a variety of substrates and rapid drying. All that's left behind is a uniform coating of your choosing on your parts.

Figure 2. Solubilities of silicones in 3M™ Novec™ Engineered Fluids

Properties	Unit	7100 / 7100DL*	7200 / 7200DL*	71PA	71DE	71DA	72DE	72DA	73DE
Formulation	-	Novec 7100 (100%)	Novec 7200 (100%)	Novec 7100 (95%) Isopropanol (5%)	Novec 7100 (50%) t-DCE** (50%)	Novec 7100 (53%) t-DCE** (45%) Ethanol (2%)	t-DCE** (70%) Novec 7200 (20%) Novec 7100 (10%)	t-DCE** (68%) Novec 7200 (20%) Novec 7100 (10%) Isopropanol (2%)	t-DCE** (85%) Novec 7300 (15%)
Boiling point	°C	61	76	55	41	40	44	44	48
Kinematic viscosity	cSt	0.38	43	0.41	0.31	0.34	0.35	0.35	0.3
Specific heat	J/kg•K	1183	1220	1255	1192	1230	1210	1242	1201
Surface tension	mN/m	13.6	13.6	14.5	16.6	16.4	19	18	19.9

Dow Corning Silicones

200, 350 cst	% Solubility w/w	1%	3%	1%	>50%	>50%	>50%	>50%	>50%
200, 1000 cst		<1%	<1%	<1%	15%	>50%	>50%	>50%	>50%
360, 20 cst		2%	6%	4%	>50%	>50%	>50%	>50%	>50%
360, 100 cst		<1%	3%	2%	>50%	>50%	>50%	>50%	>50%
360, 350 cst		<1%	<1%	<1%	>50%***	>50%	>50%	>50%	>50%
360, 1000 cst		<1%	<1%	<1%	15%	>50%	>50%	>50%	>50%
360, 12500 cst		<1%	<1%	<1%	10%	>50%	>50%	>50%	>50%
MDX4-4159		1%	3%	3%	>50%	>50%	>50%	>50%	>50%

NuSil Silicones

MED-4162	% Solubility w/w	<1%	<1%	<1%	>50%	>50%	>50%	>50%	>50%
MED-4159		<1%	<1%	<1%	>50%	>50%	>50%	>50%	>50%
MED-400, 350 cst		<1%	<1%	<1%	>50%	>50%	>50%	>50%	>50%
MED-400, 100,000 cst		<1%	<1%	<1%	>50%	>50%	<1%	<1%	<1%
MED-420, 350 cst		<1%	<1%	<1%	>50%	>50%	>50%	>50%	>50%
MED-420, 12,500 cst		<1%	<1%	<1%	>50%	>50%	>50%	>50%	>50%
MED-460, 350 cst		<1%	<1%	<1%	>50%	>50%	>50%	>50%	>50%
MED-460, 12,500 cst		<1%	<1%	<1%	>50%	>50%	>50%	>50%	>50%
MED-361, 350 cst		<1%	<1%	<1%	>50%	>50%	>50%	>50%	>50%
MED-361, 12,500 cst		<1%	2%	<1%	18%	>50%	>50%	>50%	>50%
MED-361, 100,000 cst		<1%	<1%	<1%	29%	30%	16%	22%	>50%

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

* Each DL-designated product has specified maximum levels of various substances including: ions (ppb), metals (ppb) and water (ppm). Particles are monitored, but not specified. Please refer to each product's Product Information page for more information.

** trans-1,2-dichloroethylene

*** When Dow Corning 360, 350 cst was added slowly to Novec 71DE fluid. But if a large amount of Dow Corning 360, 350 cst was added initially, the solution would become cloudy, and remain this way after time.

Technical support from 3M

3M™ Novec™ Engineered Fluids have replaced a wide variety of solvents that have been restricted due to regulations – including HCFC-141b and HCFC-225. Our global technical service team has significant experience assisting customers with conversions to Novec fluids. There are many factors to consider in these conversions and our team can work with you side-by-side to assist with process optimization factors – including methods to recapture/reclaim solvent, increase the pot life of the solution and optimize the coating process.

Safety, handling & storage

To make sure your coating solutions perform as designed, it is important that they are handled and stored appropriately. Please follow the “Safety, Handling and Storage” information

on the 3M Technical Data Sheets and Safety Data Sheets for these products.

Before using 3M products, please read the current product Safety Data Sheet (SDS), which is available through your 3M sales or technical service representative or at 3M.com/Novec, and the precautionary statement on the product package. Follow all applicable precautions and directions. Always practice smart and safe industrial hygiene practices.

For additional information

To request additional product or process information, please contact 3M Customer Service at one of the numbers below or visit 3M.com/Novec. For other 3M global offices or information on other 3M products for electronics, please visit our website at 3M.com/electronics.

3M EMSD Medical Device Policy

3M™ Novec™ products are intended for use as process solvents in applications, such as cleaning and coating, that historically used CFCs and HCFCs. They are not intended, nor approved, for incorporation into medical devices or for use in pharmaceuticals. 3M will not support applications that involve temporary or permanent implantation of the Novec product.

[Click here](#) to download a complete statement of 3M Electronics Materials Solutions Division’s Global Policy regarding the sale and use of products for medical and pharmaceutical applications. This document is also available on 3M.com/Novec.

The 3M™ Novec™ Brand Family

The Novec brand is the hallmark for a variety of proprietary 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, protective coatings, immersion cooling, advanced insulation media replacement solutions and several specialty chemical applications.

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

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Regulatory: For regulatory information about this product, contact your 3M representative.

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Electronics Materials Solutions Division

3M Center, Building 224-3N-11
St. Paul, MN 55144-1000 USA

Phone 1-800-810-8513
Web www.3M.com/novec

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Issued: 7/16 11756HB
60-5002-0851-1