

SILFORM* FR-10 fluid / SILFORM* FR-5 fluid

SPECIALTY FLUIDS - PERSONAL CARE



INCI: *Trifluoropropyldimethylsiloxy/Trimethylsiloxy Silsesquioxane (and) Dimethicone*

SilForm FR-10/SilForm FR-5 fluids are fluoro-modified silicone resins that can provide a variety of performance benefits in skin care and color cosmetics. SilForm FR-10/SilForm FR-5 fluids form a highly flexible film on the surface of skin that typically imparts comfort along with water and oil resistance, thus extending the wear of beauty products (especially facial and color cosmetics). These products are also excellent candidates to consider for efficient improvement in the performance of formulations designed for sports enthusiasts.

Key Features and Typical Benefits

- highly flexible silicone film formers with long-lasting comfort
- extended durability
- water and oil resistance
- can be formulated into hair care formulations to add body and flexible hold

Potential Applications

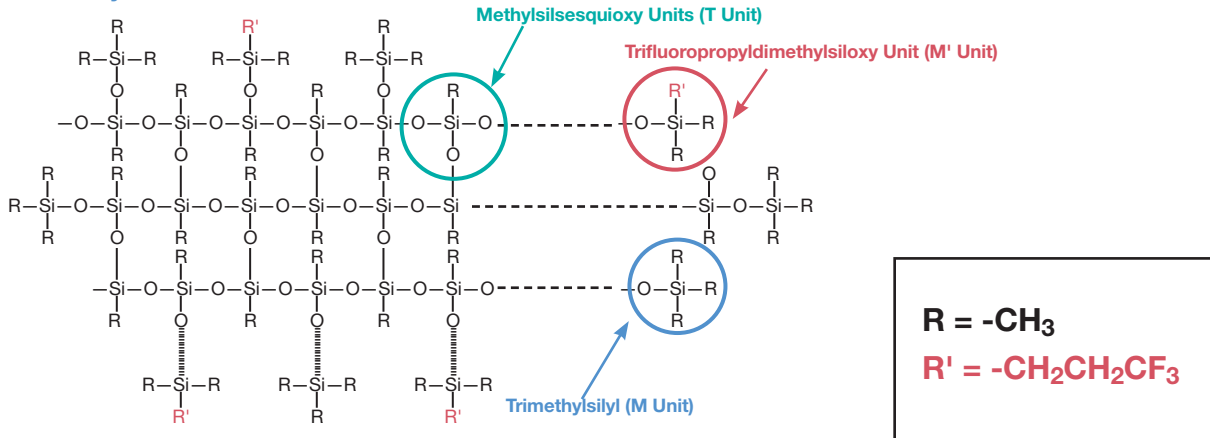
- sunscreens
- foundations
- cosmetics
- skin creams
- anti-aging products
- hair styling agents
- hair conditioners
- hair treatments

Typical Physical Properties ⁽¹⁾		
	SilForm FR-10 fluid	SilForm FR-5 fluid
Appearance	Translucent clean fluid	Transparent fluid
Viscosity, Pa*s	0.4	<0.2
Solid Content, %	50	50
Refractive Index	1.406	1.406
Diluent, cSt Dimethicone	10	5

(1) The actual values may vary. Product specifications for specific applications need to be agreed upon individually.

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Chemistry

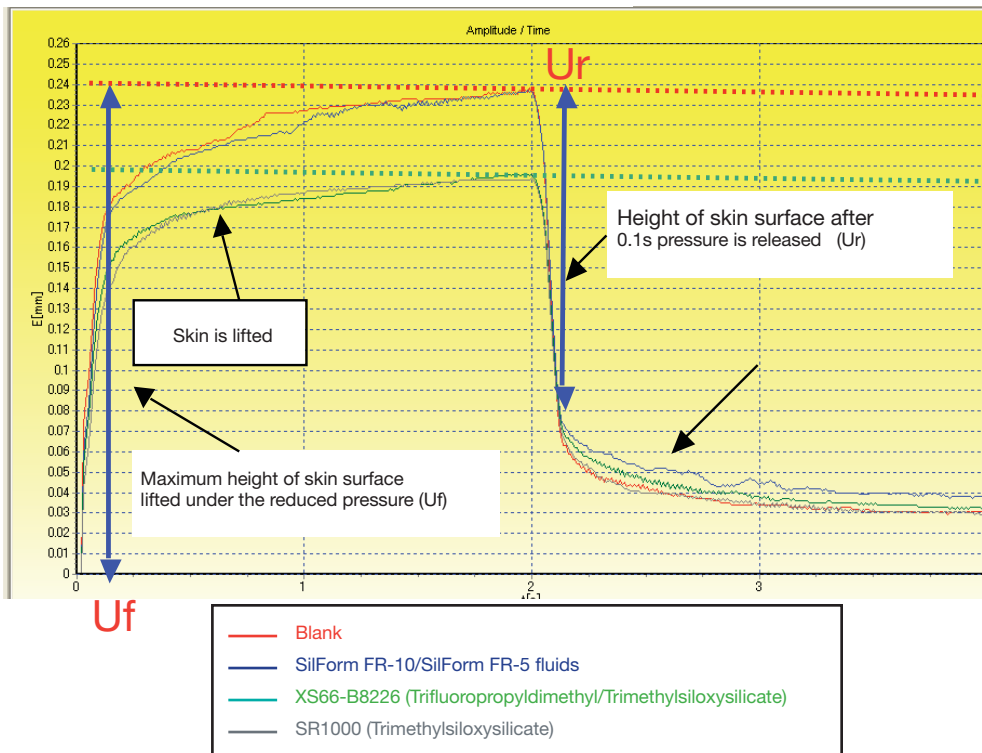


Performance Data

Film-formers are widely used in cosmetic applications to provide water and oil resistance and color transfer resistance benefits, however, they generally create rough, coarse sensory feel due to their brittle nature. Skin that is healthy will be more supple than rough, dry skin and measuring the skin's elasticity is an indicator of its overall well being.

Figure 1 shows a comparison of SilForm FR-10/SilForm FR-5 fluids against other film formers. During measurement, skin is lifted and released using a Cutometer, to measure flexibility. In this test, SilForm FR-10/SilForm FR-5 fluids provided the best skin elasticity (flexibility) which suggested that SilForm FR-10/SilForm FR-5 fluids could be excellent candidates to consider for formulations requiring maximum natural sensory with wash and wear resistance.

Figure 1: Skin Elasticity



Procedure

- (1) Prepared 50 wt% cyclopentasiloxane solutions of resin samples.
- (2) Uniformly applied 0.02cc of sample solution to vitro skin at 25°C.
- (3) Dried for 10 minutes.
- (4) Measured the skin elasticity by Cutometer.

Note: Test results. Actual results may vary.

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Performance Data (continued)

Film Flexibility on Synthetic Skin (Figure 2)

Silicone film was subjected to 110% lateral expansion on synthetic skin, and SilForm FR-10/SilForm FR-5 fluids showed excellent flexibility, similar to an MT resin (Polymethylsilsesquioxane). The results represented below suggest that SilForm FR-10/SilForm FR-5 fluids, fluorinated MT resins, improved the durability of make-up, since the film is still intact and uniform compared to MQ resin types of products.

Figure 2: Film Flexibility



SilForm FR-10/SilForm FR-5 fluids



MT Resin



MQ Resin



FI MQ Resin

Procedure:

- (1) Prepared solutions of 30 wt% resin in cyclopentasiloxane.
- (2) Applied 0.5g of cyclopentasiloxane resin solution uniformly on synthetic skin (5 x 10cm).
- (3) Dried overnight at ambient temperature.
- (4) Laterally expanded 110%. Released to normal state and observed the surface.

Note: Test results. Actual results may vary.

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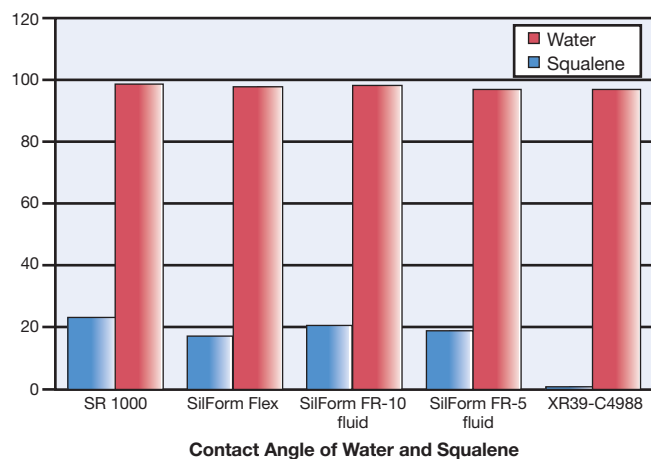
Performance Data (continued)

Water and Oil Resistance (Figure 3)

SilForm FR-10/SilForm FR-5 fluids improved oil repellency compared to other evaluated silicone film formers, while providing excellent water repellency.

- 30% resin in D5 was applied on a glass slide and the film was dried overnight.
- Contact angle of water and squalene was measured.

Figure 3: Water and Oil Resistance



Treatment	Contact Angle	
	Water	Squalene
SR-1000	101	33
SilForm Flex	100	33
SilForm FR-10 fluid	100	38
SilForm FR-5 fluid	99	36
XR39-C4988	99	17

Procedure:

- (1) Prepared a 30 wt% solution of resin in Cyclopentasiloxane.
- (2) Applied the solution uniformly on a glass slide.
- (3) Dried overnight at ambient temperature.
- (4) Measured the contact angle of water and squalane.

Note: Test results. Actual results may vary.

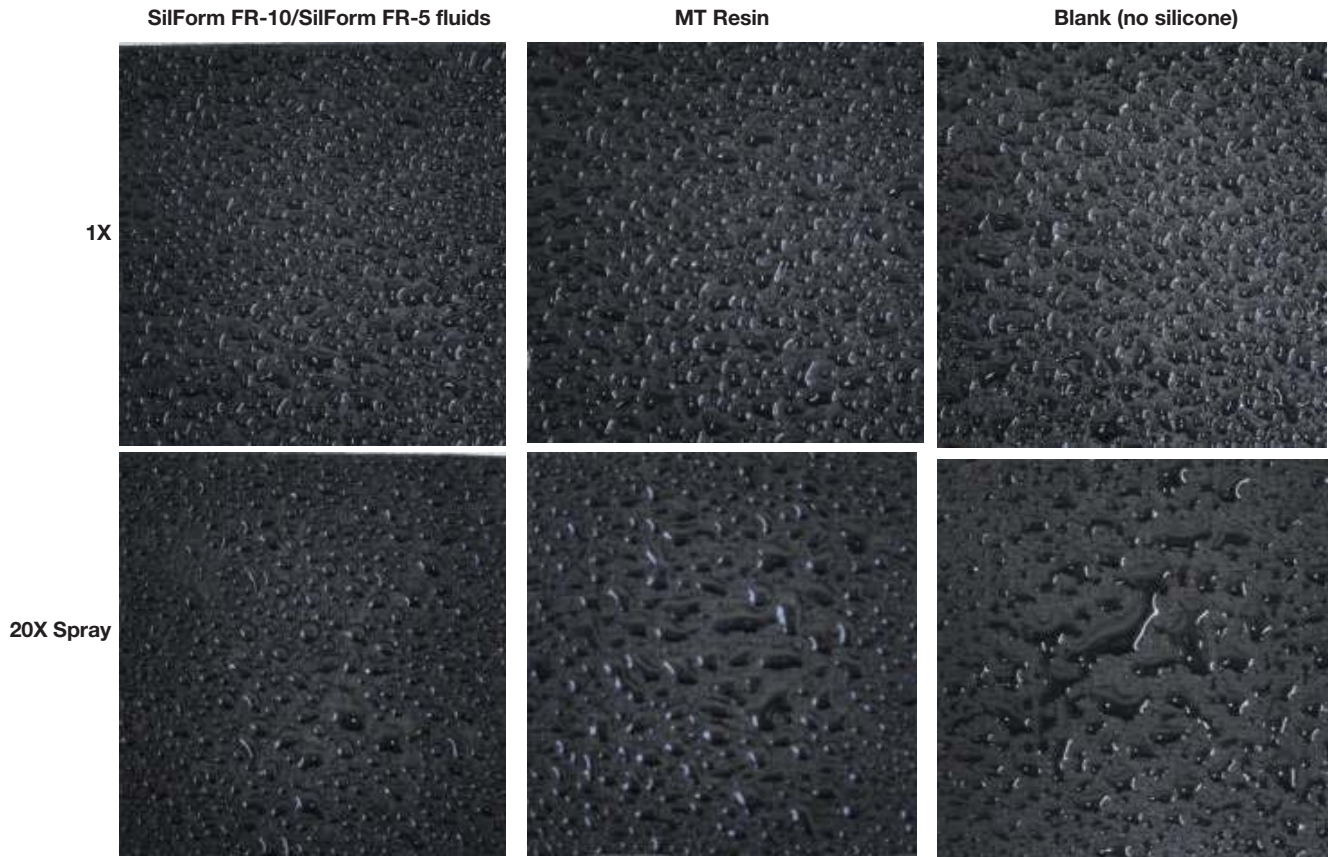
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Performance Data (continued)

Wash Off Durability (Figure 4)

To test the durability of SilForm FR-10/SilForm FR-5 fluids, a model sunscreen⁽¹⁾ formulation containing silicone film formers as prepared, applied on synthetic skin and allowed to dry. The substrate was insulted with a water spray, followed by towel drying, to simulate swim and exercise conditions. The procedure was repeated 20 times. SilForm FR-10/SilForm FR-5 fluids showed improved wash off resistance, which implied extended wear benefits in products designed for exercise and outdoor activities.

Figure 4: Wash Off Durability



Water Durability Test Procedure

- (1) Applied 0.01g of the model sunscreen formulation uniformly to the synthetic skin (5cm x 5cm).
- (2) Dried for 10 minutes.
- (3) Sprayed water (40°C) onto the surface of the synthetic skin and observed.
- (4) Using dry towel, wiped substrate 1X.
- (5) Repeated steps (3) and (4) 20 times.
- (6) After repeating 20 times, observed substrate.

Note: Test results. Actual results may vary.

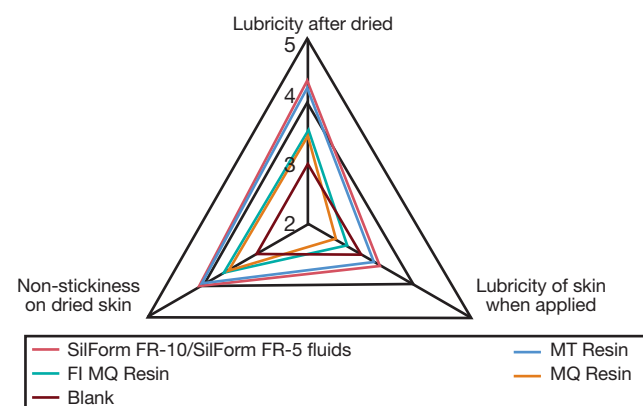
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(1) Model Sunscreen Formulation

Ingredient	INCI	wt%
Part A		
SilForm FR-10 or SilForm FR-5 fluid		2.0
SF1540	Cyclopentasiloxane (and) PEG/PPG-20/15 Dimethicone	0.8
Cyclopentasiloxane	Cyclopentasiloxane	32.0
Velvesil* 125 silicone copolymer network	Cyclopentasiloxane (and) C30-45 Alkyl Cetearyl Dimethicone Crosspolymer	4.0
Silsoft* 034 organosilicone fluid	Caprylyl Methicone	0.7
Ethylhexyl Methoxycinnamate		7.0
Sorbitan Sesquioleate		1.0
Tocopherol		0.1
Part B		
Tospearl* 145A microspheres	Polymethylsilsesquioxane	4.0
Zinc Oxide		9.0
Part C		
EDTA		0.1
NaCl		0.4
Glycerin		2.0
Ethanol		5.0
Preservative		0.1
Water		qs

Product formulations are included as illustrative examples only. Momentive makes no representation or warranty of any kind with respect to any such formulations, including, without limitation, concerning the efficacy or safety of any product manufactured using such formulations.

Figure 5: Sensory Panel Test Result



SilForm FR-10/SilForm FR-5 fluids provided excellent lubricity and non-stickiness when dried while enhancing lubricity during rub-in.

Procedure

- (1) Dissolved Part A at 80°C.
- (2) Added Part B to Part A and mixed well.
- (3) Added Part C to oil phase (Part A and B) and emulsified by homogenizer.
- (4) Cooled to room temperature.

Note: Test results. Actual results may vary.

Compatibility with Personal Care Ingredients

SilForm FR-10 or SilForm FR-5 fluid was dissolved in the solvent at 5 wt%. Both resins easily dissolved in low viscosity dimethicone, selected organo-functional silicones, hydrocarbons and esters.

Ingredient		SilForm FR-10/ SilForm FR-5 fluids	SilForm Flex.
Silicones	Cyclopentasiloxane	S	S
	Caprylyl Methicone (Silsoft* 034)	S	S
	Ethyltrimethicone (Silsoft ETS)	S	S
	Dimethicone, 10cs	S	S
	Dimethicone, 100cs	I	I
	Phenyltrimethicone (SF1550)	SH	SH
Hydrocarbons	Liquid Isoparaffin	I	I
	Isododecane	S	S
	Hydrogenated Polyisobutene	S	S
Vegetable Oils	Corn Oil	I	I
	Caster Oil	I	I
Esters	Isopropyl Myristate	S	S
	Isopropyl Palmitate	SH	SH
	Caprylic/Capric Triglyceride	I	I
	Triethylhexanoin	I	I
	Sorbian Isostearate	I	I
	Isononyl Isononanoate	S	S
	Squalane	I	I
	Ethylhexyl Methoxycinnamate	I	I
Waxes	Beeswax	I	I
	Microcrystalline Wax	I	i
	Candelilla Wax	I	I
Water, Alcohols	Water	I	I
	PG	I	I
	BG	I	I
	Glycerin	I	I

S: Soluble SH: Soluble at 70°C I: Insoluble

Sensory Test on Sunscreen (Figure 5)

In sensory testing using a model sunscreen formulation,⁽¹⁾ each silicone resin sample was subjected to panel test. Panelists scored 1 (Poor) to 5 (Excellent) on each aspect, and blank was set at 3.

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