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Ref: AMB-20

ACC C111 Dimethyl Silicone Fluids for Cosmetic/Pharmaceutical Applications

Introduction

ACC C111 Dimethyl Silicone Fluids are clear, water-white linear polydimethylsiloxanes, which have been manufactured and tested specially to meet the requirements of the cosmetics and pharmaceutical industries.

ACC C111 series of fluids are available in a range of viscosities from 20 to 60,000 $mm^2s^{-1(a)}$. They are characterised by high-temperature stability, oxidation resistance and only a small change in viscosity with temperature. In addition, the fluids are chemically very inert, have very low surface tension, high compressibility, good resistance to shear breakdown and excellent spreadability.

It is this unique combination of chemical inertness, low surface tension, high spreadability and, of course, very low order of toxicity which has made silicone fluids of this type by far the most popular special effect products for cosmetics.

This unusual combination of properties results from their molecular structure for which a helical conformation is the favoured structure in the absence of solvents, diluents or surfaces on which to spread. When spread in monomolecular layers on polar surfaces the fluids are believed to adopt a characteristics ‘spread chain’ conformation.

ACC C111 fluids are linear dimethyl polysiloxanes consisting of alternate silicone and oxygen atoms, their free valences being saturated by methyl groups. Their unique surface properties and chemical inertness are due to the methyl groups and their protective influence on the Si-O-Si bonds.

The chemical structure of the C111 fluids can be illustrated by the following generic formula.

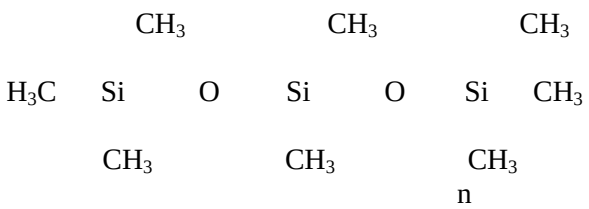

Table 1
Grade of F111 Fluid

Characteristics	C111/20	C111/50	C111/100	C111/300	C111/350	C111/500	C111/1000	C111/10,000 to 60,000
Viscostity at 25°c $mm^2 s^{-1}$	20	50	100	300	350	500	1,000	10,000-60,000
Specific gravity at 25°C/25°C	0.953	0.963	0.968	0.972	0.972	0.973	0.974	0.975 – 0.978
Flash point °C (approx) (2)	230	280	>315	>315	>315	>315	>315	>315
Freezing Point °C (approx)	-73	-55	-55	-50	-50	-50	-50	-45
Refractive index at 25°C (approx)	1.402	1.402	1.403	1.403	1.403	1.403	1.403	1.404
Surface tension at 25°C – dynes/cm (approx) - newtons/m (approx)	20.6 $2.06x10^{-2}$	20.7 $2.07x10^{-2}$	20.9 $2.09x10^{-2}$	21.1 $2.11x10^{-2}$	21.1 $2.11x10^{-2}$	21.1 $2.11x10^{-2}$	21.1 $2.11x10^{-2}$	21.1 $2.11x10^{-2}$
Vapour pressure at 200°C -mm Hg (approx - Pascals (approx)	1.10^{-2} 1.33	1.10^{-2} 1.33	1.10^{-2} 1.33	1.10^{-2} 1.33	1.10^{-2} 1.33	1.10^{-2} 1.33	1.10^{-2} 1.33	1.10^{-2} 1.33
Volume expansion coefficient between 25°C and 100°C $cm^3/cm^3\,^{\circ}C$ (approx)	$1.07x10^{-3}$	$1.05x10^{-3}$	$9.25x10^{-4}$	$9.25x10^{-4}$	$9.25x10^{-4}$	$9.25x10^{-4}$	$9.25x10^{-4}$	$9.25x10^{-4}$
Specific heat -cal/g.°C (approx) - joules/g.°C (approx)	0.39 1.63	0.35 1.46	0.35 1.46	0.35 1.46	0.35 1.46	0.35 1.46	0.35 1.46	0.36 1.50
Thermal conductivity -cal. $Cm/sec.cm^2 . °c$ (approx) - watts/m.°C (approx)	$3.4x10^{-4}$ 0.14	$3.8x10^{-4}$ 0.16	$3.8x10^{-4}$ 0.16	$3.8x10^{-4}$ 0.16	$3.8x10^{-4}$ 0.16	$3.8x10^{-4}$ 0.16	$3.8x10^{-4}$ 0.16	$3.8x10^{-4}$ 0.16
Viscosity/temperature coefficient (3) (approx)	0.59	0.60	0.62	0.62	0.62	0.62	0.62	0.62
Dielectric constant at 25°C between 0.5 and 100kHz (approx)	2.68	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Dielectric Strength at 25°C kV/mm (approx)	15	16	16	16	16	16	16	18
Power factor at 25°C ➢ 0.5kHz (approx) ➢ 100kHz (approx)	$4x10^{-5}$ $1x10^{-5}$	$2x10^{-4}$ $1x10^{-4}$	$2x10^{-4}$ $1x10^{-4}$	$2x10^{-4}$ $1x10^{-4}$	$2x10^{-4}$ $1x10^{-4}$	$2x10^{-4}$ $1x10^{-4}$	$2x10^{-4}$ $1x10^{-4}$	$2x10^{-4}$ $1x10^{-4}$
Volume Resistivity at 25°c ohm.cm	$1x10^{14}$	$1x10^{14}$	$1x10^{15}$	$1x10^{15}$	$1x10^{15}$	$1x10^{15}$	$1x10^{15}$	$1x10^{15}$

(1) C111/20 to C111/1000 measured using Test method IP71/87 (ASTM D445-60) using Ostwald U-tube viscometers to BS188 - 1977 “Methods for determination of viscosity” C111/10,000 and above are tested on Brookfield RV viscometer.
(2) Test method is Pensky-Martens, Closed Cup Method, IP 34/88 (BS.2000 Part 34:1990)
(3)Viscosity/temperature coefficient = 1 - (visc. at 99°C/visc. at 38°C).

General Physical & Chemical Properties

The Physical & Chemical properties of ACC C111 Dimethyl Silicone fluids are the same as those for ACC F111 Dimethyl Silicone Fluids.
Customers are asked to refer to the TDS ref AMB –1 ACC F111 Dimethyl Fluids for details.

Specifications

Nomenclature: 'Dimethicone' is the adopted name for the series of trimethylsilyl – terminated polydimethylsiloxanes with nominal viscosities between 20 and 1,000 $mm^2 s^{-1}$ used by the British Pharmacopoeia (B.P.) and by Cosmetic, Toiletry and Perfumery Association (C.T.P.A) also known as the Cosmetic, Toiletry and Fragrance Association (C.T.F.A.) in the US.

'Dimeticonum' is the name used by the European Pharmacopoeia and most continental Western European Pharmacopoeia. Grades with viscosities in excess of 1,000 $mm^2 s^{-1}$ nominal viscosity are regarded as lubricants in the European Pharmacopoeia and have wider specification.

Compliance: At the time of publication ACC C111/50 to 1000 Dimethyl Silicone Fluids complied with the specifications for Dimethicone or Dimeticonum given in the following publications.

British Pharmacopoeia, 1988 at page 200

European Pharmacopoeia, 1982 2nd Edition, Part II, Forth Fascicule at pages 138 138-2.

Cosmetic, Toiletry and Fragrance Association Specification.

Properties off C11 Dimethyl Silicone Fluids

The following properties are particularly useful to the cosmetic and pharmaceutical formulator.

- Low surface tension
- Lubricity
- Improved spreading on the skin
- Tastelessness
- Virtually odourless
- Resistance to bacteria and fungi
- Thermal stability
- Non-occlusive – no interference with normal transpiration
- Oxidation resistance – do not oxidise or become rancid after long exposure or shelf aging
- Defoaming action – prevents foaming during rub-out
- Enhancement of water repellency eg protective creams

Table 2 : **Compatibility of C111 Dimethyl Silicone Fluids with Typical Cosmetic Ingredients**

Cosmetic Ingredient	C111/50		C111/300		C111/1000	
	1%	10%	1%	10%	1%	10%
Water	**I**	**I**	**I**	**I**	**I**	**I**
Ethanol (96%)	**P**	**I**	**I**	**I**	**I**	**I**
Isopropanol (99%)	**P**	**I**	**P**	**I**	**I**	**I**
Cetyl alcohol	**I**	**I**	**I**	**I**	**I**	**I**
Diethyl ether	**C**	**C**	**C**	**C**	**C**	**C**
Chloroform	**C**	**C**	**C**	**C**	**C**	**C**
White spirit	**C**	**C**	**C**	**C**	**C**	**C**
Acetone	**I**	**I**	**I**	**I**	**I**	**I**
Beeswax	**I**	**I**	**I**	**I**	**I**	**I**
Paraffin oil (Perliquidum)	**I**	**I**	**I**	**I**	**I**	**I**
Petrolaturn	**I**	**I**	**I**	**I**	**I**	**I**
Isopropyl myristate	**C**	**C**	**C**	**C**	**C**	**C**
Isopropyl isostearate	**C**	**C**	**C**	**C**	**C**	**C**
Groundnut oil	**I**	**I**	**I**	**I**	**I**	**I**
Wheatgerm oil	**I**	**I**	**I**	**I**	**I**	**I**
Sunflower oil	**I**	**I**	**I**	**I**	**I**	**I**
Jojoba	**I**	**I**	**I**	**I**	**I**	**I**
Avocado oil	**I**	**I**	**I**	**I**	**I**	**I**
Lemon oil	**C**	**C**	**C**	**C**	**P**	**P**
Lanolin	**I**	**I**	**I**	**I**	**I**	**I**
Glycerol	**I**	**I**	**I**	**I**	**I**	**I**
Propylene glycol	**I**	**I**	**I**	**I**	**I**	**I**
*** Arlamol E**	**I**	**I**	**I**	**I**	**I**	**I**
****Miglyol 812**	**I**	**I**	**I**	**I**	**I**	**I**
Cyclomethicone CTFAC	**C**	**C**	**C**	**C**	**C**	

***Arlamol E (PPG-15 stearyl ether CTFA)**
**** Miglyol 812 (caprylic/capric triglyceride CTFA)**

I : Incompatible
P : Partially compatible
C : Compatible

General Information
Common Solvents and other products
Customers are advised to obtain data sheets for any common solvents or other products referred to from the manufacturers and to satisfy themselves as to the hazards which they may present in handling and use for the purpose described.

In addition, care should be taken to comply with any government legislation currently in force in the country in which the solvents are to be used.

Occupational exposure limits have been assigned to many common solvents and other chemicals.

Products of Combustion

When burned with excess oxygen, the C111 fluids form silicone dioxide, carbon dioxide and water.
If combustion is incomplete the products may also include short-chain polymers, methane, formaldehyde and formic acid.

Storage
ACC C111 Dimethyl Fluids are exceptionally stable and will last indefinitely if stored in clean, covered containers under reasonable storage conditions. If necessary, they can be stored, for extended periods, under adverse conditions, e.g. below freezing point or under tropical conditions.

The fluids should no be stored or used in contact with lead or tin alloys, e.g. from soldered seams, as these metals will promote gelling

Packages

Silicone fluids in the ACC C111 Dimethyl fluid series are supplied in non-returnable packs containing the following net quantities of product

1kg 5kg 25kg and 200kg