

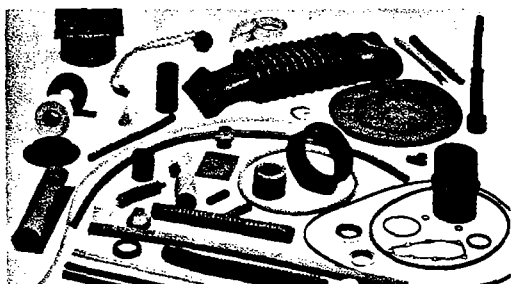
Silicones

Silicones are a family of man-made materials having their origins in silicon, an abundant, rock-like substance derived from quartz, and in organic hydrocarbons such as petroleum. ■ General Electric was the first to develop commercial silicones in the late 1930's and early 1940's, and today manufactures well over 900 different silicone products.

Silicone Rubber

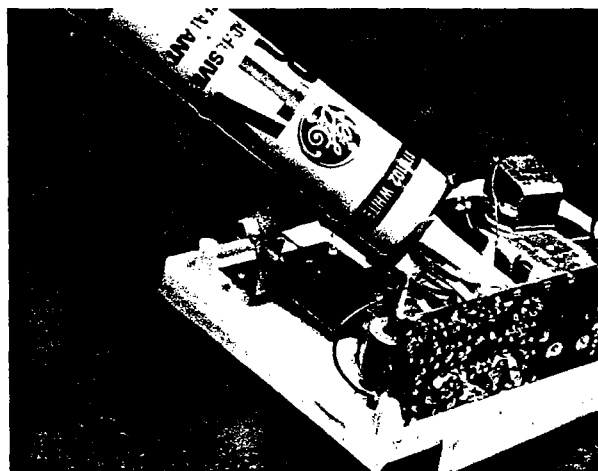
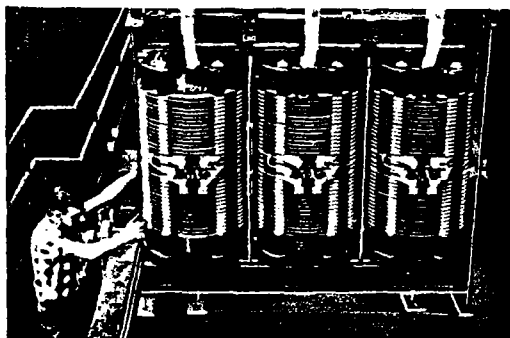
Silicone rubber can withstand temperatures up to 600°F, remain flexible down to -65°F, and offer years of resistance to temperature extremes, ozone, aging and weathering unmatched by any other elastomers. Silicone rubbers today match organic rubbers in physical properties. They can be molded, extruded, or fabricated by any conventional method and are widely used for seals, gaskets, shock mounts, and wire insulation in aerospace, automotive and other industrial applications.

The creation of RTV (room temperature vulcanizing) silicone rubbers expanded the uses for this material. RTV silicone rubber is used for molds for precise plastic reproductions, protective coatings and as a liquid roofing material in the construction industry, and made possible silicone rubber sealants.



Electrical Insulation

Silicones have outstanding electrical properties which are retained over a wide temperature range. Combined with their resistance to corona, ozone and aging, their properties make silicones ideal insulating materials for the most demanding service. Silicone resins are used as coil impregnating varnishes and as binders for mica products. Both resins and rubber are used in electrical tapes. Other electrical uses include dielectric fluids and compounds, wire and cable insulation and RTV silicone rubber potting and encapsulating compounds.



Adhesives and Sealants

RTV silicone rubber products are widely used as adhesives and sealants. Long life, temperature resistance, and weatherability make them ideal for interior or exterior use. General Electric silicone adhesives have been used to hold photo-cells to the exterior surfaces of spacecraft and satellites. Silicone sealants are also widely used in aircraft, manned spacecraft, a wide variety of OEM applications and in building construction.

Lubricants and Mechanical Fluids

Silicone lubricants can solve almost any extreme temperature lubrication problem. Silicone fluids maintain relatively constant viscosities over a wide temperature range. Silicone greases do not harden at low temperatures or soften or bleed at high temperatures. Silicone protective compounds guard against moisture and corrosion.

Silicone mechanical fluids have excellent shear resistance as well as outstanding viscosity/temperature characteristics. They are used as power transmission fluids in such devices as constant-speed automobile fan drives, and in damping and heat-transfer applications.

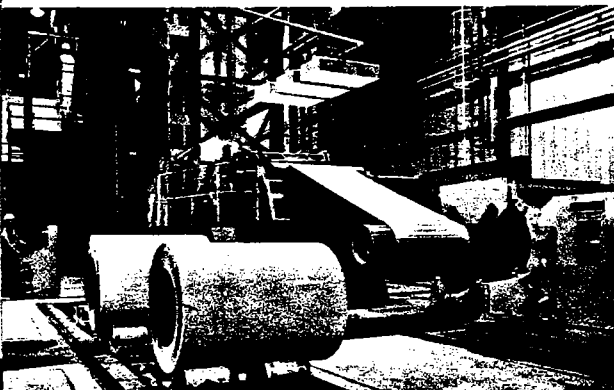
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Silicones *(continued)*



Coatings and Finishes

General Electric Silicone resin copolymers provide the base for architectural and equipment finishes with outstanding weatherability and long-term gloss retention. These durable finishes promise substantial maintenance savings. Silicone resins are used in the best high-temperature paints and masonry water repellents. Silicone non-stick coatings are used on release paper. Silicone textile finishes make fabrics water and stain repellent.



Processing Aids and Additives

Silicone release agents are used in molding rubber, plastic, and die-cast metal parts. They provide quick, easy release and reduce mold build-up, since they resist breakdown at molding temperatures. Silicone antifoam agents control foam in chemical processing. Special silicone surfactants are used in the manufacture of polyurethane foam to control cell size and provide uniformity.

Silicone additives improve processability, application characteristics, and service life in many products. Silicone additives improve gloss, rub-out, and water-repellency in auto and furniture polishes, and significantly improve the performance of cosmetics, aerosols, cleaners, and hundreds of consumer products.

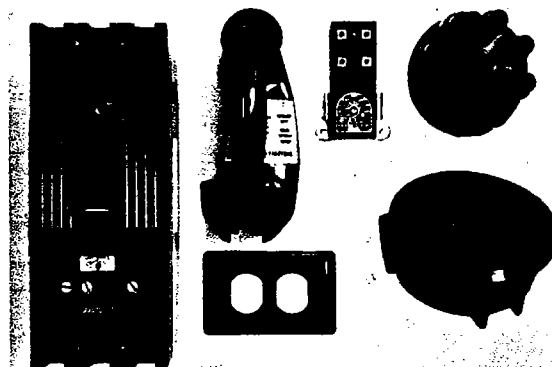
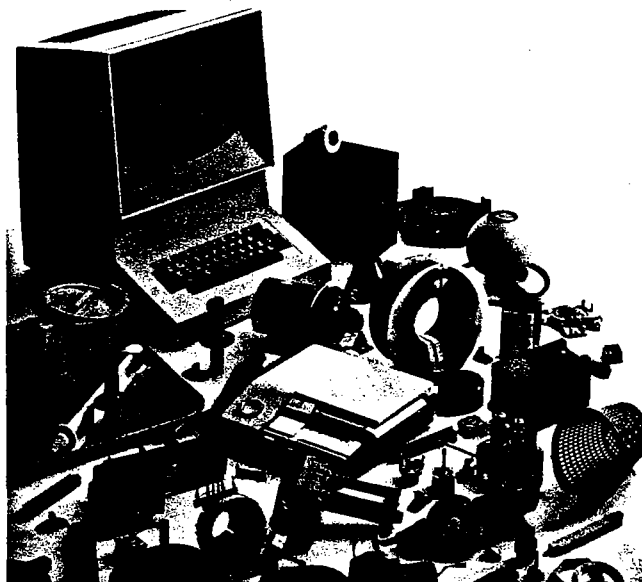


Plastics

General Electric
a full range of

NORYL® Thermoplastic Resins

NORYL® thermoplastic resins, based on GE's own polyphenylene oxide technology, provide a family of materials priced in the middle range of the engineering plastics with properties rivaling even the most expensive materials. NORYL resins offer exceptional resistance to high temperatures and hot water. They are used extensively in business machine housings and appliances, and in electrical, water distribution, and automotive applications.



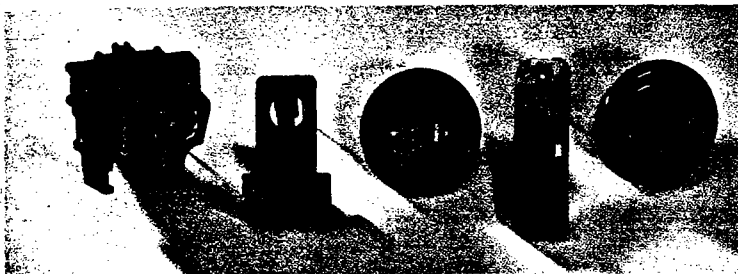
Phenolics

Oldest of General Electric's engineering plastics, phenolic molding compounds still offer performance advantages over newer materials where heat resistance, chemical resistance and dimensional stability are required. Phenolic compounds are commonly used for wiring devices, appliance parts, automotive applications, and computer parts.

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manufactures a unique group of high-performance engineering plastics covering performance, processing, and cost requirements.



GENAL[®]

New GENAL compounds are the industry's only thermosets made and controlled specifically for the screw-injection molding. The GENAL line combines top performance with the consistent and predictable moldability of the best engineering thermoplastics, at a lower price. GENAL products and the injection molding process open several new application areas previously served by thermoplastics with processing advantages, which no longer exist.

LEXAN[®] Polycarbonate Resins

General Electric's tough, rigid, transparent, LEXAN polycarbonate resins combine many performance features of metal, glass and other engineering thermoplastics. Their broad performance versatility is matched by equally impressive versatility of fabrication. This combination means consistent and economical production of parts and products which capitalize fully on the outstanding properties of the material. While LEXAN has more than a dozen useful properties, those most commonly called for are: exceptional impact strength, dimensional stability, self-extinguishing behavior, creep resistance, high-heat resistance, and water-clear transparency.

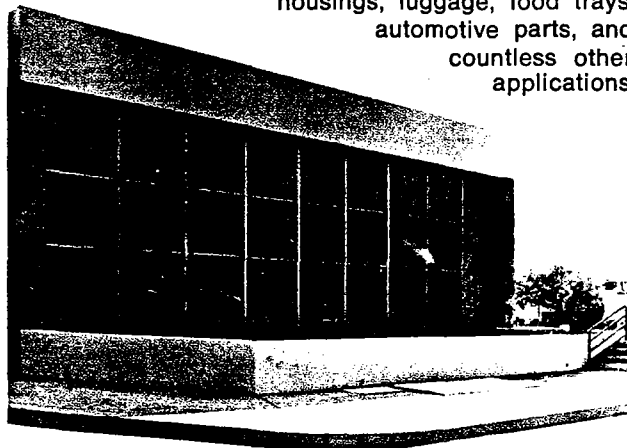


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Sheet Products

No other material matches LEXAN polycarbonate sheet in offering superior product performance, easy processing and significant cost savings. It combines the best properties of both glass and metal while providing the inherent processing economies found in many of today's engineering thermoplastics. The result is window glazing that just won't break, tougher, more serviceable aircraft components, and many other new products where LEXAN sheet is replacing metal, glass, and fiberglass reinforced polyester.

NORYL sheet offers a balance of performance, and economy ideal for business machine and appliance housings, luggage, food trays, automotive parts, and countless other applications.



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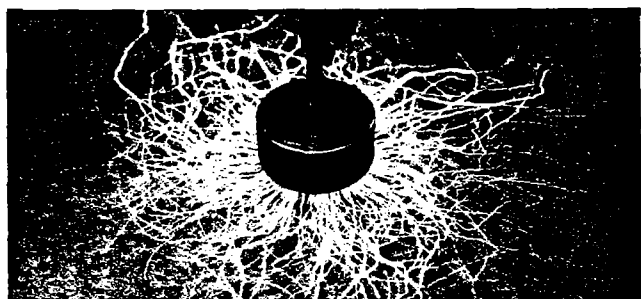


Insulating Materials

General Electric's strength in materials technology also provides hundreds of traditional and innovative products for electrical, insulation, and high-performance coating applications in scores of industries.

Mica Products

Because of their unusually good voltage endurance, General Electric's mica products have gained a reputation for reliability that is unexcelled by that of any other insulation product in the electrical industry. Insulation products such as built-up mica and MICA MATTM enable many designers and manufacturers to place more insulation in less space, a benefit that is further enhanced by the wide variety of forms in which mica products are available: rolls, tapes, plate, wrapper and composite sheets.

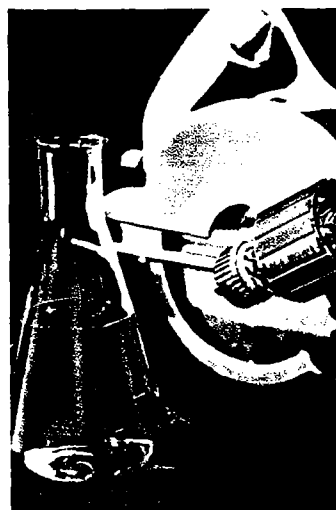
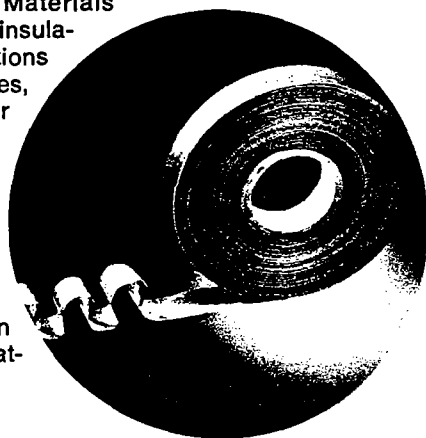


Cable Accessories

General Electric cable accessory products have continually proved their value to electric utility linemen and electrical contractors in helping to speed the distribution of electric power. In this product area, General Electric has introduced such advances as TERMI-MATICTM Cable Termination Systems that cut application time from as much as two hours to as little as thirty seconds, UNI-KIT[®] and TERMI-KIT[®] Cable Splicing and Terminating Systems that save significant time in application over conventional hand-taped systems, and General Electric ALL WEATHER Vinyl Plastic Electrical Tape for a superior combination of properties in a variety of indoor and outdoor applications.

Coated Materials

General Electric Coated Materials are designed for reliable insulation protection in applications calling for motor coil tapes, wrappers, phase and layer insulation. Coated Materials are also recommended for ground, layer, and window insulation in transformers, while stiff versions serve as excellent replacements for laminated plastics in slot-spacer and pad-insulating applications.



Insulating Varnishes

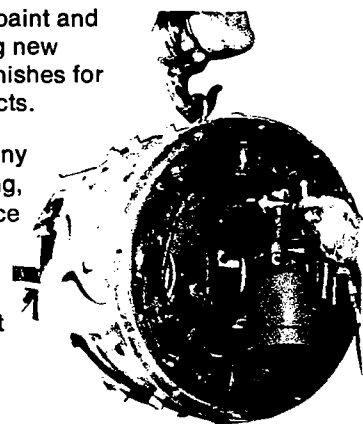
General Electric solventless and conventional insulating varnishes are perfect for bonding coil structures and wires, protecting windings from adverse environments, and filling voids for better heat transfer and corona resistance. They also serve as electrical insulation or as adhesives in certain products.

Paints and Coatings

General Electric's advances in paint and coating technology are opening new doorways to vastly improved finishes for industrial and consumer products.

GE GLYPTAL[®] paints serve many industries with a neat appearing, fast drying, hard glossy surface that can withstand a variety of adverse conditions.

Insulating Materials Department is also evaluating its complex polyimide polymer technology that will result in new grades of highly durable industrial and commercial finishes far superior to existing materials.



DSW 233364



Please send me information about the following GE Silicone Products checked below:

- | | | |
|--|--|---|
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| ☐ Silicone Rubber Adhesive/Sealants | ☐ Silicons for Insulation Manufacturers | ☐ Silicone Thermal Barriers |
| ☐ RTV Silicone Rubber | ☐ Silicone Greases | ☐ Silicone Construction Sealant |
| ☐ Silicone Fluids | ☐ Insulating Varnishes | ☐ Silicone Roofing & Weatherproofing |
| ☐ Silicone Lubricants | | |
| ☐ Release Paper Coatings | | |
| ☐ Silicone Antifoams | | |
| ☐ Silicone Release Agents | | |
| ☐ Organosilicon Chemicals | | |
| ☐ Silicons for Protective Coatings | | |
| ☐ Polishes and Chemical Specialties | | |
| ☐ Urethane Additives | | |
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Please send me information about the following GE Plastics checked below:

- ☐ NORYL[®] Thermoplastic Resins
- ☐ LEXAN[®] Polycarbonate Resins
- ☐ Phenolic Thermoset Compounds
- ☐ GENAL[™] Injection Thermosets
- ☐ LEXAN[®] & NORYL[®] SHEET Products

NAME

TITLE

COMPANY

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CITY

STATE

ZIP



Please send me information about the following GE materials checked below:

- ☐ Insulating Materials
- ☐ Cable Accessories
- ☐ Glyptal[®] Paints and High Performance Coatings

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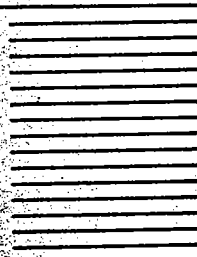


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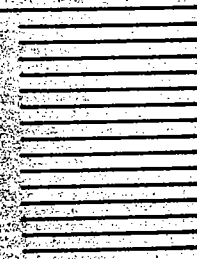


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SILICONES

SILICONE PRODUCTS DEPARTMENT

GENERAL  ELECTRIC

WATERFORD, NEW YORK

DSW 233369

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Lower production costs, increase efficiency, improve your products with General Electric Silicones



SILICONE RUBBER—Long life and resistance to extreme operating conditions make silicone rubber molded, extruded and fabricated parts ideal answers to tough design problems.



RTV SILICONE RUBBER ADHESIVE/SEALANTS are ready-to-use at room temperatures, bond securely to most surfaces; shrug off aging, moisture, -75° to +500°F temperatures.



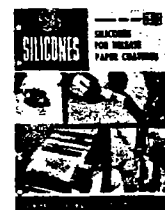
TWO-PART RTV COMPOUNDS cure to form tough, resilient silicone rubber with outstanding dielectric properties for encapsulating, sealing, bonding; flexible molds.



SILICONE FLUIDS offer high temperature properties; general inertness for heat transfer/damping, lubricating, hydraulic system, food processing; textile softening needs.



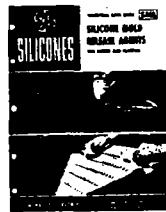
VERSILUBE® LUBRICANTS exhibit unique stability at -100°F to +700°F; assure long operating life where conventional lubricants fail.



RELEASE COATINGS FOR PAPER—stable release, water repellency, heat stability make G-E Silicone Coatings ideal for packaging tacky materials or backing pressure sensitives.



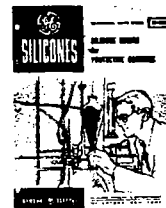
G-E SILICONE ANTI-FOAM emulsions, compounds and fluids help optimize production in the textile, paper, leather, latex, petroleum and food and drug industries.



G-E SILICONE MOLD RELEASE AGENTS speed production, improve product quality; assure quick, clean release of intricate parts.



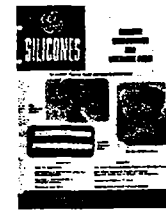
G-E ORGANOSILICON INTERMEDIATES can be synthesized to produce various chemicals and polymers; also serve as adhesion promoters for many substrates.



SILICONE ADDITIVES, resins; intermediates speed processes, give superior temperature, weather resistance in finishes for industrial equipment, appliances, building materials.



SILICONES FOR CHEMICAL SPECIALTIES AND POLISHES provide quick, easy wipe-on/wipe-off, brilliant shine and depth of color, water repellency, lubricity; ease of formulation.



SILICONE URETHANE ADDITIVES control foam during cure, prevent collapse of large sections and provide maximum rise and cell uniformity in polyurethane foams.



G-E SILICONES AS A BASIC INGREDIENT IN MASONRY WATER REPELLENTS provide a durable, invisible, highly effective treatment for above-grade structural masonry.



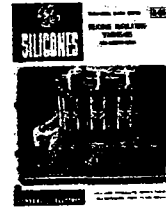
G-E SILICONE RUBBER INSULATION withstands temperatures to 600°F, stays flexible at -150°F, exhibits outstanding resistance to corona, ozone, sunlight and radiation.



SILICONES FOR INSULATION MANUFACTURING—Silicone rubbers and resins with inorganic materials as glass cloth, mica or asbestos form insulating components with excellent heat resistance, electrical characteristics.



LUBRICATING GREASES, DIELECTRIC COMPOUNDS AND GENERAL PURPOSE COMPOUNDS offer temperature resistance, water repellency, dielectric strength; long life.



G-E SILICONE INSULATING VARNISHES AND ADHESIVE RESINS protect electrical equipment operating at continuous or intermittent high temperatures in humid or corrosive atmospheres.



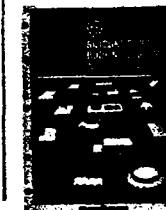
G-E SILICONE DIE CASTING LUBRICANT, a paintable universal release agent, for aluminum and zinc casting—provides shiny castings; easy die maintenance; mixed, applied easily.



SILICONE THERMAL BARRIERS, solid or foam, sprayed or cast-in-place, protect against heat and flame to +5000°F for aerospace, firewall; engine compartment protection.



G-E SILICONE CONSTRUCTION SEALANT, made of most durable elastomer available, resists temperature fluctuations, weathering; corrosive atmospheres, forms strong, flexible bonds.



GE SILICONE ROOFING AND WEATHER-PROOFING MATERIALS provide unequalled weatherability. For roofs, balconies, sun decks, etc. Provide long years of service, lower maintenance costs.

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Silicones

FLUIDS

Plastic, rubber,
and metal lubrication

Heat transfer
applications

Hydraulic and
lubricating systems

Fluid dielectrics for
electronic components

Torsional and lineal
vibration damping

Power transmission
applications

Liquid springs



SILICONE FLUIDS

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INTRODUCTION TO SILICONE FLUIDS

There are many types of General Electric silicone fluids: thick fluids, thin fluids, fluids that lubricate well, fluids that do not; there are fluids that resist the destructive effects of extremely high temperatures and fluids which can be easily pumped at extremely low temperatures. Silicone fluids may be used as hydraulic fluids, fluid dielectrics for electronic components, liquid phase dielectric coolants, as liquid springs and damping fluids, fluids for power transmissions, heat transfer, rust prevention, water repellency . . . there is no limit to the variety of applications.

The existence of such a wide range of silicone fluids fulfills the varying requirements of thousands of applications and provides potential solutions and advantages for new products.

In chemical structure, silicone fluids are quite different from all other fluids. Where organic hydrocarbon fluids are based on a backbone of carbon-to-carbon atoms, silicone fluids have a backbone of silicon-oxygen linkages similar to the Si-O linkages in other high-temperature materials (quartz, glass and sand). It is this Si-O linkage that contributes to the outstanding broad-temperature characteristics and general inertness of silicone fluids.

The Silicone Products Department of the General Electric Company produces a comprehensive line of silicone fluids for hundreds of applications in almost every industry. This data book is designed to provide a convenient reference source for commonly used silicone fluids. Your General Electric silicone products representative or distributor will be pleased to help you select the right General Electric silicone fluid to meet your requirements.

Inasmuch as General Electric Company has no control over the use to which others may put the material, it does not guarantee that the same results as those described herein will be obtained. Each user of the material should make his own tests to determine the material's suitability for his own particular use. Statements concerning possible or suggested uses of the materials described herein are not to be construed as constituting a license under any General Electric patent covering such use or as recommendations for use of such materials in the infringement of any patent.

COVER: Silicone fluids can be used in high-temperature applications; they will also flow freely at low temperatures.

PROPERTIES OF SILICONE FLUIDS

The chemical structure of General Electric silicone fluids gives them a unique combination of properties which permits silicone fluids to perform in many applications where no other fluids are suitable. Some of the outstanding properties of General Electric silicone fluids are:

LOW VISCOSITY - TEMPERATURE CHANGE — All fluids show some degree of change in viscosity with temperature change, but General Electric silicone fluids exhibit a much smaller amount of change over a wider temperature range than non-silicone fluids.

WIDE TEMPERATURE RANGE — Low-temperature limits and high-temperature capabilities of General Electric silicone fluids far surpass conventional fluids.

EXCELLENT THERMAL STABILITY — General Electric silicone fluids show excellent stability when exposed to very high temperatures for long periods of time.

EXCELLENT OXIDATION STABILITY — The oxidation stability of General Electric silicone fluids is excellent. Absence of copper-induced oxidation is especially important and contrasts with the sludging that occurs with mineral oils, especially at high temperatures.

CHEMICAL INERTNESS — General Electric silicone fluids are chemically inert to most common materials of construction.

NON-FLAMMABILITY — General Electric silicone fluids are self-extinguishing. Most have flash points in excess of 550°F and auto ignition temperatures in the range of 820° to 860°F.

LOW SURFACE TENSION — All General Electric silicone fluids have unusually low surface tensions which help provide easy and efficient spreading, high surface activity and low internal cohesive energies.

HIGH COMPRESSIBILITY — General Electric silicone fluids have the unusual property of being highly compressible — much more so than petroleum oils and other organic liquids.

EXCELLENT SHEAR STABILITY — Silicone fluids have unusually high resistance to breakdown by mechanical shearing. The shear stability of silicone fluids can be as much as twenty times that of quality petroleum oils, providing longer life at higher speeds and loadings.

EXCELLENT HEAT CONDUCTIVITY — The thermal conductivity of General Electric silicone fluids is relatively constant over a wide temperature range, making them an ideal choice for hydraulic fluids and coolants.

EXCELLENT DIELECTRIC PROPERTIES — General Electric electrical grade silicone fluids offer excellent dielectric properties which are maintained for prolonged periods, even under adverse operating conditions.

NON-CORROSIVE — General Electric silicone fluids contain no acid-producing chemicals to cause staining or corrosion.



SILICONE FLUIDS

PRODUCT DESCRIPTIONS AND SELECTION

General Electric offers a complete line of silicone fluids in a wide viscosity range to provide maximum latitude in selecting the specific silicone fluid to meet the requirements of a particular industrial, military or consumer application. While it is difficult to recommend the use of any one fluid for an application, the Application Guide on pages 6 and 7 lists various applications and indicates the General Electric silicone fluids most frequently used. (These suggestions are not meant to exclude any other General Electric silicone fluid from a given application.) Generally speaking, it is best to evaluate several possible silicone fluids to determine which will provide the optimum performance in an application. Listed below are descriptions of the commonly used General Electric silicone fluids with examples of the types of applications for which the fluids are designed.

SF-96*

General Electric SF-96 silicone fluids are dimethyl polysiloxane fluids. They are clear, water-white, oily fluids; non-toxic, inert, tasteless and odorless. SF-96 fluids are available in standard viscosity grades; nominally 5, 20, 50, 100, 200, 350, 500, 1000 and 2000 centistokes at 25°C. The actual viscosity is controlled within ± 5 percent of the nominal viscosity in the grades of 50 centistokes or higher. The 5 and 20 centistoke grades are controlled within ± 10 percent of the nominal viscosity. The unique combination of properties associated with the SF-96 fluids makes them suitable for plastic and rubber lubrication, as dampening or heat transfer fluids, and as an oil defoamer. These fluids are also used in shock absorbers, liquid timers, high-temperature baths, liquid springs, and other similar applications.

SF-97

General Electric dimethyl polysiloxane silicone fluids of the SF-97 series are clear, water-white, oily liquids. Chemically, the SF-97 fluids are identical to the SF-96 series but have been specially processed and controlled to meet electrical grade specifications. SF-97 fluids are available in standard viscosities; nominally 20, 50, 100, 200, 500, and 1000 centistokes at 25°C. The actual viscosity is controlled within ± 5 percent of the nominal viscosity in the grades of 50 centistokes or higher. The 20 centistoke grade is controlled within ± 10 percent of the nominal viscosity. The unique properties of General Electric SF-97 electrical grade silicone fluids extends their capabilities beyond those of conventional dielectric fluids making them suitable for use in: capacitors, pulse transformers, specialty transformers, air-borne and landbased radar equipment, television circuit components and in systems where heat transfer properties are as necessary as dielectric behavior. For example, components such as power tubes used in tracking and guidance systems utilize silicone fluids to remove heat and permit operation in extremely close quarters with other devices. Other units that can benefit from the heat transfer properties of SF-97 fluids include: electronic modules, microwave tubes, power rectifiers, junction tube transformers, magnetrons, klystrons and deflection amplifiers. In these applications, silicone fluids are used to help maintain circuit stability and reliability under the most stringent conditions of continuous, high-duty operation.

VISCASIL®

Viscasil silicone fluids are clear, water-white dimethyl polysiloxane fluids with no suspended particulate matter. They are non-toxic, inert, tasteless and odorless. The Viscasil fluids are available in standard viscosity grades of 5,000, 10,000, 12,500, 30,000, 60,000, 500,000, 600,000, and 1,000,000 centistokes at 25°C. Viscasil fluids are characterized by relatively small change in viscosity over a wide temperature range. They have good oxidative stability, unusual chemical inertness and resistance to breakdown under mechanical shearing. Viscasil fluids are especially useful for linear and torsional dampeners, viscous drive clutches, speed control devices, liquid springs, dashpots, rubber and plastic lubricant, timing devices, and are the base fluids for silicone compounds.

SF-18

General Electric SF-18 silicone fluid is a clear, water-white, oily liquid. The fluid is tasteless, and odorless. This specially prepared dimethyl polysiloxane fluid meets the requirements of the Federal Food, Drug, and Cosmetic Act for use as a component of antifoam agents contributing no more than 10 ppm of the fluid to food, other than milk and articles intended for the feeding of infants and invalids. SF-18 may be used for the same applications as a dimethyl polysiloxane fluid of 350 centistokes viscosity, particularly where a silicone of especially high purity is required. It is particularly well suited to the manufacture of cosmetic and pharmaceutical formulations calling for a dimethyl polysiloxane fluid. The principal application for SF-18 is as a defoamer or antifoam agent in itself, or as the base fluid for defoamer compounds incorporating silicones. This fluid may also be used as a release agent on conveyors, heat sealers and many other kinds of machinery used in the processing and handling of goods.

SF-81

General Electric SF-81 is a dimethyl polysiloxane silicone fluid that is very similar to the SF-96 series in most of its properties and has been developed for low temperature operation without sacrifice in high temperature properties. This silicone fluid has an extremely low pour point of -120°F but still retains excellent high temperature properties. It is suggested for applications where low temperatures (below -60°F) are encountered and is available only in the single viscosity grade, 50 centistokes at 25°C. SF-81 is especially useful as low temperature damping media, heat transfer media, dielectric coolants, and is a base fluid for low temperature silicone compounds.

* Trademark of General Electric Company.

- SF-99** SF-99 is a clear, low viscosity dimethyl polysiloxane silicone fluid that may be polymerized by proper application of heat and/or catalysis to yield water repellent surface coatings. The addition of metallic paint driers (such as tin or lead naphthenates) followed by moderate heating will develop the desired polymeric film.
- SF-99 may be used as a water-repellent film on glass or other ceramics to obtain reliable operation of electronic equipment under conditions of wide changes of temperature and humidity. This silicone fluid is also used as a coating for water-repellency, increased durability or enhanced handling properties and may be applied to a number of substrate materials such as paper, fabrics, wood, and metals.
-
- SF-1029** General Electric's chlorophenylmethyl silicone fluid SF-1029, meets the requirements specified in Table 5 and Paragraph 5 of the American Petroleum Institute's "Bulletin on Thread Compounds" (No. 5A2, Third Edition). This fluid is specifically designed for use in the API thread lube formulation and shows much better lubricating properties than standard dimethyl polysiloxane or methylphenyl silicone fluids. In addition to its lubricating properties, SF-1029 shows excellent high temperature stability, resisting gelation for long periods at extreme temperatures.
-
- SF-1093** SF-1093 silicones fluids have unique high temperature resistance allowing their use up to 550°F in the presence of air for extended periods without sacrifice in low temperature properties. Their unusual extreme temperature performance combines with a relatively flat viscosity-temperature relationship, high flash point and excellent shear stability, thus making them extremely versatile materials.
- General Electric SF-1093 silicone fluids are dimethyl polysiloxane fluids created by combining an oxidation inhibitor with dimethyl fluids. They are amber colored, non-toxic and essentially odorless. SF-1093 fluids are available in viscosities of 50, 100, and 500 centistokes at 25°C. The 50 centistoke viscosity is controlled within ± 10 percent of its nominal viscosity while the higher viscosities are controlled within ± 5 percent of their nominal viscosities. Intermediate viscosities may be obtained by blending. Because of the method of combining the oxidation inhibitor in the fluid, extended use at either high or low temperatures will produce no sludge or other precipitation. In addition, General Electric silicone fluids of the SF-1093 series are more resistant, in most cases, to oxidation breakdown at high temperatures than the more expensive methyl phenyl polysiloxanes. The excellent high temperature properties of SF-1093 fluids suggests their use in high temperature heat transfer applications, laboratory constant temperature baths, aerosol oven sprays, high temperature fluid clutches, military applications requiring extreme temperature operation, mechanical damping, thermostats, and as a mold release. SF-1093 fluids are not recommended for closed or inert systems where air is not present.
-
- SF-1153** SF-1153 is a methyl phenyl polysiloxane silicone fluid exhibiting excellent low temperature properties without sacrificing high temperature performance. Besides its unique low temperature properties, this fluid possesses a relatively flat viscosity-temperature relationship, excellent shear stability and a high flash point. The SF-1153 is also more resistant to oxidation breakdown at high temperatures than a dimethyl fluid.
- The properties of SF-1153 fluid makes it ideal for low temperature damping applications such as aircraft instruments and electronic equipment. Other mechanical applications include the use of SF-1153 as heat transfer media, dielectric coolant and low temperature lubricant involving light to moderate bearing loads. SF-1153 is also used as a base fluid in silicone greases for ball bearing lubrication from -100°F to 400°F .
-
- SF-1154** SF-1154 methyl phenyl polysiloxane silicone fluid is a clear, light-straw colored liquid which possesses even better heat stability than the dimethyl polysiloxane silicone materials. This outstanding heat resistance is combined with low volatility and high flash point to provide a normal useful service temperature range of -40° to 500°F . General Electric SF-1154 is an excellent choice for high temperature heat transfer applications or as a base fluid in high temperature greases. In addition, its excellent electrical properties make it useful as a dielectric coolant, high temperature ultra-sonic coupler, high temperature heat bath and oxide protector for solder baths.
-
- F-50 and F-44** Versilube® F-50 is an additive-free silicone lubricating fluid with a useful temperature range from -100°F up to 450°F . This fluid exhibits excellent temperature viscosity characteristics, chemical and physical properties, oxidative and thermal stability. Versilube F-50 will lubricate many metal combinations in sliding, rolling, and anti-friction mechanisms, however, it is not recommended when both surfaces are soft metals.
- For operating temperatures above 450°F (up to 550°) or for applications where severe and relative continuous oxidizing conditions exist, Versilube F-44 should be used. F-44, however, should not be used in closed or inert systems where air is not present.
- Typical applications where Versilube fluids are used include: hydraulic systems; fluid transmissions, vacuum pumps and high vacuum lubrication; servo motors and mechanisms; instruments, controls, clocks, and timers; machine tool components; anti-friction, rolling, and sliding mechanisms; and bearings in high ambient temperature industries.
-
- SF-1147** Versilube® Plus SF-1147 methyl alkyl polysiloxane silicone fluid is a high temperature hydraulic and lubricating fluid. This fluid is a combination of a hydrocarbon and a silicone so formulated to produce a fluid that has the most desirable properties of both. The basic polysiloxane structure of alternating silicone-oxygen atoms has been maintained; and organic and hydrocarbon radicals have been molecularly attached to the silicone atom. The integral antioxidant is chemically bound to the silicone atom which provides for a more stable and longer-life fluid. Typical applications for the SF-1147 fluid are: lubricant for impregnating sintered metal bearings for fans and motors, hydraulic fluid, fluid for machine operations with aluminum—drilling, tapping, hobbing, broaching, turning, spinning, drawing, extruding; instrument lubrication.



APPLICATION	SF-96									SF-97						
	Nominal Viscosity (ctks.) at 25°C.															
	5	20	50	100	200	350	500	1000	2000	20	50	100	200	500	1000	
DAMPING FLUIDS																
Dashpots				X	X	X	X	X	X			X	X	X	X	
Aircraft Instruments			X	X	X	X	X	X	X		X	X	X	X	X	
Time Delay Relays				X	X	X	X	X	X			X	X	X	X	
Gyros		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Shock Absorbers								X	X						X	
Meters			X	X	X	X	X				X	X	X	X		
Torsional Vibration Dampers						X	X	X	X					X	X	
Timing Devices																
HEAT TRANSFER																
Heating Baths			X	X							X	X				
Low Temperature Baths																
Heat Exchangers		X	X	X	X	X				X	X	X	X			
Thermostats		X	X	X	X	X				X	X	X	X			
POWER TRANSMISSION																
Fluid Clutches*							X	X	X					X	X	
Controlled Speed Devices							X	X	X					X	X	
Hydraulic Fluids			X								X					
OTHER MECHANICAL USES																
Fluid Springs	X			X				X	X			X			X	
Electrical Discharge																
Machining Coolants	X															
Transducers	X		X	X							X	X				
LUBRICATION																
Aluminum																
Lubricate O-rings									X							
Lubricate Rubber or Plastic Parts				X	X	X	X	X	X			X	X	X	X	
Base Fluids for Greases				X		X		X				X			X	
Sliding Metal on Metal Lubrication																
Thread Lubrication																
ELECTRICAL																
Coolant for Transformers, Capacitors & Amplifiers										X	X	X	X	X	X	
Coolant for Tubes, Restifiers, Electronic Modules										X	X	X	X	X	X	
Extreme Temperature Range Coolant																
Curable Treatment for Electrodes																

* Special blending of fluids may be required for obtaining specific shear viscosity characteristics.

The following chart is intended as a guide only and indicates the General Electric silicone fluid or fluids most frequently used in a given application — the specific fluid or fluids most likely to provide maximum performance at minimum cost. These product suggestions are not meant to exclude any of the other General Electric fluids from a given application.

[illegible]



SILICONE FLUIDS

TYPICAL PROPERTIES

GE SILICONE FLUID	Nominal Viscosity cts at 25°C (77°F)	Viscosity Temperature Coefficient	Specific Gravity 25°/25°C	Refractive Index at 25°C (77°F)	Pour Point °F	Flash Point °F	Surface Tension dynes cm at 77°F
SF-96 or SF-97 ⁽¹⁾	5	0.53	0.916	1.397	-120	275	19.7
	20*	0.58	0.953	1.401	-85	>400	20.8
	50*	0.59	0.963	1.402	-67	>535	20.8
	100*	0.59	0.968	1.4030	-67	>575	20.9
	200*	0.59	0.972	1.4031	-58	>600	21.0
	350	0.60	0.973	1.4032	-58	>600	21.1
	500*	0.60	0.973	1.4033	-58	>600	21.1
	1000*	0.60	0.974	1.4035	-58	>600	21.1
	2000	0.60	0.974	1.4035	-58	>600	21.1
Viscasil	5000	0.60	0.975	1.4035	-56	>600	21.3
	10,000	0.60	0.975	1.4035	-53	>600	21.3
	12,500	0.60	0.975	1.4035	-53	>600	21.3
	30,000	0.60	0.976	1.4035	-50	>600	21.3
	60,000	0.60	0.977	1.4035	-47	>600	21.3
	500,000	0.60	0.978	1.4035	-40	>600	21.3
	600,000	0.60	0.979	1.4035	-30	>600	21.3
	1,000,000	0.60	0.980	1.4035	-25	>600	21.3
SF-18	350	0.60	0.973	1.4030	-58	>600	21.1
SF-81	50	0.57	0.972	1.4030	-120	>600	21.0
SF-99	10	0.59	0.970	—	—	145	20.5
SF-1029	75	0.68	1.030	1.4290	-100	560	21.0
SF-1093 ⁽²⁾	50	0.59	0.963	1.4040	-100	>535	20.8
	100	0.59	0.968	1.4040	-90	>575	21.0
	500	0.60	0.973	1.4040	-85	>600	21.1
SF-1153	100	0.62	0.980	1.4219	-100	540	22.6
SF-1154	190	0.78	1.050	1.4980	-40	>550	24.5
F-44	75	0.68	1.050	1.4290	-100	>550	21.0
F-50	70	0.68	1.050	1.4280	-100	>550	21.0
SF-1147	50	0.76	0.890	1.4433	-60	>480	26.0

* SF-97 available only in these viscosities.

(1) General Electric SF-97 electrical grade silicone fluids are SF-96 fluids specially processed and tested to meet electrical grade specifications listed above. These electrical specifications do not apply to SF-96.

(2) SF-1093 may be used in applications where a lower volume resistivity is required.

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PROPERTIES SHOWN SHOULD NOT BE USED IN PREPARING SPECIFICATIONS:

The data shown in this book are typical values, defining the character of General Electric silicone fluids; they are not intended for use in writing specifications. For details on the test properties, tolerances and test methods which may be used in the preparation of purchasing specification, contact the Fluid and Specialties Product Section, Silicone Products Department, General Electric Company, Waterford, New York 12188.

Thermal Expansion cc/cc/°C (25-150°C)	Thermal Conductivity BTU/hr.-°F ft. ² /ft.	Maximum Volatility % Wt. Loss 24 hrs. at 302°F (150°C).	Specific Heat BTU/lb./°F	ELECTRICAL PROPERTIES ⁽¹⁾			
				Dielectric Strength KV	25°C 10 ² - 10 ⁶ cycles		Volume Resistivity ohm-cm
					Dissipation Factor	Dielectric constant	
0.00105	0.067	90	0.36	35.0	0.0001	2.60	1 x 10 ¹⁵
0.00107	0.082	10	0.36	35.0	0.0001	2.68	1 x 10 ¹⁴
0.00106	0.087	0.5	0.36	35.0	0.0001	2.72	1 x 10 ¹⁴
0.000925	0.090	0.5	0.36	35.0	0.0001	2.75	1 x 10 ¹⁴
0.000925	0.091	0.5	0.36	35.0	0.0001	2.75	1 x 10 ¹⁴
0.000925	0.092	0.5	0.36	35.0	0.0001	2.75	1 x 10 ¹⁴
0.000925	0.092	0.5	0.36	35.0	0.0001	2.75	1 x 10 ¹⁴
0.000925	0.092	0.5	0.36	35.0	0.0001	2.75	1 x 10 ¹⁴
0.000925	0.091	0.5	0.36	35.0	0.0001	2.75	1 x 10 ¹⁴
0.000925	0.090	2.0	0.36	35.0	0.0001	2.75	1 x 10 ¹⁴
0.000925	0.090	2.0	0.36	35.0	0.0001	2.75	1 x 10 ¹⁴
0.000925	0.090	2.0	0.36	35.0	0.0001	2.75	1 x 10 ¹⁴
0.000925	0.090	2.0	0.36	35.0	0.0001	2.75	1 x 10 ¹⁴
0.000925	0.090	2.0	0.36	35.0	0.0001	2.75	1 x 10 ¹⁴
0.000925	0.090	2.0	0.36	35.0	0.0001	2.75	1 x 10 ¹⁴
0.000925	0.090	2.0	0.36	35.0	0.0001	2.75	1 x 10 ¹⁴
0.000925	0.092	0.5	0.36	35.0	—	—	—
0.0095	0.087	0.5	0.36	35.0	0.0001	2.74	1 x 10 ¹⁴
—	—	—	0.36	—	—	—	—
0.000925	0.087	0.5	0.34	—	—	—	—
0.00095	0.087	2.0	0.36	—	—	—	4 x 10 ¹¹
0.00095	0.090	1.0	0.36	—	—	—	4 x 10 ¹¹
0.000925	0.092	0.5	0.36	35.0	—	—	4 x 10 ¹¹
0.00094	0.083	1.0	0.39	—	0.0001	2.75	1 x 10 ¹⁴
0.00075	0.082	1.0	0.39	—	0.0005	2.83	1 x 10 ¹⁴
0.000975	0.087	0.5	0.34	—	—	—	—
0.000975	0.087	0.5	0.34	29.0	0.0013	2.90	8 x 10 ¹²
0.000040	0.113	2.5	0.48	—	0.0001	2.39	3 x 10 ¹³

DSW 233379



SILICONE FLUIDS

SPECIFICATIONS AND TEST METHODS

Standard test procedures developed for petroleum products are commonly used in measuring the properties of silicone fluids. Where the properties of silicones fall beyond the norm for petroleum products, test methods have been modified and new methods have been devised. In most cases, however, standard ASTM test methods are applicable. ASTM D 2225-63 describes methods of testing silicone fluids.

The use of silicone fluids in military applications has become widespread. As a result of this, a military Specification designated VV-D-001078(GSA-FSS) has been written to describe "dimethyl polysiloxane silicone fluids having viscosities of 0.65 through 200,000 centistokes." This is a coordinated specification to be used by all branches of the military.

The following table lists standard ASTM test methods that are used to test silicone fluids.

ASTM TEST METHODS

Property	Test	Property	Test
Dielectric Constant	D 924	Pour Point	D 97
Dielectric Strength	D 877	Specific Gravity	D 1298
Dissipation Factor	D 924	Viscosity	D 445
Fire Point	D 92	Refractive Index	D 1807
Flash Point	D 92	Volume Resistivity	D 1169

TOXICITY

Comprehensive tests on laboratory animals have demonstrated that silicone fluids, as a class, are very low in toxicity and present no significant handling problems.

In acute oral feeding tests, it has not been possible to feed test animals enough of the silicone fluids tested to establish an LD₅₀ (dosage required to kill fifty percent of the test animals). It has been estimated that about three quarts could be fed to a 155 pound man during a brief period without inducing toxic effects.

Patch testing of silicone fluids has shown no skin irritation. Draize eye irritation studies of these materials did indicate slight temporary irritation of the mucous membranes which cleared within 24 hours and caused no corneal damage.

FDA STATUS

General Electric silicone fluids are used in many food-oriented applications as either direct or indirect food additives. Dimethylpolysiloxane fluids (the SF-96 series, SF-18, and Viscasil fluids) and methylphenylpolysiloxane fluids (SF-1153, SF-1154) are sanctioned by the Food and Drug Administration for many applications as indicated in the Food Additive Regulations. In some cases, there are viscosity restrictions on the silicone which may be used.

FOOD ADDITIVE REGULATIONS WHICH REFER TO SILICONES

1. Subpart D — Food Additives Permitted in Food for Human Consumption:
Paragraph 121.1099 — Defoaming Agents
Section (a) (2) — Dimethyl polysiloxanes (300-600 cstks.)
2. Subpart E — Substances for Which Prior Sanctions have been Granted:
Paragraph 121.2001 — Substances Employed in the Manufacture of Food Packaging Materials.
Section (f) — Release Agents — Dimethyl polysiloxanes (300-600 cstks.)
3. Subpart F — Food Additives Resulting From Contact:
a Paragraph 121.2507 — Cellophane
Section (b) (2) — Refers to materials permitted under 121.2001.
b Paragraph 121.2514 — Resinous and Polymeric Coatings
Section (3) XXV — Release Agents — Dimethyl polysiloxanes (300 cstks. or higher)

- Section (3) XXVIII — Silicones as the basic polymers and their catalysts
- c Paragraph 121.2519 — Defoaming Agents Used in the Manufacture of Paper and Paperboard
Section (d) (3) — Dimethyl polysiloxanes.
- d Paragraph 121.2520 — Adhesives
Section (c) (5) — Polysiloxanes
- e Paragraph 121.2526 — Components of Paper and Paperboard in Contact with Aqueous and Fatty Foods
Section (b) (1) — Refers to materials permitted under 121.2514
Section (b) (2) — Dimethyl polysiloxane (100 cstks.)
- f Paragraph 121.2531 — Surface Lubricants Used in the Manufacture of Metallic Articles.
Section (b) (2) — Dimethyl polysiloxane conforming to the identity prescribed in 121.2001.

- g Paragraph 121.2534 — Animal Glue
Section (c) (2) — Refers to 121.2520
- h Paragraph 121.2536 — Filters, Resin Bonded.
Section (d) (2) — Dimethyl polysiloxanes
Section (d) (4) — Dimethyl Polysiloxanes with methyl cellulose and sorbic acid (as antifoam agent)
- i Paragraph 121.2550 — Closures With Sealing Gaskets for Food Containers
Section (b) — Refers to 121.2514
- j Paragraph 121.2553 — Lubricants with Incidental Food Contact.
Section (a) (3) — Dimethyl polysiloxane (300 cstks. or higher)
- k Paragraph 121.2557 — Defoaming Agents Used in Coatings.
Section (d) (3) — Dimethyl polysiloxanes.
- l Paragraph 121.2571 — Components of Paper and Paperboard in Contact with Dry Food.
Section (b) (1) — Refers to 121.2526.

SOLUBILITY OF SILICONE FLUIDS

General Electric dimethyl silicone fluids are non-polar and insoluble in water or the lower alcohols. They are completely miscible in typical aliphatic and aromatic solvents, including the halogenated solvents, but are only partially miscible with the intermediate petroleum fractions such as the naphthenes. These materials can dissolve enough silicone, particularly of the lower viscosity grades, to be suitable for many purposes. The dimethyl silicone fluid family (SF-96, SF-81, etc.) and SF-1153 are insoluble in the higher hydrocarbons, lube oils, waxes, fatty acids, vegetable oils and animal oils. SF-1147 and SF-1154 silicone fluids are soluble in the higher hydrocarbons, lube oils, waxes, fatty acids, vegetable oils and animal oils.

The following table lists some chemicals according to their miscibility with silicone fluids.

Solvent Type	Solvent	SF-96		SF-1153	SF-1154	SF-1147
		20 ctks.	350 ctks.	100 ctks.	190 ctks.	50 ctks.
Highly Polar	Water	I	I	I	I	I
Hydrocarbon Solvents	VM&P Naptha	S	S	S	S	S
	Mineral Spirits	S	S	S	S	S
	Kerosene	S	S	S	S	S
	Toluene	S	S	S	S	S
	ISOPAR E, G, L	S	S	S	S	S
Hydrocarbon and Vegetable Oils	Mineral Oil 65/75 SSU	S	I	I	S	S
	Mineral Oil 200/210 SSU	PS	I	I	S	S
	Oleic Acid	I	I	I	S	S
	NEOBEE M-5	S	I	I	S	S
	Cotton Seed Oil	I	I	I	S	I
	Castor Oil	I	I	I	PS	I
Alcohols and Glycols	Ethanol, 95%	I	I	I	S	I
	Ethanol, SDA-40	S	I	I	S	I
	Isopropanol, 99%	S	I	I	S	I
	n-Butanol	S	PS	PS	S	I
	n-Amyl Alcohol	S	PS	PS	S	I
	2-Ethyl-Hexanol	S	S	S	S	S
	Lauryl Alcohol	S	S	I	S	S
	Hexadecyl Alcohol	S	I	I	S	S
	Oleyl Alcohol	I	I	I	S	S
	Cyclohexanol	I	I	I	I	I
	Ethylene Glycol	I	I	I	I	I
	Propylene Glycol	I	I	I	I	I
	Glycerine	I	I	I	I	I
	CARBOWAX 300	I	I	I	I	I
	UCON HB-660	I	I	I	PS	I
Esters	Isopropyl Palmitate	S	S	S	S	S
	Isopropyl Myristate	S	S	S	S	S
	Ethyl Acetate	S	S	S	S	I
	n-Butyl Acetate	S	S	S	S	S

KEY: S = Soluble • 10% by weight or higher PS = Partly Soluble • 1-10% by weight
I = Insoluble • less than 1% solubility

COLORING SILICONE FLUIDS

It is occasionally desirable to dye or provide fluorescence to SF-96 and Viscasil fluids to make them more visible. There are very few dyes that are soluble in these fluids, strong in color and thermally stable. However, the following colorants and fluorescents have been useful. Only .002-.005% by weight required.

Colorant

Supplier

Sudan Red 4BA.....General Dyestuff Company
Calco ZZ.....American Cyanimid Company,
Calco Chemical Division
National Oil Brown DN.....Allied Chemical Corp.,
National Aniline Division

Fluorescents

Calco Fluoro White RWP.....American Cyanimid Company,
Calco Chemical Division
Helecon 2330.....U. S. Radium Corp.



SILICONE FLUIDS

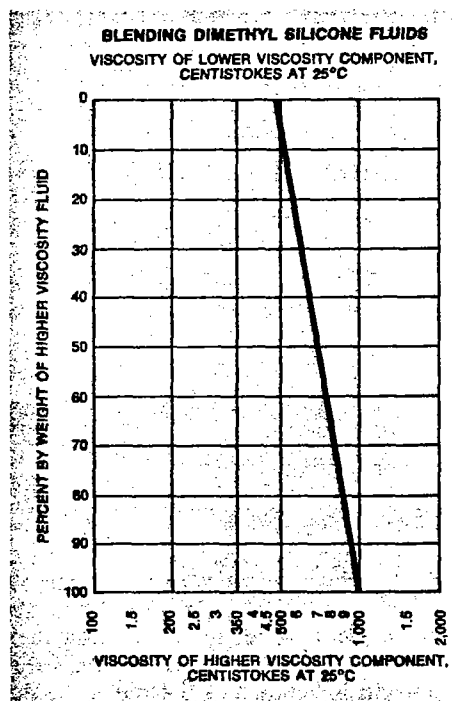
BLENDING SILICONE FLUIDS

Any standard viscosity grade of SF-96, SF-97, Viscasil or SF-1153 can be blended together with another viscosity grade of the same fluid to produce an intermediate viscosity. The following blend chart provides a means for determining the proper blend ratio.

The chart below should be used as follows:

1. Decide upon the viscosity grades to be blended. For high accuracy, measure the actual viscosity of the blending fluids.
2. Locate the lower viscosity on the left hand scale.
3. Locate the higher viscosity on the right hand scale.
4. Connect these two points with a straight line.
5. Locate the point where the line indicating the desired blend viscosity intersects the constructed line. From this point, follow down to the horizontal scale to read the percent of the higher viscosity fluid to use in the blend.

This method is reasonably accurate in predicting blend viscosity when the two fluids differ in viscosity by no more than one magnitude (one power of ten). When fluids covering a wider range are blended, the chart will only approximate the finished viscosity. SF-96 (500) and SF-96 (100) are used in the example on the chart.



APPROXIMATE BLENDS FOR OPTIMUM OXIDATIVE STABILITY IN AIR

Blend Couple	Maximum Temperature for Use			
	Below 300°F	Below 400°F	400-500°F	Above 500°F
SF-1093	0%	10-25%	20-60%	50-100%
SF-96	100%	75-90%	40-80%	0-50%
F-44	0%	0-25%	20-60%	50-100%
F-50	100%	75-100%	40-80%	0-50%

NOTE: The exact level of SF-1093 or F-44 to use for blending depends upon the fluid life required, upon aeration conditions, upon relative dwell time at maximum temperature as compared with dwell time at lower temperatures, and upon frequency of cycling.

USES FOR SILICONE FLUIDS

Damping Fluids
Power Transmission
Heat Transfer
Liquid Springs and Shock Absorbers
Polishes
Cosmetics and Pharmaceuticals
Rust Prevention
Hydraulic Fluids

Dielectric Fluids
Release Agents
Water Repellents
Paper Release
Coatings
Antifoams
Paint and Coating Additives
Lubricants
Textile Finishing

Anti-Block Agents
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