Technical Data
Product 593, 594, 595

December 1987

PRODUCT DESCRIPTION

Loctite® Superflex Silicone Adhesives/Sealants are soft, creamy, paste-like, single component materials. The thixotropic (non-flowing) characteristic of these materials make them easy to apply to all surfaces including horizontal, vertical and overhead. The products also exhibit sufficient surface to fixture most small objects while cure is taking place.

When exposed to moisture in the air, these materials cure at room temperature without the use of catalysts or primers. Cure time is dependent upon thickness of the sealant, temperature and humidity conditions. When cured these materials form flexible (600% elongation), soft (27 Shore A Durometer), tough, silicone rubbers for service at temperatures between -95°F and +400°F.

As a cured silicone rubber, these materials are recommended for use in gasketing, sealing, bonding and caulking applications in gap (clearance) thickness up to 0.25" thick (6mm).

Superflex Silicone Adhesives/Sealants will adhere to clean metal, glass, natural and synthetic fibres, ceramics, other silicone rubbers, painted surfaces and many plastic substrates.

(Note: Standard solvent or water-base paint will not adhere to cured Superflex Silicone Adhesives/Sealants).

TYPICAL APPLICATIONS

Loctite Superflex Silicone Adhesives/Sealants are especially formulated for plant maintenance and production.

- Seal panels, window plates, oven doors, flues, etc., on high temperature applications.
- Form anti-abrasion coatings.
- Bond and seal appliance parts.
- Insulate and seal electrical wires and terminals.
- Make flexible, extreme temperature gasketing material.
- Attach brackets and name plates.
- Bond gaskets and insulation materials in heating and refrigeration units.
- Form fillets and caulk joints in sheet metal assemblies and duct work.
- Make see-through, flexible insulation on electrical apparatus.
- Sealant for closures on chemical containers.

PRODUCT FEATURES

- One-component - no mixing or use of primer or catalyst.
- Cures at room temperature.
- Will not slump or flow prior to cure, yet will apply as a smooth, creamy, soft paste.
- Excellent low and high temperature performance, from -95 to +400°F (with short-term performance up to 480°F).
- Excellent weatherability and extreme flexibility. Will not harden or crack; negligible shrinkage and excellent ozone resistance.
- Designed to meet performance requirements of military specification MIL-A-46106A Type 1.
- Outstanding dielectric properties for electrical insulating applications.
- Resistant to most chemicals, solvents and oils.

USER BENEFITS

- Superflex Silicone Adhesives/Sealants require no costly mixing equipment (are ready-to-use).
- Superflex products do not require electrical, thermal or ultra-violet light sources to process or cure (cure at room temperature).
- Superflex products function in most every temperature or chemical environment now required by industry specifications (a universal product selection).
- Superflex products, as cured silicone rubber, are safe, non-toxic, non-dermatitic, flexible adhesives/sealants.

TYPICAL PROPERTIES OF UNCURED MATERIAL

Appearance	#593	Black
	#594	White
	#595	Clear (translucent)
Consistency	Smooth creamy spreadable paste - (free of lumps, oils, solids)	
Specific gravity @ 77° F (25°C)		1.05 ± .04
Solids Content		98 % Non-volatile (contains no solvents)
Tack Free Time (Note1)		
Cure rate at 75°, 50% RH		30 minutes
Flow/Slump Rate (Note 1)		Nil
Application Extrusion Rate (Note 1)		
(1/8" orifice applicator at 90 psi air pressure)		100 grams/minute (minimum)
Flash point TCC		>200°F
Toxicity		Low

TYPICAL PROPERTIES OF CURED MATERIAL

Measured on cured sheets approximately 0.125" thick - cured at 77°F 50% RH for 72 hours.

Mechanical properties

Durometer Hardness ASTM-D-676 (Shore A)	27
Tensile Strength ASTM-D-412 (psi)	400 psi (2.8 Mpa)
Elongation ASTM-D412 (%)	600%
Modulus @ 100% Elongation	75 psi (0.5 Mpa)
Compression Set (1/2" rod 1" dia.)	1.2%
Tear Strength (Die B.)	30 lbs./in. (5.2 KN/m)
Adhesion (peel) Cohesion Failure Strength at 100%	125 lbs./inch (22 KN/m)

Thermal properties

Functional Temperature Range	-95°F to +400°F (-71°C to +204°C)
Brittle Point ASTM-D-746	-110°F (-79°C)
Thermal Conductivity Ca/cm, sec, °C	4.5 x 10^{-4}
Linear Coefficient of Thermal Expansion - cm/cm, °C	25 x 10^{-5}

Electrical properties

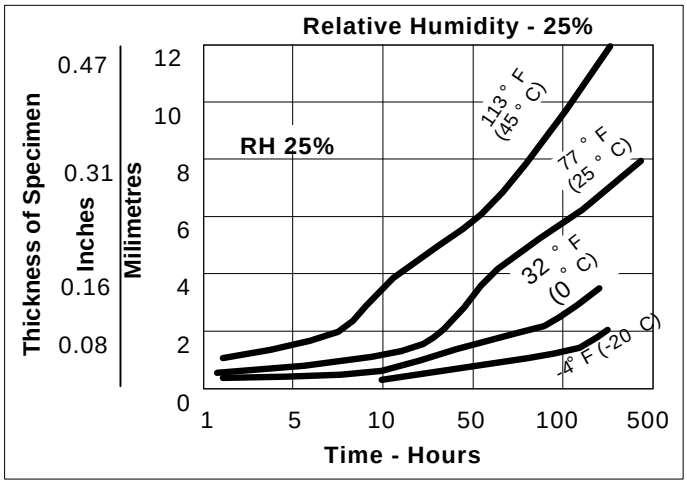
Dielectric Strength ASTM-D-149	16 KV/mm 400 V/mil
Dielectric Constant @ MHZ, ASTM-D-150	2.8
Dissipation Factor @ 1MHZ, ASTM-D-150	2 x 10^{-3}
Volume Resistivity, Ohm-cm	1 x 10^{15}

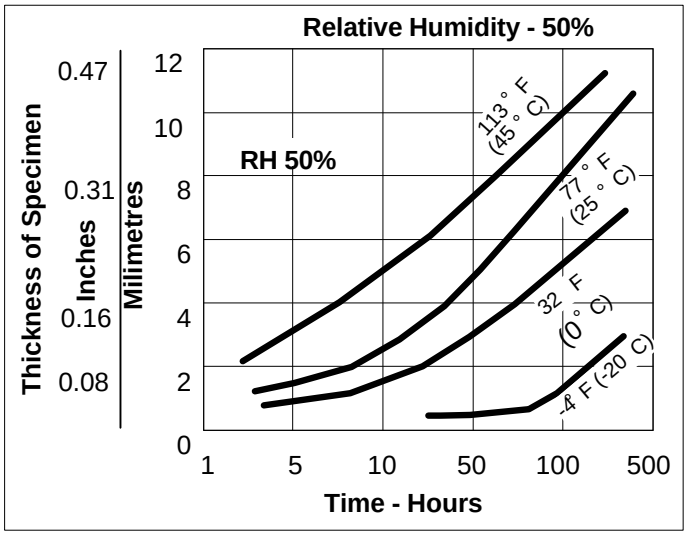
CURING SPECIFICATIONS

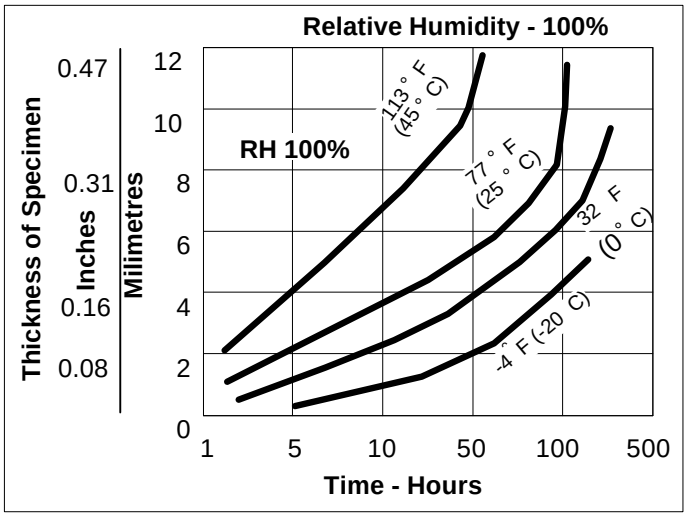
In general, these materials will cure tack-free to touch, in 15 to 30 minutes. Allow at least 24 hours for full cure and development of strength. The acetic acid (vinegar) odour will disappear when the materials are fully cured. During cure, confinement of the acetic acid fumes may cause mild surface corrosion on some metals, such as copper, steel etc. Use with adequate ventilation.

Since these materials depend upon reaction with moisture to cure, speed of cure will be dependent upon temperature, relative humidity, thickness of material and presence of moisture. (See tables below for varied cure characteristics.

The Influence of Temperature and Relative Humidity on the Speed of Cure







ENVIRONMENTAL RESISTANCE

Superflex silicone Adhesives/Sealants exhibit outstanding performance in severe environments of extreme temperatures, harsh chemicals, and weathering.

The following changes in physical properties have been recorded after exposure to:

1. Four years exposure to normal atmospheric environmental conditions.

	% Change
Durometer Hardness (shore A)	+ 8%
Tensile Strength	(-6%)
Elongation	(-7%)

2. 90 Day Accelerated Ultraviolet Ageing

	% Change
Durometer Hardness (shore A)	+ 46%
Tensile Strength	(-3%)
Elongation	(-29%)

3 Resistance to Heat Ageing @ 300°F (149°C)

	% Change after Days of Exposure				
	1 day	5 days	15 days	25 days	40 days
Durometer Hardness *(Shore A)*	+18%	+15%	+15%	+18%	+15%
Tensile Strength	+15%	+18%	+10%	+10%	(-2%)
Elongation	+9%	+10%	+10%	+4%	(-2%)

4. Temperature Resistance

Low temperature resistance. Superflex Products remain flexible to -58°F (-50°C). The following table shows the variation in tensile strength and elongation at low temperatures (in percentage) in relation to the values measured at 73°F (23°C).

Temperature	Tensile strength	Elongation
-40°C	+185%	+25%
-77°C	+230%	(-25%)

5. Chemical Resistance: (see table below)

The following properties were obtained on a 2mm thick film, cured 7 days at room temperature 73°F (23°C and 50% relative humidity. Test conditions: 8 days at 73°F (23°C).

Chemical Product	**Superflex Silicone Adhesives/Sealants Change of Properties after exposure**					
	Concentration (%)	**Weight (%)**	**Volume (%)**	**Tensile strength (% of initial resistance)**	**Elongation (% of initial elongation)**	**Hardness (Shore A points)**
Nitric Acid	50	+ 3.5	+ 2	-40	-15	-10
40° Beaume	10	+1.7	0	-20	-10	-8
Sulphuric Acid	50	-0.2	0	-6	-10	-3
66° Beaume	10	-0.1	0	-6	-5	0
Acetic Acid	50	+2	0	-6	-10	-2
glacial	10	+1.4	0	-5	-5	0
Ammonia	50	+5	+5	-10	+10	-8
concentrated		+5	+5	-3	+5	-2
Soda 36	50	-0.6	0	-5	+5	-3
	10	-1	0	-3	0	0
Hydrochloric Acid	50	+5	+5	-30	-32	-8
22° Beaume	10	+0.3	0	-15	-15	-2
Gasoline	100	+165	+275	-70	-50	-15
Ethanol	100	0	0	-7	-5	0
Methyl ethyl ketone	100	+40	+50	-35	-10	-5
Acetone	100	+6	+7.5	-22	-28	-2
Kerosene	100	+225	+160	-70	-50	-13
toluene	100	+160	+200	-72	-43	-15
Skydrol 500	100	+5	+6	-23	-12	-5
Exxon turbo oil 35	100	+7	+7	-10	-5	0
Exxon turbo fuel JP 4	100	+162	+205	-70	-45	-20
Invard J43	100	+80	+92	-56	-42	-15
Silicone Fluid 100cST	100	+100	+92	-66	-27	-15
Pyralene 1476	100	+4	+3	-20	-12	0
Arctic oil	100	+3	+3	0	0	0
ASTM oil no. 1	100	0	0	-5	-5	-2
ASTM oil no. 3	100	+6	+5	-10	-8	-5
Pyralene 1476*	100	+8	+6	-6	-17	-5
Skydrol 500*	100	+10	+11	-10	-15	-15
ASTM oil no. 1*	100	+1	0	-5	-10	-5
ASTM oil no. 3*	100	-27	+20	-25	-20	-15
Exxon turbo oil 35*	100	+8	+7	-20	-17	-10

Superflex Silicone Adhesive Sealants exhibit a good resistance to phosphoric acid up to a concentration of 50% and at a temperature of 380°F (193°C) for one week. They also have a good resistance to hydrochloric acid up to a concentration of 20% at 140°F (60°C) for one week.

6. Resistance to boiling water

Superflex products have a good resistance for prolongs periods of time in hot water 185°F(85°C) and degradation in boiling water is quite slow. For example, the following variations (in percentage) of the principal properties have been measured on a 2mm thick film.

Properties	**Tensile Strength**		**Elongation**		**Shore A Hardness**	
Test	185°F	212°F	185°F	212°F	185°F	212°F
Temperatures	85°C	100°C	85°C	100°C	85°C	100°C
After 1 month	-25%	-64$	-13%	-8%	-12%	-37%
After 2 months	-38%	-80%	-14%	+14%	-18%	-40%

7. Resistance to Corrosive Gases:

Hydrochloric Gas:	Severely affected
Sulphurous and Hydride Vapour	Good resistance
Ammonia Vapour	Fair resistance; (durometer lowers typically 15 points)
Sea fog	Very good

8. Permeability to Gases

As cured silicone rubber, Superflex Silicone Adhesives/Sealants exhibit a high permeability to most gases.

Values indicated below expressed in cubic cm and correspond to the volume of gas passing during 1 second through a one-centimetre thick sealant bead, on a surface of 1 cm^2 and under a pressure of 1cm of Hg.

- Permeability to hydrogen 65
- Permeability to helium 35
- Permeability to nitrogen 28
- Permeability to oxygen 60
- Permeability to carbon dioxide 325
- Permeability to methane 95
- Permeability to ethylene 135
- Permeability to propane 410
- Permeability to butane 900
- Permeability to water vapour 2,500

Permeability shall be calculate by the formula:

$$\frac{cm^3 \times \text{thickness, cm} \times 10^{-9}}{\text{sec.} \times cm^2 \text{ cm Hg}}$$

USE AND APPLICATION

Surface preparation

Loctite Superflex Silicone Adhesives/Sealants will bond to most clean, dry surfaces without extensive surface preparation techniques. These surfaces include most metals, glass, ceramics, silicone rubber and certain plastic products. All surfaces, however must be clean. The use of Methyl Ethyl Ketone (MEK) or Loctite Safety Solvent #755 is recommended for easy and simple cleaning process. To obtain maximum bond reliability, the following procedures are recommended for the appropriate substrates.

Substrate	Surface Preparation
Steel (iron, cast iron)	Rubbing with sand paper or abrasive finishing (or sandblasting or shot-blasting)
Stainless Steel	Rubbing with sand paper or abrasive finishing (or sandblasting or shot-blasting)
Aluminium (light)	Degreasing followed, if necessary, by abrasion with sandpaper.
Copper	Dulling with emery cloth, abrasive finishing or sandblasting, followed by degreasing.
Substrate	**Surface Preparation**
Lead	Wire brushing, followed by degreasing*
Zinc	Wire brushing, followed by degreasing*
Galvanised surfaces	Wire brushing, followed by degreasing*
Painted surfaces	Thorough degreasing
Glass (enamelled/ glazed surfaces, porcelain, ceramic)	Cleaning with aqueous detergent solution, followed by thorough rinsing ⍀
Commonly used Thermoplastic & Thermosetting Materials & Organic Elastomers	Light Abrasion, followed by degreasing with an inert solution.
Polyolefins (high density polythene, polypropylene)	Degreasing, followed by abrasive polishing or chemical treatment.
Polytretrafluoroethylene (PTFE)	De-flashing, followed by abrasive polishing.
Polythylene Glycol (Terephthalate)	De-flashing, followed by abrasive polishing.
Silicone Elastomers	Light abrasion, followed by degreasing with inert solvent

*****Degreasing is always necessary. The use of MEK (Methyl Ethyl Ketone) or Loctite Safety Solvent #775 is recommended.

⍀ For example, a 0.5% aqueous solution of an anionic tensio-active agent.

In all cases a preliminary check should be made to determine satisfactory performance and bond strengths prior to production applications.

Application techniques

Superflex Silicone Adhesives/Sealants, supplied in the tube, are easy to apply be hand squeezing at uniform pressure to apply a desired amount of material.

The use of the Loctite Tube Wringer Item # 11727 is a super applicator to assure both ease of application and complete dispensing of the material from the tube.

The industrial caulker cartridge for larger volume applications is used with a standard caulking gun.

When applying the material from a nozzled container, for optimum adhesion and seal, the material must be applied by pushing the product in the direction of use (forward) into the surface. For bonding applications apply sealant to one surface only and join surfaces to be bonded immediately. Excess material should be removed immediately. To improve the appearance of an uncured extruded bead (etc.) the simple use of an “ice cube” will serve as an excellent doctor blade to give that exceptional, professional finish.

Clean up and removal

Uncured Superflex Silicone Adhesive/Sealant should be cleaned up immediately. Use of Loctite Safety Solvent #755 or methyl ethyl ketone (MEK) is recommended.

Cured silicone rubber can be cut away with appropriate scrapers or with the use of specially selected caustic industrial (paint) strippers (including Loctite Chisel™ Gasket Remover 790) which will dissolve the silicone rubber. Appropriate chemicals must be sourced from the manufacturer of such chemical stripping agents.

GENERAL INFORMATION

This product is not recommended for use in pure oxygen and/or oxygen rich systems and should not be selected as a sealant for chlorine or other strong oxidising materials.
For safe handling information on this product, consult the Material Safety Data Sheet, (MSDS).

Where aqueous washing systems are used to clean the surfaces before bonding, it is important to check for compatibility of the washing solution with the adhesive. In some cases these aqueous washes can affect the cure and performance of the adhesive.
This product is not normally recommended for use on plastics (particularly thermoplastic materials where stress cracking of the plastic could result). Users are recommended to confirm compatibility of the product with such substrates.

Directions for use

For best performance surfaces should be clean and free of grease. Product should be applied to the bolt in sufficient quantity to fill all engaged threads. This product performs best in thin bond gaps, (0.05mm). Very large thread sizes may create large gaps which will affect cure speed and strength. This product is designed to give controlled friction, (torque/tension ratio), during assembly. In critical tightening applications this ratio should be confirmed.

Storage

Product shall be ideally stored in a cool, dry location, in unopened containers at a temperature between 8°C to 28°C (46°F to 82°F) unless otherwise labelled. Optimal storage is at the lower half of this temperature range. To prevent contamination of unused product, do not return any material to it’s original container. For further specific shelf life information contact your local Technical Service Centre.

Data Ranges

The data contained herein may be reported as a typical value and/or range (based on the mean value ±2 standard deviations). Values are based on actual test data and are verified on a periodic basis.

Note

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