NuSil SILICONE TECHNOLOGY
Creative Partners in a Material World

Choosing a Silicone Primer/Adhesive System

Selecting a silicone primer to optimize your bonding process

- Primer Choices
- Application Techniques
- How a Primer Works
- Primer Storage
- Adhesion Testing

Primer Choices

	Description
SP-120	**Clear General Purpose Primer.**
SP-121	Red version of SP-120
SP-130	Blue version of SP-120
CF1-135	**Clear General Purpose Primer**
CF1-136	Red version of CF1-135
CF1-137	Clear version of SP-135 with UV tracer for blacklight inspection
CF2-137	Clear version of CF1-135 with UV tracer for blacklight inspection
CF1-141	Clear version of CF1-135 using IPA solvent instead of Naptha
CF2-135	**Clear General Purpose Primer with slightly more aggressive bonding characteristics when using addition cure systems.**
CF2-136	Red version of CF2-135
CF6-135	**Clear General Purpose Primer with more aggressive bonding characteristics. For inhibited surfaces when using addition cure systems.**
CF6-136	Red version of CF6-135
CF6-137	Clear version of CF6-135 with UV tracer for blacklight inspection
SP-124	**Clear General Purpose primer for Condensation Cure systems.**
SP-142	**Clear Primer for Polycarbonate and other plastics**
SP-270	**Translucent Primer with more aggressive bonding characteristics. For inhibited surfaces when using addition cure systems. Increases surface wetting on some substrates (i.e. Metals).**
SP-133	**Clear primer to improve adhesion to polyimide.**

Application Techniques

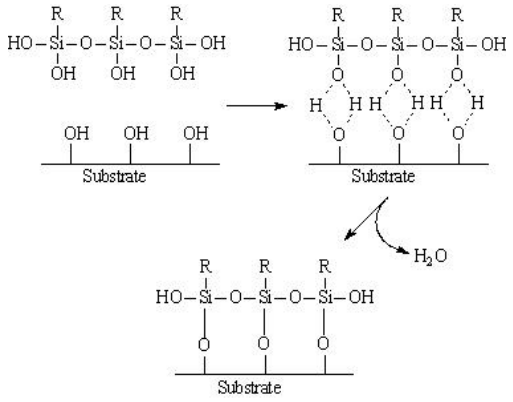
Apply by brushing, wiping or dipping a uniform thin film onto the substrates. The following procedures are recommended for best bonding results:

1. Clean and degrease the surface being primed with an appropriate solvent and a coarse lint-free cloth.
2. Rinse the surface off with clean solvent.
3. When completely dry, apply a uniform thin coat by dipping, spraying or brushing. Use a camel hair brush, or on smooth surfaces, a lint-free tissue. When priming substrates for use with addition-cure silicones, do not use sulfite containing materials such as brushes with wood handles or latex gloves as they may inhibit cure. Dried primer coatings vary from being clear to having a slight haze. If dried to a whitish haze or chalky appearance, the coating is too thick. Clean and reapply. (The common misconception of "more is better" can cause considerable trouble – **more is definitely not better**.)
4. Allow to dry for 30 minutes at room temperature and 50% relative humidity. This primer is actuated by atmospheric moisture, so lower levels of humidity require longer drying times.
5. Apply the appropriate NuSil Technology adhesive/sealant.

How a Primer Works

Silane primers are used to promote adhesion between two non-bonding surfaces. Although designed for use with silicone adhesives, they can also be used with other adhesives, such as epoxies. The primers usually consist of one or more reactive silanes, a condensation catalyst and some type of solvent carrier. The reactive silanes typically have two different reactive groups: one compatible with the substrate and the other with the adhesive. Some reactive groups may be hydrophilic like a silanol (Si-OH) group or hydrophobic like a 1-octenyl group. These different groups form a compatible interface between the incompatible substrates and promote adhesion. The reactive silanes are usually added as moisture sensitive alkoxy silanes and, in the presence of water and a condensation catalyst, form the priming surface.

The silanes and the condensation catalysts form a very thin polymeric film on the surface of the substrate; the silanes begin hydrolyzing with atmospheric moisture and the condensation catalyst starts joining all the hydrolyzed groups into a primer film on the substrate. Leaving a bottle open to atmospheric moisture can start this reaction while still in the bottle, often forming a precipitate and rendering the primer impotent.



Theoretically, the best primer film is a mono-molecular layer with the compatible groups facing the substrate and the organic groups facing the organic silicone adhesive's surface. In reality, these monolayers don't exist, but compatible bi or tri-layers do. This illustrates the importance of thin primer films and the necessity of solvent carriers in the primer formulation. Thick, overly primed surfaces tend to build chalky primer films that can be points of adhesive failure.

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Adhesion Testing

The tables presented hereafter evaluate 3 different adhesive cure systems:

- 1 part acetoxy cure
- 1 part oxime cure
- 2 part addition cure (fast cured with heat, or room temperature cured)

Not all primers or combinations were tested in this study, and it is meant to be a general guide only. Differences between grades of plastics and vendors may play a significant role in bonding characteristics. **These test results are meant to be a guide only, and each application should be fully tested by the end user prior to implementing the use of primer.**

General Recommendations as based on comparative Shear Values

Substrate	Primer	1 Part Acetoxy	1 Part Oxime	2 Part Addition cure Heat Cured	2 Part Addition cure Cured at ambient
PU Polyurethane	w/o primer	○	□	▲	▲
	SP-120	▲	○	▲	▲
	SP-124	▲	▲	▲	○
	SP-135	○	▲	▲	▲
	CF1-135	▲	▲	▲	▲
	CF6-135	▲	▲	▲	○
	SP-142	▲	○	▲	▲
	SP-270	▲	○	▲	▲
	SP-133	▲	▲	▲	▲
PVC Polyvinyl Chloride	w/o primer	▲	○	□	○
	SP-120	▲	▲	▲	▲
	SP-124	▲	▲	▲	▲
	SP-135	○	▲	▲	▲
	CF1-135	▲	▲	▲	▲
	CF6-135	▲	▲	▲	▲
	SP-142	▲	▲	▲	▲
	SP-270	▲	▲	▲	▲
	SP-133	▲	○	▲	▲
PC Polycarbonate	w/o primer	□	▲	□	□
	SP-120	▲	▲	○	○
	SP-124	▲	▲	○	○
	SP-135	▲	▲	○	○
	CF1-135	▲	▲	○	▲
	CF6-135	▲	▲	○	○
	SP-142	▲	▲	○	○
	SP-270	▲	▲	○	▲
	SP-133	▲	▲	□	▲
PP Polypropylene	w/o primer	□	□	□	□
	SP-120	□	□	□	○
	SP-124	□	□	□	□
	SP-135	□	□	□	○
	CF1-135	□	□	□	○
	CF6-135	□	□	○	○
	SP-142	□	□	○	○
	SP-270	□	□	○	○
	SP-133	□	□	□	□
PSU Polysulfone	w/o primer	○	○	□	□
	SP-120	○	▲	○	○
	SP-124	▲	▲	□	○
	SP-135	▲	▲	○	○
	CF1-135	▲	▲	○	○
	CF6-135	▲	▲	○	○
	SP-142	▲	▲	○	○
	SP-270	▲	▲	○	□
	SP-133	▲	▲	□	□

▲ = Good Adhesion ○ = Moderate Adhesion □ = Poor Adhesion

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Substrate	Primer	1 Part Acetoxy	1 Part Oxime	2 Part Addition cure Heat Cured	2 Part Addition cure Cured at ambient
PPSU Polyphenylene sulphone	w/o primer	□	□	□	□
	SP-120	○	▲	▲	▲
	SP-124	○	○	○	▲
	SP-135	○	▲	▲	▲
	CF1-135	○	○	▲	○
	CF6-135	○	▲	▲	▲
	SP-142	○	○	▲	▲
	SP-270	○	□	○	○
	SP-133	○	○	▲	○
PMMA Polymethyl methacrylate	w/o primer	□	□	□	□
	SP-120	○	□	▲	○
	SP-124	□	○	▲	▲
	SP-135	□	□	▲	▲
	CF1-135	○	□	▲	▲
	CF6-135	○	○	▲	▲
	SP-142	□	○	▲	▲
	SP-270	□	○	▲	○
	SP-133	○	□	▲	▲
PEEK Poly ether-ether-ketone	w/o primer	▲	▲	□	□
	SP-120	▲	▲	▲	▲
	SP-124	▲	▲	○	▲
	SP-135	▲	▲	▲	▲
	CF1-135	▲	▲	▲	▲
	CF6-135	▲	▲	○	▲
	SP-142	▲	▲	▲	▲
	SP-270	▲	▲	▲	▲
	SP-133	▲	▲	▲	▲
PI Polyimide	w/o primer	○	▲	□	□
	SP-120	▲	▲	▲	▲
	SP-124	▲	▲	▲	▲
	SP-135	▲	▲	▲	▲
	CF1-135	▲	▲	▲	▲
	CF6-135	▲	▲	▲	▲
	SP-142	▲	▲	▲	▲
	SP-270	▲	▲	▲	▲
	SP-133	▲	▲	▲	□
PET Polyethylene terephtalate	w/o primer	□	○	□	□
	SP-120	▲	▲	▲	○
	SP-124	▲	▲	▲	○
	SP-135	○	▲	▲	○
	CF1-135	○	▲	▲	○
	CF6-135	○	▲	▲	▲
	SP-142	○	▲	▲	○
	SP-270	○	▲	▲	▲
	SP-133	○	□	○	○
POM Polyoxomethylene	w/o primer	○	□	□	□
	SP-120	○	□	□	□
	SP-124	□	□	□	□
	SP-135	□	□	○	○
	CF1-135	○	□	○	○
	CF6-135	□	○	○	○
	SP-142	□	□	○	○
	SP-270	□	□	○	□
	SP-133	○	□	□	□

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Substrate	Primer	1 Part Acetoxy	1 Part Oxime	2 Part Addition cure Heat Cured	2 Part Addition cure Cured at ambient
Epoxy	w/o primer	▲	▲	□	○
	SP-120	▲	▲	▲	○
	SP-124	▲	▲	▲	▲
	SP-135	▲	▲	▲	▲
	CF1-135	▲	▲	▲	▲
	CF6-135	▲	▲	▲	▲
	SP-142	▲	▲	▲	▲
	SP-270	▲	▲	▲	▲
	SP-133	▲	▲	▲	▲
Copper	w/o primer	▲	▲	▲	□
	SP-120	▲	▲	▲	○
	SP-124	▲	▲	▲	▲
	SP-135	▲	▲	▲	▲
	CF1-135	▲	▲	▲	▲
	CF6-135	▲	▲	▲	▲
	SP-142	▲	▲	▲	▲
	SP-270	▲	▲	▲	▲
	SP-133	▲	▲	▲	▲
Aluminum	w/o primer	▲		○	□
	SP-120	▲	▲	▲	▲
	SP-124	▲	▲	▲	▲
	SP-135	▲	▲	▲	▲
	CF1-135	▲	▲	▲	▲
	CF6-135	▲	▲	▲	▲
	SP-142	▲	▲	▲	▲
	SP-270	▲	▲	▲	▲
	SP-133	▲	▲		▲
Stainless Steel	w/o primer	○	○	○	□
	SP-120	▲	○	○	□
	SP-124	▲	▲	○	○
	SP-135	▲	▲	▲	○
	CF1-135	▲	▲	○	○
	CF6-135	▲	○	▲	○
	SP-142	▲	○	▲	▲
	SP-270	▲	○	▲	○
	SP-133	▲	○	○	○

▲ = Good Adhesion ○ = Moderate Adhesion □ = Poor Adhesion

Adhesion to PTFE was also tested with very poor results. Results were not reported.