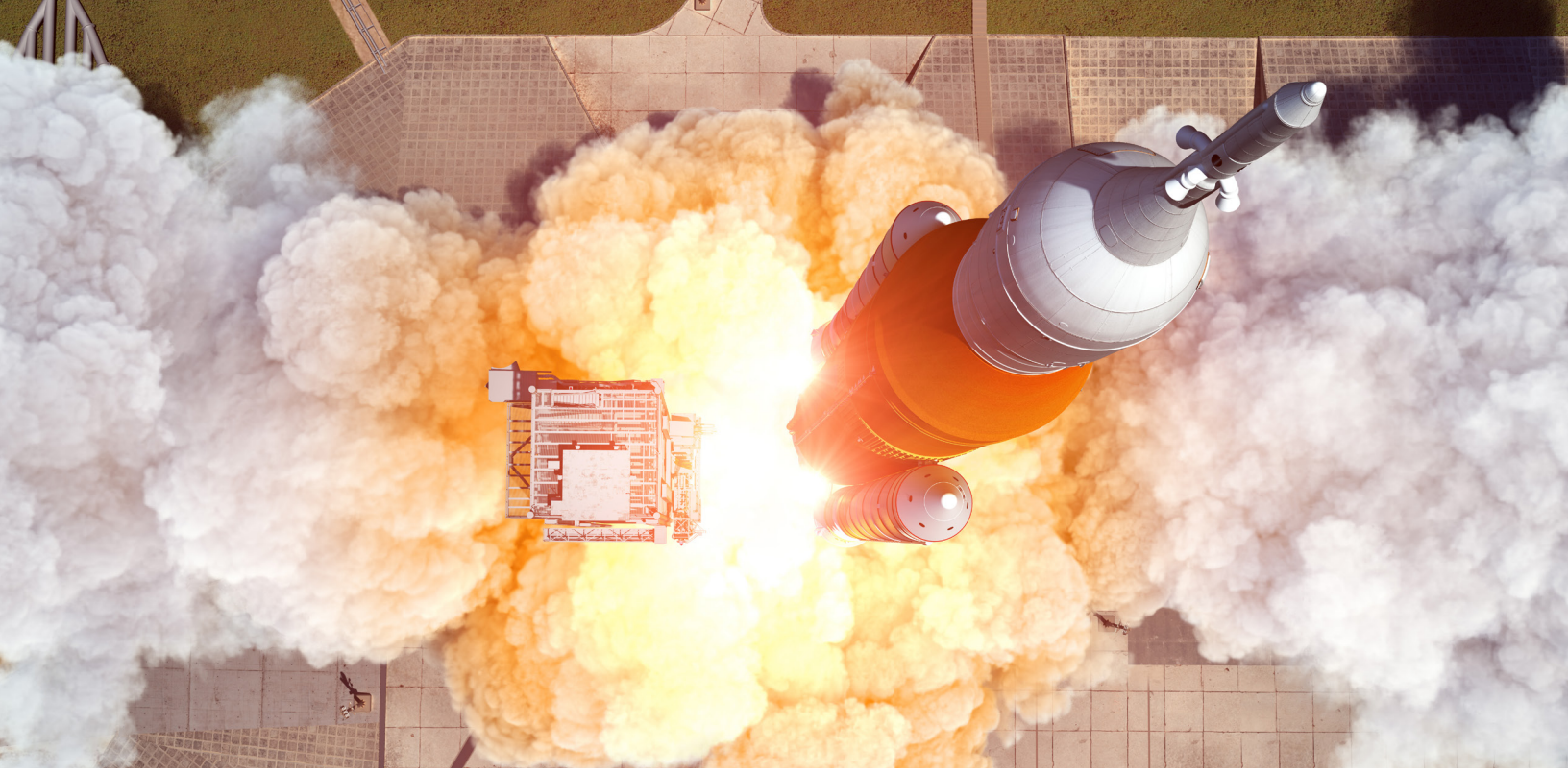
AVIONICS, AEROSPACE AND DEFENSE

Exploring the frontiers of tomorrow

DOWSIL™ Silicone Ablatives application guide



Protective silicones for spacecraft, launch structures, and defense applications

We've had our eyes to the skies for decades, developing the first silicones for aviation in 1943. We haven't looked back. Instead, we look up. We are meeting the challenges in emerging technologies such as reusable rockets, small satellites, drones, hypersonic missiles, and mobile rocket launchers with new material innovations and proven DOWSIL™ protective silicones.

These class-leading materials are designed for application flexibility, ease of use, and sustainability, and provide asset protection with improved efficiency and reduced cycle time.

DOWSIL™ Silicone Ablatives benefits:

- Superior performance in high-shear, high-heat flux environments
- Tough, tenacious char characteristics
- Thermally stable from -65°C to +200°C, and for short periods of time at temperatures greater than 3000°C
- Excellent resistance to weathering, moisture, ozone
- Flexible application options
- Room temperature and heat-curing options

Potential applications

Rocket and missile propulsion

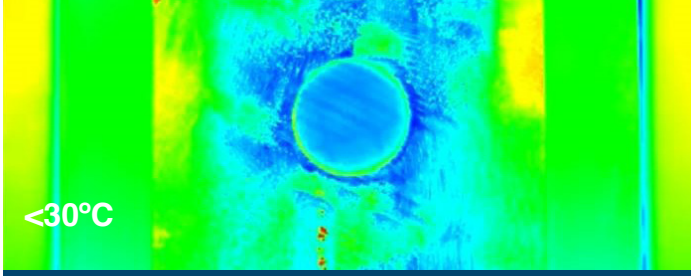
Heat shields, nose cones, and fin assemblies

Direct or indirect protection of launch infrastructure and deployment devices

Product	Cure	Working time	Cure time at RT	Application method	Surface orientation	Char durability
DOWSIL™ 93-104 Ablative	2-part, addition	5 hours	≤24 hours	Brush, roll, trowel, moldable	Horizontal	Best
DOWSIL™ 93-104 Ablative Fast Cure	2-part, addition	2.5 hours	≤12 hours	Brush, roll, trowel	Horizontal	Best
DOWSIL™ 3-6077 Ablative	2-part, condensation	2-3 hours	≤24 hours	Brush, roll, trowel	Horizontal and vertical	Better
DOWSIL™ LPA-4000 Sprayable RTV Ablative	1-part, moisture	5-45 minutes	≤24 hours	Spray, brush, roll, trowel	Horizontal and vertical	Good

DOWSIL™ 93-104 Ablative and DOWSIL™ 3-6077 Ablative are International Traffic in Arms regulated

Heating top of ablative surface



Bottom heat map – Ablative-coated tile immediately after flame extinguished

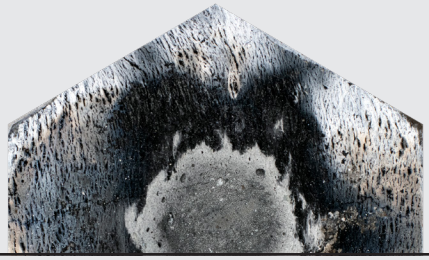
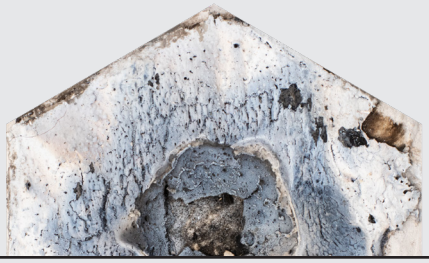
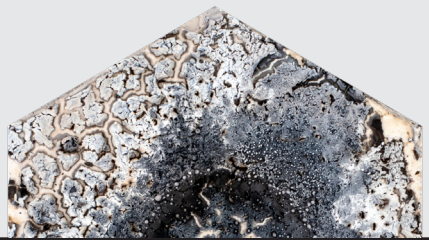
DOWSIL™ Silicone Ablatives coated to 4.8 mm on ceramic tile and exposed to 3500°C for up to 30 seconds

Product	Penetration rate (mm/sec)	Bulk loss rate (g/sec)	Bottom temperature rise (seconds)*
DOWSIL™ 93-104 Ablative	<0.1	0.11	>30
DOWSIL™ 3-6077 Ablative	0.15	0.11	20
DOWSIL™ LPA-4000 Sprayable RTV Ablative	0.16	0.53	20

*Exposure time before tile fracture

Ablatives adhesion profile

Product	Pounds per linear inch			
	Steel		Concrete	
	Bare	Primed	Bare	Primed
DOWSIL™ 93-104 Ablative	5.1	7.8	5.1	7.6
DOWSIL™ 3-6077 Ablative	<1	15.1	<1	12.6
DOWSIL™ LPA-4000 Sprayable RTV Ablative	14.7	14.4	15.2	10.8

Product	New application	Heated at 3500°C
DOWSIL™ 93-104 Ablative		30 seconds 
DOWSIL™ 3-6077 Ablative		20 seconds 
DOWSIL™ LPA-4000 Sprayable RTV Ablative		20 seconds 

Surface preparation

To ensure maximum adhesion and best product performance, surface preparation, including cleaning and priming is recommended.

Surface cleaning

- Ensure all surfaces to be coated with DOWSIL™ Silicone Ablatives are cleaned and free of dust, loose impediments, residual surface char, and any oils/greases. Surfaces can be cleaned and/or degreased with DOWSIL™ OS Fluids, naphtha, mineral spirits, methyl ethyl ketone (MEK) or other suitable solvents that will remove oils, and other contaminants that may be present.
- Typically, cleaning the substrate with a power washer and water will provide enough surface abrasion to promote robust adhesion (initial ablative coating or previously coated surfaces).

Priming with DOWSIL™ Prime Coat materials

- DOWSIL™ Prime Coat can increase substrate surface energy and material wetting – both of which improve adhesion. DOWSIL™ 1200 RTV Prime Coat is recommended in conjunction with DOWSIL™ 93-104 and DOWSIL™ 3-6077 Ablatives.
- DOWSIL™ Prime Coat materials should be applied in a very light, even coat by wiping, dipping, or spraying. Excess material should be removed to avoid overapplication which leaves a white, chalky residue on the surface. When dip or spray coating, diluting by a factor of 2 to 4 with additional solvent may avoid excessive build-up.
- These primers require moisture in the air to cure. For optimal performance, we recommend curing at room temperature within a range of 20- to 90-percent relative humidity for 1 to 2 hours. Low humidity and/or low-temperature conditions require longer cure times. Mild heat can be used to accelerate the rate of cure for primers.
- Be sure to keep DOWSIL™ Prime Coat containers tightly closed when not in use. If the prime coat takes on a “cloudy” appearance in the container, it has likely been exposed to ambient moisture and may not perform as specified.

DOWSIL™

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Application

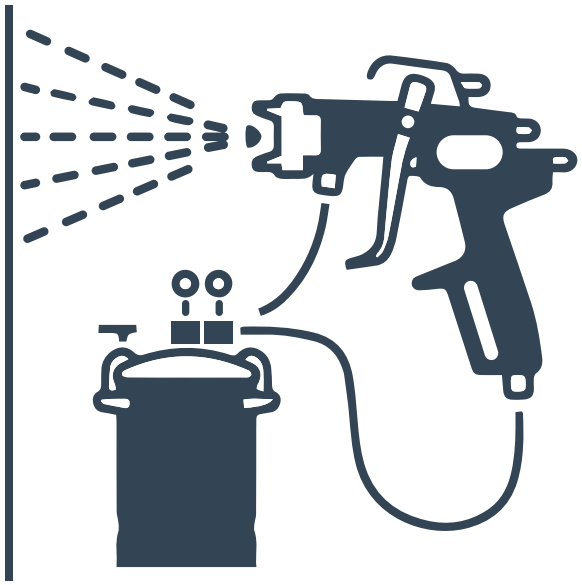
DOWSIL™ Silicone Ablatives are formulated for application flexibility. These materials can be applied by the following methods.

Painting, troweling, or rolling

- DOWSIL™ 93-104 Ablative is formulated for manual application to target thickness on horizontal surfaces. In addition, DOWSIL™ 93-104 Ablative can be molded into custom parts and shapes.
- The paste-like consistency of DOWSIL™ 3-6077 Ablative allows for troweling on horizontal, inclined, and vertically opposed surfaces without creep.
- DOWSIL™ LPA-4000 Sprayable RTV Ablative can also be applied with brush, roller, or by troweling onto both horizontal and vertical surfaces.

Spraying

DOWSIL™ LPA-4000 Sprayable RTV Ablative can be applied using conventional airless spray systems. Interchangeable spray tips can be selected to provide optimal spray performance on both horizontal and vertical surfaces. DOWSIL™ LPA-4000 Ablative has exhibited up to 200 mils without creep.



Ablatives

Here are some FAQs about DOWSIL™ Silicone Ablatives and recommendations for their applications and use.

Frequently asked questions

1. How is application thickness determined?

Application thickness depends on several variables including which ablative is being applied, location relative to flame impingement, and fuel type. DOWSIL™ 93-104 Ablative is recommended for direct impingement (flame diversion shields, flame trench throat, etc.). DOWSIL™ 3-6077 Ablative and DOWSIL™ LPA-4000 Sprayable RTV Ablative are recommended for protection of peripheral structures (strongback, gantry, etc.). Field testing ablative selection and application thickness is recommended to validate assumptions for structure protection.

2. Is a primer required for ablative adhesion?

Adhesion of the ablative to the substrate is critical for proper structural protection. Adhesion can be optimized by using a compatible silicone primer to increase surface energy on the substrate. DOWSIL™ 1200 Primer is versatile and works well with DOWSIL™ Silicone Ablatives. DOWSIL™ LPA-4000 Sprayable RTV Ablative provides primerless adhesion to most substrates, however field testing both primed and unprimed adhesion is recommended to verify the need for a primer.

3. Is heat required to cure DOWSIL™ Silicone Ablatives?

Heat is not required as they will cure in-depth at room temperature. DOWSIL™ 93-104 Ablative cure can be significantly accelerated with heat but will typically cure fully at room temperature — between 24 and 48 hours — depending on application thickness. Please consult the DOWSIL™ Ablative technical datasheets for more specific information.

4. Are there requirements for personal protective equipment (PPE) when applying DOWSIL™ Silicone Ablatives?

PPE requirements include the use of protective gloves and eyewear (avoid nitrile gloves if using DOWSIL™ 93-104 Ablative). Respirators are not typically required during application. Following your company requirements for PPE is recommended when mixing and applying DOWSIL™ Silicone Ablatives.

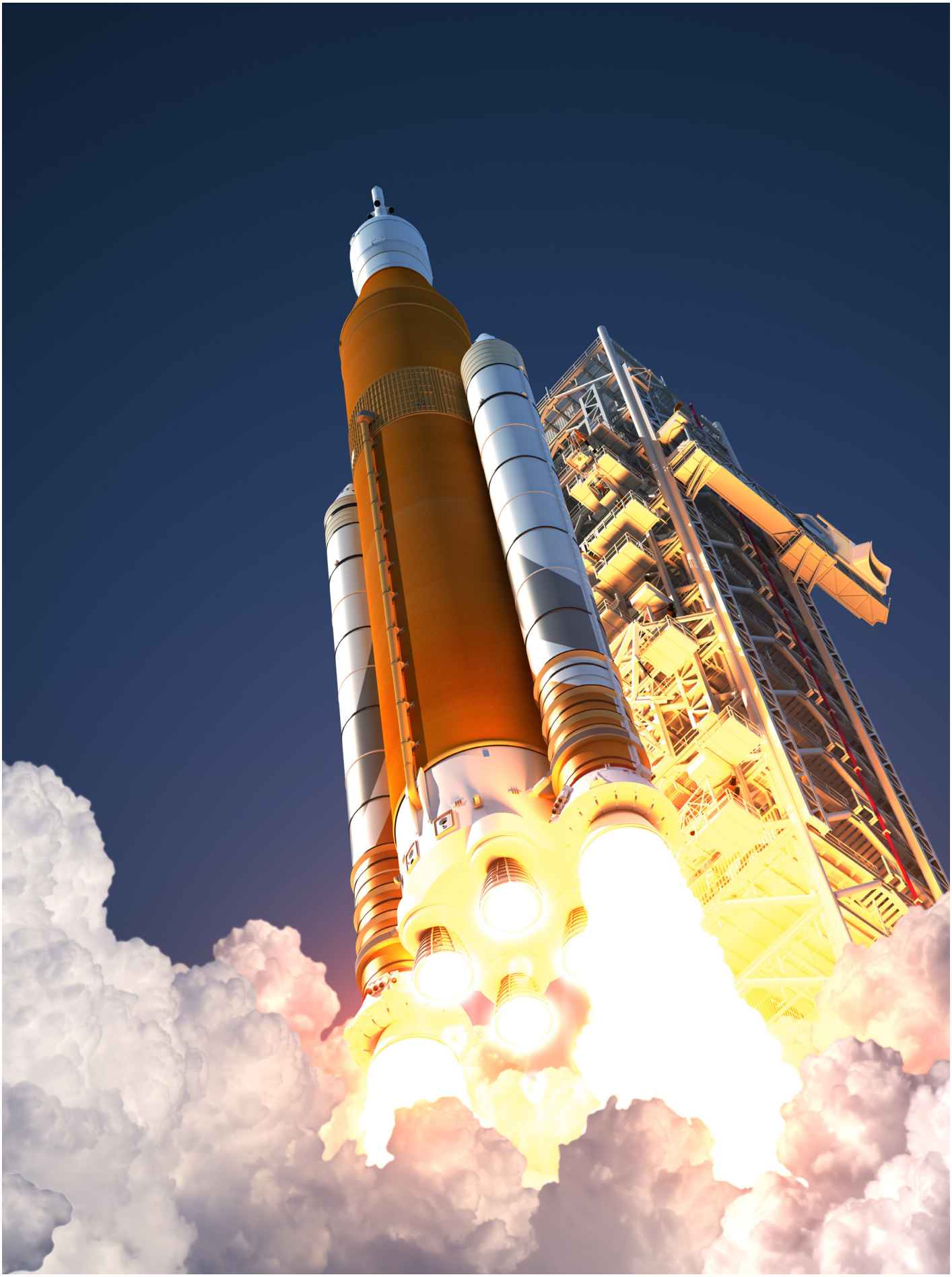
Before handling these materials, read product and safety data sheets and container labels for safe use, physical and health hazard information. The safety data sheets are available at **dow.com**, or from your Dow sales application engineer or distributor.

5. What kind of surface preparation is required before applying DOWSIL™ Silicone Ablatives?

Surfaces should be free from dust, dirt, greases, oils, and any other surface contaminant that might interfere with cure and/or adhesion. Surfaces can be cleaned in a variety of ways including air wand and high-pressure power washing. Care should be taken to remove any loose impediments. Stubborn areas with grease or oils should be removed with a solvent prior to application. A properly cleaned surface will encourage durable, robust adhesion of the ablative to the surface.

6. Can ablatives be applied/re-applied to surfaces already containing cured ablative coatings?

DOWSIL™ Silicone Ablatives can be applied to surfaces that have been previously coated. However, care must be taken to ensure the surface is free of residual char, loose impediments, or other surface residues that could negatively affect adhesion. When applying DOWSIL™ 93-104 Ablative or DOWSIL™ 3-6077 Ablative to an existing ablative layer, a compatible prime coat such as DOWSIL™ 1200 Primer is recommended to promote adhesion.



Discover more

We bring more than just an industry-leading portfolio of advanced silicone-based materials. As your dedicated innovation leader, we bring proven process and application expertise, a network of technical experts, a reliable global supply base, and world-class customer service.

To find out how we can support your applications, visit **dowablatives.com**.

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