

Instructions: Use of SQUID3 Space Pressure-Sensitive Adhesives

Applicable PSAs: 3M™ 966 (Acrylic) | 3M 9703™ (Electrically Conductive)

1. Overview

SQUID3 Space utilizes two classes of Pressure-Sensitive Adhesives (PSA) for assembly of spacecraft thermal control materials: a standard acrylic film adhesive (3M™ 966) and an electrically conductive Z-axis adhesive (3M™ 9703). Both are qualified for use in vacuum environments per 3M Technical Datasheets and NASA Outgassing Database.

3M™ 966 is a high-performance acrylic transfer adhesive commonly used for bonding spacecraft thermal management components, such as flexible Optical Solar Reflectors (FOSR), Teflon® and Kapton® films, heaters, and temperature sensors to flat or mildly curved surfaces. Its operating temperature range is -60°C to 120°C (-76°F to 250°F) with Silver AlphaFEP™ film.

3M™ 9703 is an electrically conductive adhesive (Z-axis) designed for EMI shielding, grounding, and static dissipation bonding applications. It provides reliable electrical continuity through the adhesive thickness while maintaining strong mechanical adhesion. Its operating temperature range is -40°C to 85°C (-40°F to 185°F) with ITO coated Silver AlphaFEP™ film.

NOTE: 3M™ 9703 must only be used in applications where Z-axis electrical conductivity is specifically required. For purely structural or thermal bonding applications, 3M™ 966 is the preferred adhesive due to shorter lead time and wider temperature range.

2. Shelf Life / Warranty

PSA Type	3M™ Product Name	Manufacturer Shelf Life (roll form)	SQUID3 Shelf Life (converted/applied form)
Acrylic (Standard)	3M™ 966	24 months from manufacture date	12 months from product ship date
Electrically Conductive (Z-axis)	3M™ 9703	24 months from manufacture date	12 months from product ship date

Manufacturer Shelf Life Definition

The PSA materials listed above are supplied by 3M™ on rolls. The manufacturer shelf life is defined as the period from the PSA manufacture date to when it should be converted (applied onto a product such as a Teflon® FEP or Kapton® film) for later use as bonding adhesive during product installation. Once the PSA is in a converted state, the manufacturer shelf life is no longer applicable.



SQUID3 Space Shelf Life Definition

PSA materials are supplied from SQUID3 Space in a converted state, applied onto coated films, for use by the customer at the point of system integration. The SQUID3 Space shelf life is defined as the time from the product shipment date (shown on packaging labels) to when the assembly should be installed (bonded). The 12-month period represents the standard SQUID3 Space warranty shelf life, provided the material is sealed/stored in the original packaging materials (double vacuum sealed bag) @ 16°C to 27°C (60°F to 80°F), 40–60% RH.

Shelf Life Validation and Storage Controls

- Relevant literature has confirmed that 3M™ 966 PSA materials exhibit no measurable adhesion degradation change when stored in a controlled environment (16°C/60°F to 27°C/80°F, 40–60% RH) for up to 60 months of aging time.
- SQUID3 Space ERP systems manage all received PSA material lots to ensure they do not exceed manufacturer shelf life prior to converting.
- Storage in a cool, dry, UV-free environment (16°C/60°F to 27°C/80°F, 40–60% RH) is strongly recommended to maintain optimum adhesive bond strength and release liner adhesion. Special storage requirements are no longer applicable once the PSA has been used to bond a component to its mating surface.

3. Surface Preparation

Proper surface preparation is critical to achieving the specified bond strength for both 3M™ 966 and 3M™ 9703 applications. Inadequate surface preparation is the leading cause of adhesive bond failures in spaceflight hardware.

General Requirements (All PSA Types)

- Remove all dust, oil, grease, flux residue, and other contaminants from the bonding surface using a lint-free cloth dampened with isopropyl alcohol (IPA). Allow the surface to dry fully before applying the PSA.
- Both adhesives bond well to most smooth, clean metallic and polymeric surfaces. An etched or lightly abraded surface will enhance mechanical bond strength for 3M™ 966 applications.
- Bonding surfaces must be dry and at room temperature prior to PSA application. Do not apply PSA to surfaces that are below the dew point.
- Ideal tape application temperature range is 21°C to 38°C (70°F to 100°F) and application to surfaces at temperatures below 10°C (50°F) is not recommended for PSA because the adhesive becomes too firm to adhere readily.
- Bond strength can also be improved with firm application pressure and moderate heat, from 38°C to 54°C (100°F to 130°F).

Additional Requirements for 3M™ 9703 (ITO Conductive Applications)

- Bonding surfaces must be electrically conductive and free of anodizing, heavy oxide layers, non-conductive coatings, or passivation layers that would impede electrical contact. Verify surface conductivity with a multimeter prior to bonding.



4. Mounting Procedure

Special care is required when applying either PSA type to ensure freedom from trapped air, which can impede heat transfer, reduce bond strength, and in the case of 3M™ 9703, degrade electrical conductivity. Follow the procedure below to minimize the risk of entrapped air.

1. With the PSA release liner still intact, position the component onto the mating surface in the desired location. Verify correct orientation and alignment before proceeding.
2. Once position is confirmed, peel back the release liner from one corner of the component while leaving the remainder of the liner in place. Soft fluoropolymer tweezers may be used to lift the liner. Do not touch the exposed adhesive surface.
3. Beginning at the corner with exposed adhesive, apply the component to the mating surface using firm, even hand pressure. Ensure correct placement before full adhesion.
4. Slowly peel back the remaining release liner while pressing the adhesive progressively onto the mating surface. Work from the bonded end outward to prevent air entrapment.
5. Use a rubber roller to press the component onto the mating surface. Roll from the center outward toward the edges to displace any remaining trapped air. Mechanical pressure at 15 psi (0.1 MPa) or greater is required.
6. The assembly is now functional. However, step 7 is recommended for enhanced adhesion.
7. Place the bonded assembly in a 70°C (158°F) vacuum oven for 5 to 10 minutes. While the adhesive is still warm, repeat the rolling step above. A 2–3 day wet-out period at room temperature will maximize adhesion. For 3M™ 9703, a wet-out period of at least 24 hours under light clamping load is recommended to ensure stable contact resistance.

CAUTION: Do not oven-cure the PSA assembly if any component in the assembly cannot withstand the temperatures specified in the following steps. Remove any protective coverlay prior to oven curing

5. Adhesive Removal and Reapplication

Partial PSA removal and reapplication is not recommended. If any portion of the bond area requires re-work, remove and replace the entire piece of PSA. ITO coated Silver Teflon® and their electrical connections are susceptible to mechanical damage during PSA removal.

1. If the PSA release liner is still attached, remove it from the adhesive before proceeding.
2. Lay the component flat with the exposed PSA surface facing upward. Apply IPA to the PSA surface using a stream from a solvent wash bottle or a lint-free cloth. Use only enough solvent to wet the PSA surface. Do not immerse the component in solvent.
3. Allow the solvent to dwell for approximately 1 minute but no longer than 3 minutes.
4. Blot the PSA surface dry with a lint-free tissue. Firmly press a length of masking tape onto the softened PSA.
5. Hold the component flat on the work surface with one hand. Begin to pull the tape slowly at an angle greater than 90°. Confirm that the component remains undamaged before completing removal with a swift, continuous pulling motion. The PSA contacted by the tape should lift free from the component.



6. Apply fresh masking tape to any remaining PSA and repeat step 5 until the adhesive is fully removed.
7. Before applying new PSA, clean the component surface thoroughly using a lint-free cloth dampened with IPA. Allow the surface to dry fully.
8. Apply new PSA per the instructions in Section 4 above.

6. Miscellaneous Considerations

Outgassing

Both 3M™ 966 and 3M™ 9703 meet NASA low outgassing requirements per ASTM E595 (TML < 1.0%, CVCM < 0.10%) and are listed in the NASA GSFC Outgassing Database. Vacuum bake-out per Section 4 is recommended for critical flight assemblies.

Thermal Cycling

Both adhesives are qualified for thermal cycling environments encountered in standard spacecraft applications.

PSA Type	Continuous Temperature	Intermittent Temperature
3M™ 966	-60 to 120°C	-185 to 230°C
3M™ 9703	-60 to 85°C	-75 to 85°C

Electrical Performance – 3M™ 9703

Post-installation contact resistance measurements are recommended for all flight-critical grounding applications. Document and retain all resistance measurements as part of the assembly data package.

This document provides installation guidance based on current best practices. The customer assumes responsibility for component performance in the intended application. SQUID3 Space accepts no liability beyond its standard warranty terms for consequences of improper installation or adhesive failure. For further technical questions, please contact info@squid3.space