



THE GUND COMPANY

MANUFACTURERS & FABRICATORS OF ENGINEERED MATERIAL SOLUTIONS

Outgassing Selecting Spacecraft Materials

Outgassing is the release of by-products such as water vapor, gases, oil, or additives from materials that are subject to the vacuum or elevated temperatures. When selecting materials for space applications, outgassing is one of the most critical properties to consider. Outgassing can cause significant problems to satellites or spacecraft by impacting critical components such as electronics, optics, and sensors. Furthermore, outgassing can even pose health hazards. Often, these by-products are captured in materials during the manufacturing process. This is why it's crucial to produce top-notch materials using cutting-edge manufacturing techniques, similar to those provided by The Gund Company.



INDUSTRY STANDARD TESTING

Testing for material outgassing typically follows the industry Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment, ASTM E595.

The ASTM E595 tests materials under vacuum at 1,250°C for 24 hours. During this condition, the material outgassing vapor passes through a chamber, where the outgassing will be contained on a collector plate. After the 24-hour testing parameter, the samples are weighed in order to determine the Total Mass Lost (TML) and Collected Volatile Condensable Material (CVCM) percentage.

One critical aspect of testing, initially developed by NASA and widely adopted by industry leaders, is the acceptable limit for outgassing. These limits are stringent, with the acceptable levels being less than 1% for Total Mass Loss (TML), and less than 0.10% for Collected Volatile Condensable Material (CVCM). Additionally, the water vapor regained (WVR) can be evaluated to understand how much moisture can be regained at room temperature for 24 hours.

Check out The Gund Company's extensive list of acceptable laminates, thermoplastics and films that offer low outgassing values.

LAMINATES

MATERIAL	Standards	Resin/Substrate	Data Reference	TML %	CVCM%	WVR%	Cost	Add. Properties
G-7	NEMA LI-1 (IM 60000) MIL-I-24768: / 17 GSG IEC 60893: SI GC 201 / SI GC 202 (sheet & tube)	Silicone/Glass	GSC11521	0.09	0.02	0.01	\$\$\$\$	Tech. Data Sheet
G-10	NEMA LI-1 (IM 60000) MIL-I-24768/2 GEE IIEC 60893: EP GC 201 (sheet), IEC 61212: EPGC21 (tube)	Epoxy/Glass	GSFC06614	0.52	0.00	0.16	\$\$	Tech. Data Sheet
FR4	NEMA LI-1 (IM 60000) MIL-I-24768/27 GEE-F IIEC 60893: EP GC 202 (sheet)	Epoxy/Glass	GSC23727	0.22	0.00	0.09	\$\$\$	Tech. Data Sheet
G-11	NEMA LI-1 (IM 60000) MIL-I-24768/3 GEB EPGC 203, 22	Epoxy/Glass	GSFC8999	0.59	0.00	0.20	\$\$\$	Tech. Data Sheet
G-30	NEMA LI-1 (IM 60000) IEC 60893-3-7 PI GC 301	Polyimide/Glass	GSFC09476	0.71	0.00	0.40	\$\$\$\$\$	Tech. Data Sheet

The Gund Company fabricates insulation materials to the exact specifications and drawings specified by our customers. We offer our customers the proper product for their specific application. A variety of dimensions and diameter sizes are available. Product colors vary according to material type.

The data supplied are typical values. They are not to be considered specification values. All of the information, suggestions, and recommendations about these properties and uses of the products herein are based on tests and data believed to be accurate; however, the final determination regarding the suitability of any material described herein for the contemplated application, the manner of such use, and whether the use infringes any patents is the sole responsibility of the user. There is no warranty - expressed or implied - including, without limitation, warranties of merchantability or fitness for a particular purpose. Under no circumstances shall we be liable for incidental or consequential loss or damage.



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Outgassing (cont.)

THERMOPLASTICS

MATERIAL	Standards	Resin/Substrate	Data Reference	TML %	CVCM%	WVR%	Cost	Add. Properties
PEEK	MIL-P-46183 Type 2 Class 1 & 3 (other grades available)	Polyetheretherketone	GSFC30151	0.14	0.00	0.05	\$\$\$\$\$	Tech. Data Sheet
Delrin Acetal	ASTM D 4181	Polyoxymethylene (POM)	GSFC17976	0.28	0.02	0.13	\$\$\$	Tech. Data Sheet
Rulon™		Reinforced PTFE	GSFC6826	0.00	0.00	0.01	\$\$\$\$	Tech. Data Sheet
Ryton®		Polyphenylene Sulfide (PPS)	GSC21579	0.09	0.00	0.01	\$\$\$\$	Tech. Data Sheet
Teflon®	MIL-I-19161A	Polytetrafluoroethylene (PTFE/FEP)	GSFC10661	0.01	0.00	0.02	\$\$\$	Tech. Data Sheet
UHMW		Ultra High Molecular Weight Polyethylene	GSFC28162	0.06	0.00	0.00	\$\$	Tech. Data Sheet
Ultem®		Polyetherimide (PEI)	GSFC3286	0.40	0.00	0.32	\$\$\$\$	Tech. Data Sheet

FILMS

MATERIAL	Standards	Resin/Substrate	Data Reference	TML %	CVCM%	WVR%	Cost	Add. Properties
Kapton®		Polyimide	GSC10365	0.97	0.00	0.80	\$\$\$\$\$	Tech. Data Sheet
Mylar®		Polyester	GSFC31726	0.24	0.01	0.18	\$\$	Tech. Data Sheet
Dacron	MIL-I-22834 MIL-E-917 D	Polyester	GSFC12706	0.16	0.02	0.04	\$\$	
Teflon®	MIL-I-19161A	Polytetrafluoroethylene (PTFE/FEP)	GSFC10661	0.01	0.01	0.02	\$\$\$	Tech. Data Sheet

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