

### Outgassing

- HiPer-D® connectors must be specially processed to meet ASTM E595 outgassing requirements.
- Modification codes are a convenient way to specify special outgassing bakeout or thermal vacuum outgassing.

Space flight equipment requires low-outgassing components in order to prevent degradation to optics and other sensitive instruments. The space industry has adopted a standardized test procedure, ASTM E595, to evaluate outgassing properties. In the ASTM test, material samples are heated to 125° C at a vacuum of  $5 \times 10^{-5}$  torr for 24 hours. The test sample is then weighed to calculate the Total Mass Loss (TML), which may not exceed 1.0% of the total initial mass. A collector plate is used to determine the Collected Volatile Condensable Material (CVCM), which may not exceed 0.1% of the total original specimen mass. HiPer-D® connectors contain nonmetallic materials such as rubber, plastic, adhesives and potting compounds which can give off gasses when subjected to a vacuum or high heat. Unless the connector is specially processed, the TML and CVCM can exceed allowable limits. Glenair is able to offer two bakeout processes which assure all materials comply with ASTM E595: a 48 hour oven bakeout at 175° C or a 24 hour thermal vacuum outgassing at 125° C. The table below shows suffix codes which specify outgassing processing.

### Connector Material and Finish for Space Applications

- Cadmium and silver plating are prohibited in space.
- Specify electroless nickel plating or gold plating on connector shells

Some types of metals are prohibited from space flight. "Cadmium, zinc, chemically coated cadmium or zinc, or silver shall not be used as a connector or contact finish" (NASA EEE-INST-002 Instructions for EEE Parts Selection, Screening, Qualification, and Derating). NASA recommends electroless nickel or gold plating on connector shells and gold plating for contacts.

### NASA Screening

- "Mission critical" connectors for space flight should undergo rigorous 100% final inspection.
- Modification codes are available to invoke special screening.

NASA recommends that connectors for space flight be specially screened. NASA EEE-INST-002 Instructions for EEE Parts Selection, Screening, Qualification, and Derating contains three levels of screening: level 1 for highest reliability, level 2 for high reliability and level 3 for standard reliability. Glenair suffix codes are available to invoke NASA screening. The table below shows these "Mod" codes which can also include outgassing processing.

NASA Screening Levels and Modification Codes			
NASA Screening Level	Special Screening Only	Special Screening Plus Outgassing Processing	
		48 Hour Oven Bake 175° C.	Thermal Vacuum Outgassing 24 hrs. 125° C.
Level 1 Highest Reliability	Mod 429B	Mod 429J	Mod 429C
Level 2 High Reliability	Mod 429	Mod 429K	Mod 429A
Level 3 Standard Reliability	(Use standard part number)	Mod 186	Mod 186M

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### Residual Magnetism versus Magnetic Permeability

- HiPer-D® connectors have a magnetic permeability rating of 2  $\mu$
- 100% residual magnetism screening is available on request. NMB (200 gamma) is the preferred screening level.

Ever since the dawn of the Space Age, D-Subminiature connectors have been used in satellites and space vehicles. However, standard D-Subs with cadmium-plated steel shells are not suitable for space. The space industry, led by the Goddard Space Flight Center (GSFC), created specifications for gold-plated brass D-Sub connectors. These specs called for 100% residual magnetism screening, because D-Subs were sometimes used on magnetically sensitive instruments. NMB (200 gamma residual magnetism) and NMC (20 gamma) became the most widely specified levels of residual magnetism. Meanwhile, M83513 Micro-D connectors and various military circular connectors were also widely used on space programs. Unlike the D-Sub connector and its special residual magnetism screening, these other connectors simply had to meet a 2  $\mu$  magnetic permeability requirement. This requirement is easily met with conventional nickel-plated aluminum alloy connectors. Glenair's HiPer-D® connector meets the 2  $\mu$  permeability rating now considered acceptable for most space instruments. However, if 100% residual magnetism screening is required, Glenair can furnish NMB-rated connectors. Please contact Glenair for ordering information.

### Special Note on HiPer-D® Material Outgassing Properties

- Standard HiPer-D® connectors contain RTV silicone DC3140. This material slightly exceeds ASTM E595 outgassing limits, even after bakeout.
- Mod Codes 186 and 429 replace standard RTV with Dow Corning 6-1125 CV space-approved RTV.

Standard HiPer-D® connectors contain RTV silicone sealants. Testing has shown that these materials can exceed outgassing limits even when specially baked or thermal vacuum outgassed. All space-grade HiPer-D® connectors are manufactured with a special Dow Corning RTV specifically recommended for space flight. Whenever a space-grade modification code appears in the part number, the special RTV replaces the standard RTV. With this exception, a space-grade HiPer-D® is identical to a standard part except for screening and/or outgassing processing. Modification codes 186 and 429 assure that the RTV meets outgassing requirements.

**Table 1: Outgassing Properties of Materials Used in Conjunction with Micro-D Connectors**

Component	Material	Brand Name	% Total Mass Loss (TML)	% Collected Volatile Condensable Material (CVCM)	Test Report
Insulators and PCB Trays	Epiall	Epiall 1908	0.37	0.01	Glenair Test
Potting Compound	Epoxy	Hysol C9-4215	0.48	0.01	Glenair Test
Interfacial Seal "as received"	Fluorosilicone	(none)	0.99	0.13	Glenair Test
Interfacial Seal with Oven Bakeout 8 hrs. 400° F.	Fluorosilicone	(none)	0.03	0.01	Glenair Test
Interfacial Seal with Thermal Vacuum Bakeout 24 hrs. 125° C.	Fluorosilicone	(none)	0.08	0.02	Glenair Test
Wire	Tefzel®	Tefzel®	0.22	0.01	NASA Test #GSC19998