

ENVIRONMENTAL AND HERMETIC SERIES 23 Space-grade Guidelines

Outgassing

Space flight equipment requires low-outgassing components in order to prevent degradation to optics and other sensitive instruments. MIL-DTL-38999 environmental 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. The space industry has adopted a standardized test procedure, ASTM E595, to evaluate outgassing properties. The MIL-DTL-38999 specification Class G also details specific TVM and CVCM values. Glenair's 186T modification code, IAW Class G, requires environmental connectors to be heated to 175° C at a vacuum of 5×10^{-6} torr for 48 hours. A similar mod code is applied for hermetic connectors to meet Class H requirements. Items under test are 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. Glenair is able to offer both NASA as well as D38999 Class G or H bakeout processes which assure all materials comply with their respective standards. Glenair is a QPL supplier of Series IV environmental Class G and Series III Class H hermetic connectors.

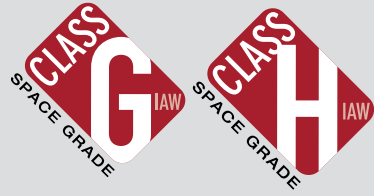
Note on Connector Material and Finish Options

Some types of metals are prohibited for space flight. "Cadmium, zinc, chemically coated cadmium, 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 passivated stainless steel, electroless nickel or gold finish on connector shells and gold finish for contacts.



- QPL supplier of Series IV Class G space-grade environmental connectors
- QPL supplier of Series III Class H space-grade hermetic connectors
- Bakeout and thermal vacuum outgas processing available for SuperNine® environmental series connectors IAW Class G space-grade requirements
- Bakeout and thermal vacuum outgas processing available for SuperNine® hermetic series connectors IAW Class H space-grade requirements

COTS EQUIVALENT MIL-DTL-38999 Series III and IV Class G (and NASA screening) Space-grade application guidelines for commercial part numbers



NASA and Class G and H Screening

The MIL-DTL-38999 specification defines TML and CVCM values for Class G and H space flight. Glenair modification code 186T assures parts are outgassed to meet the Class G and H requirements for outgassing. Additionally, 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 for space-grade components. These outgassing and screening modification codes are listed at right. To add a modification code append code to end of part number

- **“Mission critical” connectors for space flight should undergo rigorous 100% final inspection**
- **Modification codes are available to invoke special screening for both MIL-DTL-38999 and NASA applications**
- **Outgassing properties of materials used in Glenair D38999 connectors are detailed in the table below**

Screening Level and Available Outgassing Modification Codes				
Screening Level	Screening Only	48 Hour Oven Bake 175° C	Thermal Vacuum Outgassing (10 ⁻⁶ Torr)	
			24 Hour 125° C	48 Hour 175° C
NASA, Level 1 Highest Reliability	429B	429J	429C	
NASA, Level 2 High Reliability	429	429K	429A	
NASA, Level 3 Standard Reliability	Use Standard Part Number		429L	
38999, Class G or H (Group A and B inspection, no screening)				186T

Table II: NASA EEE-INST-02, Table 2A Screening Levels			
Inspection	Level 1	Level 2	Level 3
Visual	100%	100%	100%
Mechanical	2(0)	2(0)	
Dielectric Withstanding Voltage	2(0)	2(0)	
Insulation Resistance	2(0)	2(0)	
Contact Engagement & Separation Force	2(0)		
Hermeticity (Sealed Receptacles Only)	100%	100%	
Coupling Force	2(0)		

Required inspection quantity shown. Number in parenthesis indicates acceptance of failures allowed for all quantities inspected.

Outgassing Properties of Materials Used in MIL-DTL-38999 Connectors				
Component	Material	TML %	CVCM %	Test Reference
Front and Rear Insulator	Epiall 1908	0.84	0.0	NASA Test # GSC15435 (48 hours at 180°C)
Rear Grommet, Interfacial Seal, Peripheral Seal, and Special Auxiliary Seals	Blended fluorosilicone/silicone elastomer	0.04	0.0	Glenair test
Front-To-Rear Insulator Bonding Material	Eccobond 104 A/B	0.52	0.08	Emerson & Cuming Data Sheet
Insulator-to-Rubber Bonding Material	RTV, per MIL-A-46146	<1.0	<0.1	Glenair Test
White Epoxy Ink for Silk-screening	Markem 7224 White	0.49	0.03	NASA Test #GSC19899
Potting Compound	High-performance space-grade epoxy	<1.0	<0.1	Glenair Test

MIL-DTL-38999 Connector Materials Approved for Space Flight		
Component	Material	Notes
Shells, Coupling Nuts, Jam Nuts	Aluminum alloy	Approved for Space Flight
Rigid Insulators	Glass reinforced thermoset plastic, Epiall 1908	Approved for Space Flight
Contact Retention Clip	Beryllium copper, heat-treated, unplated	Approved for Space Flight
Grommet, Peripheral Seal, Interfacial Seal, Special Auxiliary Seals, O-ring	Blended fluorosilicone/silicone elastomer	Requires outgassing processing
Pin/Socket Contact	Gold plated beryllium copper alloy	Approved for Space Flight
Socket Contact Hood	Stainless steel	Approved for Space Flight
Potting Compounds and Adhesives	RTV and epoxies	Requires outgassing processing

REFERENCE INFORMATION