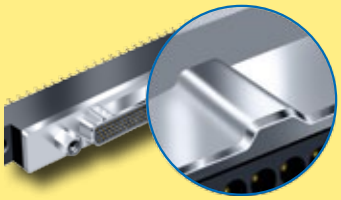
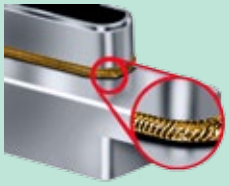
MICRO-D MOD CODE LIST

Mod 474 Keying Option
Specially modified shells feature keys and keyways for up to five keying positions. Compatible with standard hardware and backshells.



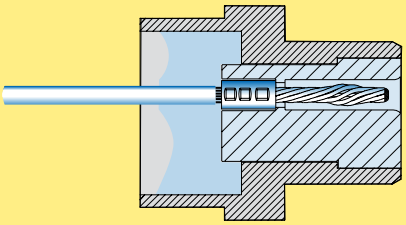
Page K-2

Mod 497 Ground Spring
Improve EMI shielding with plug connector ground springs. These gold-plated springs offer lower shell-to-shell resistance and are compatible with standard mating receptacles.



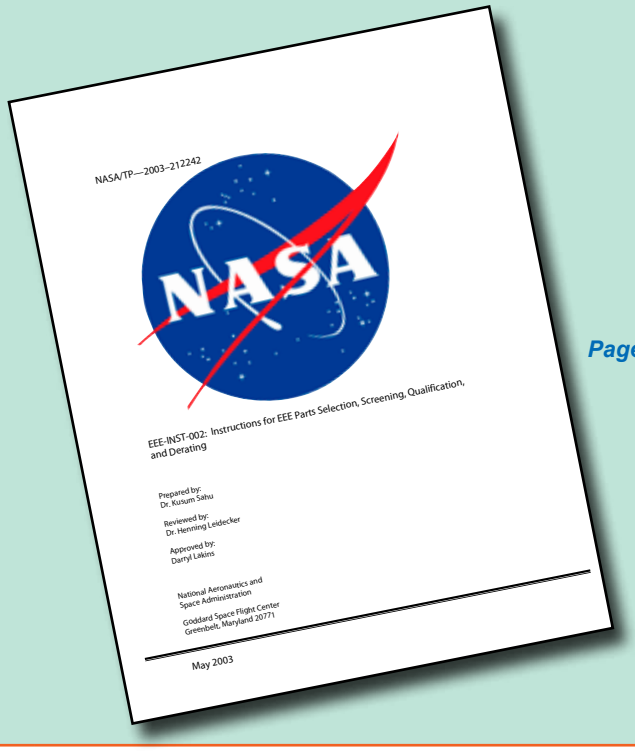
Page K-4

Mod 428 for 200° C. Continuous Temperature
Standard Micro-D connectors are rated for 150° C. maximum continuous temperature. Mod 428 changes the potting compound to provide a 200° C. rating.



Page K-5

Mod 429 Space Grade Micro-D
Save time and cost with the Mod 429 solution. Specify special NASA requirements without the expense of having to create special procurement documentation. This section also contains valuable information on Micro-D's for space applications.



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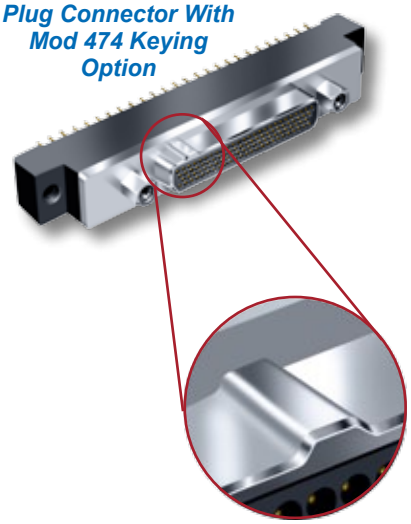
Micro-D Mod 474 Keying Options



Plug Connector With Mod 474 Keying Option

Prevent Mis-Mating with Mod 474 Keying Option

Keyed Micro-D connectors for “fail-safe” circuits feature specially modified shells to prevent mis-mating. The plug shell has a raised key, and the receptacle shell has a keyway.

The nine pin connector accommodates three key positions. All other sizes have five positions available. The letter code following Mod 474 specifies the key position. “474A” plugs mate to “474A” receptacles.

Keyed plugs will not mate to unkeyed receptacles, but keyed receptacles will plug into standard unkeyed plugs.

HOW TO ORDER MICRO-D CONNECTORS WITH MOD 474

Step 1: Find a Standard Micro-D Part Number

Mod 474 keying is available on all standard metal shell Micro-D connectors, including solder cup, pre-wired and printed circuit board versions. This feature is not available on plastic Micro-D or M83513 connectors.

Example: MWDM2L-51PCBRP-.110

Step 2: Pick a Keying Position

A letter code identifies the key position. The table on the following page shows the keying options for each shell size. Mod 474A plugs mate to 474A receptacles, and so on.

Example: 474*B*

Step 3: Add the Mod Code to the Part Number

A letter code identifies the key position. The table on the following page shows the keying options for each shell size. Mod 474A plugs mate to 474A receptacles, and so on.

Example: MWDM2L-51PCBRP-.110-474*B*

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Micro-D Mod 474 Keying Options

MICRO-D KEY POSITIONS: MODIFICATION CODE 474

Plug

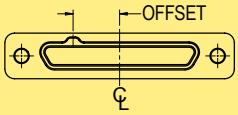

Fig. 1

Plug

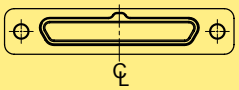

Fig. 2

Plug

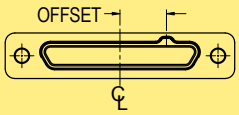

Fig. 3

Plug

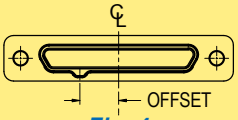

Fig. 4

Plug

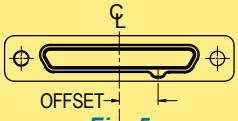

Fig. 5

Receptacle

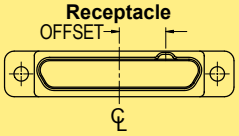

Fig. 6

Receptacle

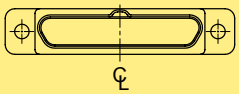

Fig. 7

Receptacle

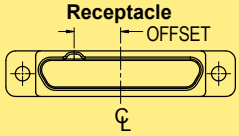

Fig. 8

Receptacle

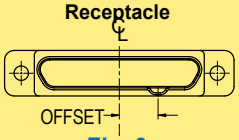

Fig. 9

Receptacle

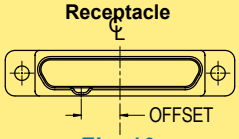

Fig. 10

Figure 1 plug connector mates to Figure 6 receptacle, figure 2 mates to figure 7, and so on. Figure 11 mates to figure 12.

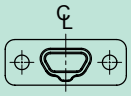

Fig. 11
Plug

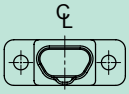

Fig. 12
Receptacle

Mating face of connector shown.

KEY POSITION OFFSETS

	Key Position A			Key Position B			Key Position C			Key Position D			Key Position E		
		Offset			Offset			Offset			Offset			Offset	
Layout	Figure	In.	mm.	Figure	In.	mm.	Figure	In.	mm.	Figure	In.	mm.	Figure	In.	mm.
9P	1	.025	0.64	3	.025	0.64	11	.000	0.00	NA	—	—	NA	—	—
9S	6	.025	0.64	8	.025	0.64	12	.000	0.00	NA	—	—	NA	—	—
15P	1	.090	2.29	2	.000	0.00	3	.090	2.29	4	.050	1.25	5	.050	1.25
15S	6	.090	2.29	7	.000	0.00	8	.090	2.29	9	.050	1.27	10	.050	1.27
21P	1	.130	3.30	2	.000	0.00	3	.130	3.30	4	.100	2.54	5	.100	2.54
21S	6	.130	3.30	7	.000	0.00	8	.130	3.30	9	.100	2.54	10	.100	2.54
25P	1	.180	4.57	2	.000	0.00	3	.180	4.57	4	.125	3.18	5	.125	3.18
25S	6	.180	4.57	7	.000	0.00	8	.180	4.57	9	.125	3.18	10	.125	3.18
31P	1	.200	5.08	2	.000	0.00	3	.200	5.08	4	.150	3.81	5	.150	3.81
31S	6	.200	5.08	7	.000	0.00	8	.200	5.08	9	.150	3.81	10	.150	3.81
37P	1	.300	7.62	2	.000	0.00	3	.300	7.62	4	.250	6.35	5	.250	6.35
37S	6	.300	7.62	7	.000	0.00	8	.300	7.62	9	.250	6.35	10	.250	6.35
51P	1	.225	5.72	2	.000	0.00	3	.225	5.72	4	.175	4.45	5	.175	4.45
51S	6	.225	5.72	7	.000	0.00	8	.225	5.72	9	.175	4.45	10	.175	4.45
100P	1	.500	12.70	1	.250	6.35	2	.000	0.00	3	.250	6.35	3	.500	12.70
100S	6	.500	12.70	6	.250	6.35	7	.000	0.00	8	.250	6.35	8	.500	12.70

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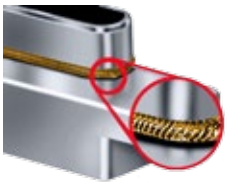
Micro-D Mod 497 EMI Ground Spring

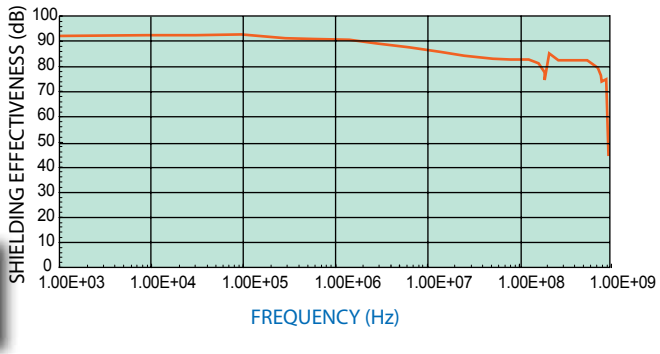
Improve EMI Performance with Mod 497 Ground Springs

Today's military and aerospace electronics systems require improved EMI protection. Micro-D connectors are widely used in EMI applications; however, the shell-to-shell resistance of a mated pair can vary, resulting in inconsistent levels of shielding effectiveness. Ground springs assure consistent shell-to-shell resistance for improved EMI protection.

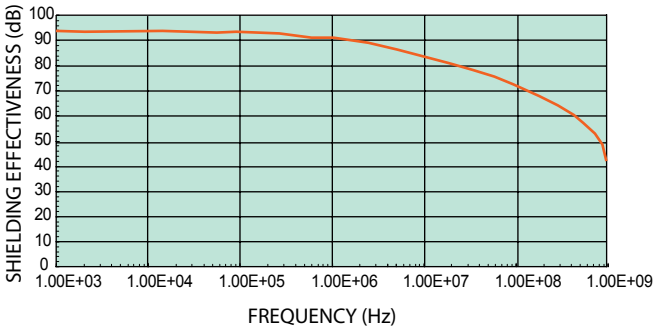
Ground Spring and EMI Shielding Effectiveness – A gold-plated stainless steel ground spring on the pin connector mating face offers substantial improvement in EMI protection. The graphs compare identical connectors tested with and without ground springs.



EMI Performance with Ground Spring



EMI Performance without Ground Spring



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HOW TO ORDER MICRO-D CONNECTORS WITH MOD 497 SPRINGS

Step 1: Find a Standard Micro-D Part Number

Ground springs are available on all standard Micro-D plug connectors with solder cups, insulated wire, or printed circuit board. Ground spring usage is limited to pin connectors with electroless-nickel plated shells.

Example: MWDM2L-100P-6K7-18B

1. Plugs only (pin connectors)
2. Nickel-plated aluminum shells only

Step 2: Add the Mod Code to the Part Number

Example: MWDM2L-100P-6K7-18B-*497*

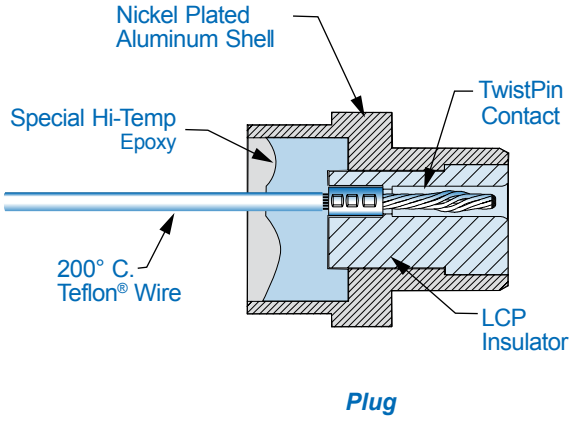
Micro-D Mod 428
for +200° C. Operating Temperature

Potting a Micro-D with Epoxy-Filled Syringe

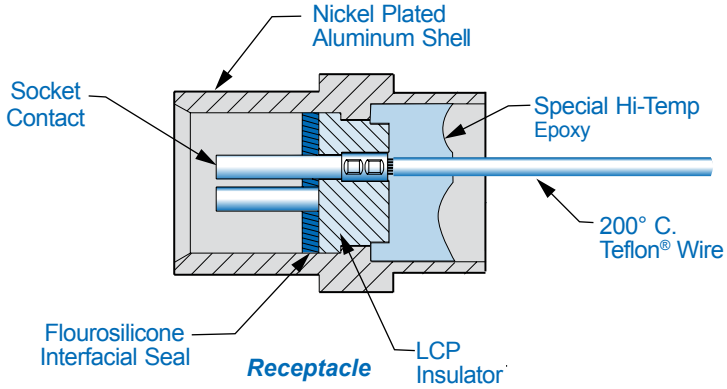
Upgrade to 400° Fahrenheit with Mod 428 High Temperature Epoxy

The search for oil and gas has led to deeper reservoirs where extreme temperatures and pressures test the limits of electronics design. Oil well logging instruments must be able to withstand temperatures beyond the limits of standard connectors.

Micro-D connectors are made from temperature-resistant materials. The Liquid Crystal Polymer (LCP) glass-filled thermoplastic insulators easily withstand 400° F. The Fluorosilicone seals, TwistPin contacts and aluminum shells also are rated for continuous exposure to 400° F. The epoxy potting compound is the only component not rated for high temperature. Mod 428 upgrades the standard epoxy with a special 600° F. epoxy.



Plug



Receptacle

HOW TO ORDER MICRO-D CONNECTORS WITH MOD 428 HI TEMP

Step 1: Find a Standard Micro-D part Number

Mod 428 is available on all standard metal shell Micro-D connectors, including solder cup, pre-wired and printed circuit board versions. Not available on plastic Micro-D or M83513 connectors.

Example: MWDM2L-37PSL

1. Metal shell only
2. Nickel-plated aluminum or stainless steel shells only.

Step 2: Add the Mod Code to the Part Number

Example: MWDM2L-37PSL-*428*

APPLICATION NOTES

1. Shell Material & Finish:	Electroless nickel plated aluminum is commonly used for high temperature connectors. Cadmium plated aluminum is not recommended for temperatures exceeding 175° C. because of discoloration and breakdown of the chromate seal applied to the cadmium. Stainless steel shells provide the best resistance to temperature and corrosive environments, but at the expense of weight and cost.
2. Potting Conmpound:	600° F. Rated Epoxy

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Micro-D Mod 429 Space Grade

Detail of the Atmospheric Infrared Sounder Instrument (AIRS) with Glenair Micro-D Cables and Connectors

Photo courtesy JPL

Six things you should know about Micro-D connectors for space flight

1 **Outgassing**: What is outgassing, why is it important, and how does it affect connector selection? Is special processing required to meet outgassing requirements?

2 **Screening**: What is NASA screening and what level of screening is required?

3 **Magnetic permeability**: Are nonmagnetic connectors required?

4 **Cryogenic exposure**: Are Micro-D connectors suitable for -200° C. exposure?

5 **Materials**: Micro-D connectors offer a variety of materials and plating finishes. Which ones are recommended for space flight?

6 **Wire Corrosion**: M22759/33 irradiated Tefzel® wire is preferred for space applications. What about corrosion problems caused by this wire?

K

Save Time and Cost with Mod 429 Space Grade Micro-D's

Micro-D TwistPin connectors are a good choice for all types of orbital and deep space projects. Glenair's Mod 429 upgrades Micro-D's to NASA requirements without the need for a customer Statement of Work or Specification Control Drawing. This section explains Glenair Mod 429 ordering, and provides valuable information on outgassing and other space flight topics.

HOW TO ORDER SPACE GRADE MICRO-D'S

Step 1: Find a Standard Micro-D Part Number

Electroless nickel plated shells and Tefzel® wire are preferred for space flight. Cadmium plating is prohibited.

Step 2: Select a NASA Screening Level

The term "Screening Level" refers to the final inspection procedure.
Level 1 for mission-critical highest reliability
Level 2 for high reliability
Level 3 for standard reliability

Step 3: Outgassing Processing

A detailed explanation of outgassing is on the following pages. The interfacial seal on Micro-D receptacles does not meet NASA outgassing requirements unless it is baked or thermal vacuum outgassed. Some customers specify deleting the seal, some opt for a bakeout, and some customers specify thermal vacuum outgassing. Both the bakeout and thermal vacuum outgassing are extra cost.

Step 4: Select the Mod 429 Code that Matches the Desired Level of Screening and Outgassing

Use the following table to choose the right modification code. Add the mod code to the connector part number. Example: MWDM2L-37P-6J5-18L-***429C***

NASA Screening Level	Special Screening Only		Special Screening Plus Outgassing Processing	
	Interfacial Seal is Installed	Interfacial Seal is Deleted	8 Hour Oven Bake 400° F.	Thermal Vacuum Outgassing 24 hrs. 125° C.
Level 1 Highest Reliability	Mod 429B	Mod 429F	Mod 429J	Mod 429C
Level 2 High Reliability	Mod 429	Mod 429D	Mod 429K	Mod 429A
Level 3 Standard Reliability	(Use standard part number)	Mod 432	Mod 186	Mod 186M

Micro-D Mod 429 Space Grade

1 Outgassing: What is outgassing and how does it affect connector selection? Is special processing required to meet outgassing requirements?

What is outgassing?

Plastic and rubber materials give off gaseous molecules. For example, the smell inside a new car is caused by polymer outgassing. Heat and vacuum increase the rate of diffusion. In a spacecraft the gases coming off polymers can contaminate optical surfaces and instruments. The result is degraded performance.

How is outgassing measured?

The space industry has adopted a standardized test procedure, ***ASTM E 595***, to evaluate out-gassing properties of polymers. Small samples of material are heated to 125° C. at a vacuum of 5 X 10^{-5} torr for 24 hours. Then the sample is weighed to calculate the ***Total Mass Loss*** (TML). The TML cannot exceed 1.00% of the total initial mass. During the test, outgassed matter condenses on a cooled collector plate. The quantity of outgassed matter is caluclated to determine the ***Collected Volatile Condensable Material*** (CVCM). The CVCM cannot exceed 0.10% of the original specimen mass.

MIL-DTL-83513 specifies that Micro-D connectors must meet outgassing requirements, but the interfacial seal exceeds the limit. How can this be?

The mil spec allows the TML and CVCM to be calculated based on the total mass of the nonmetallic components. The interfacial seal can exceed outgassing limits as long as the insulator and potting compound are well below maximum outgassing limits.

Is special outgassing necessary?

It depends on the customer. Some programs specify that all connectors be oven baked or thermal vacuum outgassed. For example, NASA GSFC programs typically require that the interfacial seals are deleted,along with level I screening and thermal vacuum outgassing processing.

Why pay extra for bakeout or thermal vacuum outgassing?

If the interfacial seal is not removed, NASA recommends a bakeout process. Table 1 demonstrates that a simple oven bake is sufficient to reduce volatile matter. The choice is up to the customer. Whatever level of processing, the Glenair mod 429 codes make ordering easy.

Outgassing At-a-Glance

1. Fluorosilicone Interfacial Seals exceed NASA outgassing limits.
2. NASA recommends removing the seal or performing a bakeout.
3. An inexpensive oven bakeout has better results than the more costly thermal vacuum outgassing.
4. Glenair Mod 429 codes provide an easy ordering solution, whatever the outgassing option.

TABLE 1: OUTGASSING PROPERTIES OF MICRO-D CONNECTORS

Component	Material	Brand Name	% Total Mass Loss (TML)	% Collected Volatile Condensable Material (CVCM)	Test Report
Thermoplastic Insulators and PCB Trays	Liquid Crystal Polymer	Vectra® C-130	0.03	0.00	NASA Test #GSC17478
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 Bakeout24 hrs. 125° C.	Fluorosilicone	(none)	0.08	0.02	Glenair Test
Wire	Tefzel®	Tefzel®	0.22	0.01	NASA Test #GSC19998

Micro-D Mod 429 Space Grade

2 Screening: What is NASA screening and what level of screening is required?

What is NASA screening?

NASA specification EEE-INST-002 provides instructions on selecting, screening and qualifying parts for use on NASA GSFC space flight projects. Table 2C in the NASA spec contains specific inspection instructions for MIL-DTL-83513 connectors. These screening requirements exceed the standard mil spec inspection levels.

What screening level is required?

NASA defines three levels of screening: level 1 for highest reliability, level 2 for high reliability, and level 3 for standard reliability. Level 3 equates to standard M83513 Group A and B lot acceptance testing, and levels 1 and 2 call for additional testing.

Why does Glenair perform extra screening tests?

Glenair has test procedures that go beyond the letter of the NASA spec. Meeting NASA requirements means not only inspecting per EEE-INST-002, but also building parts in accordance with NASA Technical Standard NASA-STD-8739.4 “Crimping, Interconnecting Cables, Harnesses, and Wiring”. Glenair fully meets these requirements and has obtained NASA certification. Our extra inspection steps reflect the fact that pre-wired connectors not only require best practices on the assembly floor, but also require thorough final electrical and mechanical testing.

What about qualification requirements?

Qualification is not required if the manufacturer has performed qualification testing per MIL-DTL-83513. Qualification by similarity is usually invoked for those Micro-D’s not specifically covered by the mil spec.

Figure 1: Excerpt from NASA EEE-INST-002

Due to the dynamic nature of this document, users are advised to check the http://nepp.nasa.gov website prior to every usage to obtain the latest document revision.

1.0 PURPOSE

The purpose of this document is to establish baseline criteria for selection, screening, qualification, and derating of EEE parts for use on NASA GSFC space flight projects. This document shall provide a mechanism to assure that appropriate parts are used in the fabrication of space hardware that will meet mission reliability objectives within budget constraints.

2.0 SCOPE

This document provides instructions for meeting three reliability levels of EEE parts requirements (see 6.0) based on mission needs. The terms “grade” and “level” are considered synonymous; i.e., a grade 1 part is consistent with reliability level 1. Levels of part reliability confidence decrease by reliability level, with level 1 being the highest reliability and level 3 the lowest. A reliability level 1 part has the highest level of manufacturing control and testing per military or DSCC specifications. Level 2 parts have reduced manufacturing control and testing. Level 3 Parts have no guaranteed reliability controls in the manufacturing process and no standardized testing requirements. The reliability of level 3 parts can vary significantly with each manufacturer, part type and LDC due to unreported and frequent changes in design, construction and materials.

GSFC projects and contractors shall incorporate this guideline into their Project EEE Parts Program.

3.0 DEFINITIONS

Screening. Screening tests are intended to remove nonconforming parts (parts with random defects that are likely to result in early failures, known as infant mortality) from an otherwise acceptable lot and thus increase confidence in the reliability of the parts selected for use.

TABLE 2: NASA SCREENING REQUIREMENTS

Inspection/ Test	NASA Level 1	NASA Level 2	Glenair Level 1 (Mod 429B)	Glenair Level 2 (Mod 429)
Visual Inspection	100%	100%	100% (10X)	100%
Mechanical	2 pcs.	2 pcs.	100%	2 pcs.
Voltage (DWV)	100%	2 pcs.	100%	100%
Insulation Resistance	2 pcs.	2 pcs.	100%	100%
Low Level Contact Resistance	2 pcs.	2 pcs.	100% (Read and Record)	2 pcs. (Read and Record)
Contact Separation Force (pins only)	N/A	N/A	100%	N/A
Mating Force	2 pcs.	N/A	2 pcs.	N/A
Contact/Wire Retention	N/A	N/A	2 pcs.	N/A
Solderability/Resistance to Soldering Heat	2 pcs.	N/A	2 pcs.	N/A

Notes:

1. NASA screening requirements from Table 2C of EEE-INST-002.

3 Magnetic permeability: Are nonmagnetic connectors required?

Spacecraft designers generally avoid the use of ferromagnetic materials, which can become magnetized and can interfere with sensitive instruments. Micro-D connectors do not contain ferromagnetic materials, so magnetic permeability is not a concern. MIL-DTL-83513 requires a maximum permeability of 2 mu. Glenair hermetic Micro-D connectors are made from Kovar® alloy, a highly magnetic material. The stainless steel e-rings commonly used for Micro-D jackscrew attachment also exceed the 2 mu requirement.

4 Cryogenic exposure: Are Micro-D connectors suitable for -200° C. ?

Micro-D connectors are rated to -55° C. Glenair has not performed testing below this temperature. EEE-INST-002 states "...experience has proven it is possible for (non-certified) connector types to be used successfully at cryogenic temperatures. It is recommended that connector samples should be subjected to five cycles of cryogenic temperature...(followed by examination for cracks and DWV)".

5 Materials: Micro-D connectors offer a variety of materials and plating finishes. Which ones are recommended for space flight?

NASA recommends electroless nickel plated connector shells and crosslinked high strength ETFE (Tefzel®) wire. Cadmium plating is prohibited because it sublimates in a vacuum environment. Gold plating is acceptable but rarely used on Micro-D connector shells.

6 Wire Corrosion: M22759/33 irradiated Tefzel® wire is preferred for space applications. What about corrosion problems caused by this wire?

Does M22759/33 wire have an outgassing problem?

Irradiated Tefzel® wire is known to cause tarnishing and corrosion of metal parts in close proximity, usually in sealed bags. Both MIL-DTL-83513 and NASA EEE-INST-002 contain cautionary notes regarding this problem. Wire manufacturers have not been able to eliminate this problem, which might be caused by the insulation extrusion process. This corrosion problem is referred to as "wire outgassing", which has led to confusion over the term outgassing. This problem has nothing to do with the ability of the wire to meet the TML and CVCM outgassing requirements of ASTM E595. M22759/33 irradiated Tefzel wire continues to be the wire of choice for spacecraft. This wire complies with outgassing requirements.

The corrosion problem

Micro-D connectors supplied as pre-wired assemblies should not be stored in sealed bags for extended periods. NASA recommends that parts be inspected for shell discoloration ("a dull "gun metal" appearance) and contact corrosion ("a flat black appearance"). Connectors with corroded contacts should be scrapped.

New Unit Pack Minimizes Corrosion

Glenair has adopted a new packaging standard to protect the connector from tarnishing or corrosion. Figure 2 shows Glenair's standard packaging for metal shell connectors supplied with M22759/33 wire. The connector is wrapped in Teflon® tape and placed in a ventilated sulpher-free paper envelope.

Figure 2
Teflon-wrapped Connector and Perforated Bag

"Users are advised that some ETFE insulations are known to outgas trace amounts of corrosive fluorine over time. When this wire is used with nickel coated metal shell connectors and stored in sealed plastic or ESD bags, trapped fluorine can attack exposed metal shells and contacts."

Excerpt from Note 9, Table 2,
NASA EEE-INST-002

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Not All QPL'd Micro-D's Are Created Equally

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