

# Thermal Straps

Thermal straps, also referred to as flexible thermal links or heat straps, are thermally conductive and mechanically flexible elements, used to isolate sensitive equipment from mechanical loads (static and dynamic) while providing thermal conductance.



PGS thermal straps (encapsulated)



Thermal Straps (custom-fit endings)

Azimut Space offers custom, high-performance and versatile flexible thermal straps. They are fabricated using conventional metals, composites, ceramics, and flexible thermal control materials, depending on the user's needs, applications and budgets.

### Key features and benefits

- Wide thermal ranges, from low cryogenic (<40K) to high temperatures (>400°C)
- Compatible with clean conditions, even for optical instruments (different solutions available depending on the customer's needs)
- From small (15mm wide, 45mm long) to very large (150mm wide, 900mm long)
- Strengthened against vibration loads
- Tailored configuration for all applications: materials, shape, size, performance
- Qualified for Space, with in-house verification and qualification
- Various materials available for the endings (for CTE matching, mass optimization...)

## Specifications

		Graphite/Aluminium	Copper
Temperature Ranges		-233°C < T < 200°C	-253°C < T < 600°C
Bridgeable Length (flexible)		Up to 900mm	Up to 500 mm
Conductance* for each 10mm width**		0.1 W/K < G < 0.2 W/K	0.05<W/K < G < 0.15 W/K
Mass for a 1 W/K* strap (200mm)		<250g	~1.5kg
Maximum Size	Length	1200mm	600mm
	Width	150mm	150mm
	Thickness	8mm°/18mm°°	15mm
Minimum	Length	100mm	80mm
	Width	20mm	15mm
	Thickness	1mm°/6mm°	0.5mm
Flexibility		>1N/mm <sup>+</sup>	>10N/mm
Mounting Bolts		Minimum 4xM3, optimal 4-6xM4	
*All conductances without external interfaces ** a 50mm wide strap can reach ~1 W/K (Graphite)			
°Flexible element °°Endings			
+ depending on displacement			

## Materials

<b>Flexible Element</b>	Aluminium, Copper, PGS, Graphene
<b>Endings</b>	Aluminium, Copper, Ceramic, Composites (SiC, CFRP)
<b>Wrapping</b>	Mylar, Kapton (natural, VDA, ITO), special fabrics
<b>Surface Treatments</b>	Alodine, SurTec, Galvanic Plating (Au, Ag)



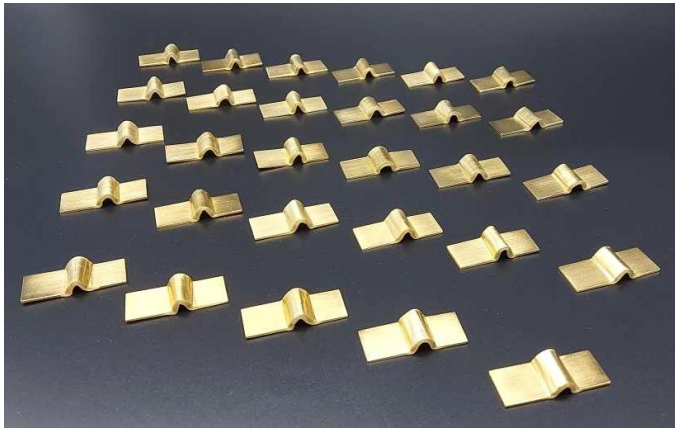
Unwrapped Copper thermal strap



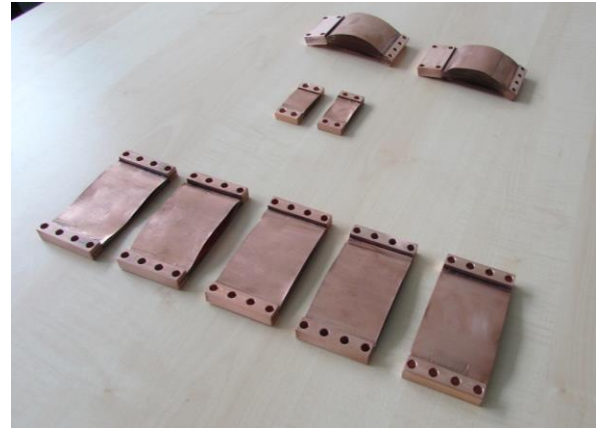
Wrapped and packed thermal straps

## Configurations/Examples

The thermal straps can have different sizes and shapes (Flat shape, 3-way shape, S-shape, C-shape...), and the mounting can be made using screws, bolts, by clamping or by gluing.



Gold-plated Thermal Straps



Copper Thermal Straps



Large Thermal Strap



3-way Thermal Strap

## Customization options

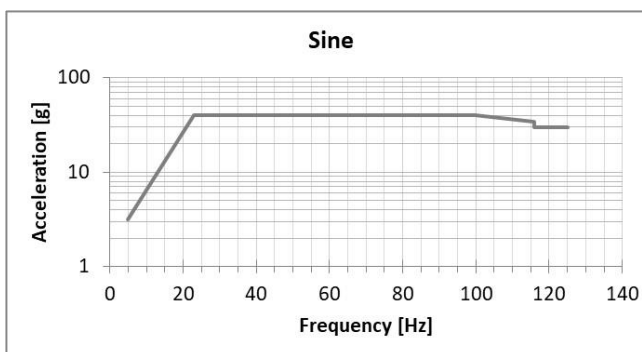
Several strap parameters can be customized, depending on customer requirements:

- Size, shape and material of the flexible element (stack)
- Material of the interfaces: Copper, Aluminium, Ceramic
- Number of interfaces: 2 (point-to-point), 3 (3-way), 4 or more (Spider or "H" configuration)
- Shape of interfaces: "flat", "T", "L shaped", custom shapes
- Surface treatments and paints for the interfaces
- Qualification Testing (from no qualification to full ECSS compatibility)
- Cleanliness level (grey, ISO8, ISO7 and even ISO5 compatibility)
- Quality level (from "Newspace" level to "NASA/ESA" level)

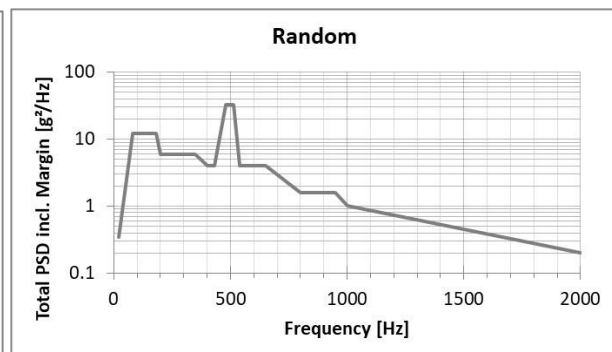


## Testing and Qualification

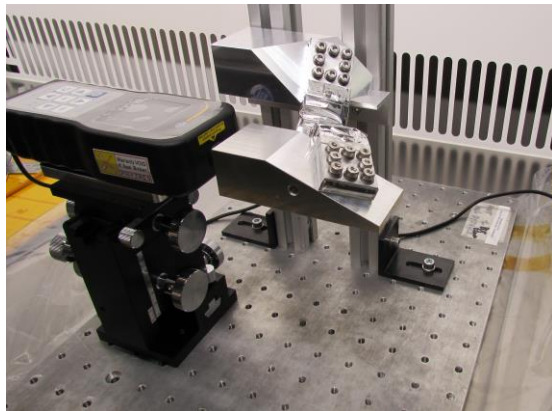
<b>Thermal Vacuum Tests</b>	$p \leq 1 \times 10^{-5} \text{ mbar}$ , $-230^{\circ}\text{C} \leq T \leq +150^{\circ}\text{C}$
<b>Life cycling (up to 5000 cycles)</b>	$p = 1 \text{ bar (N}_2\text{)}$ , $-130^{\circ}\text{C} \leq T \leq +130^{\circ}\text{C}$
<b>Stiffness</b>	In different shapes, 3 axes, static
<b>Vibration</b>	Sine. Random, both relative and global
<b>Shock</b>	(straps are not shock sensitive)
<b>Electrical and Grounding</b>	From $\text{m}\Omega$ to $\text{M}\Omega$



Envelope of already performed Sine Levels



Envelope of already performed Random Levels



Stiffness test (in-house)



MTVAC Thermal conductance test (in-house)

## Company Background

Azimut Space GmbH is a Space Thermal specialist with 15+ years of experience in thermo-mechanical engineering, offering a full spectrum of thermal services and products for small and large satellites and launchers.

### CUSTOMERS AND PARTNERS

ESA, DLR, Thales Alenia Space, AIRBUS D&S, OHB, TNO, Redwire, Nanoavionics, Fraunhofer, Sonaca

### DESIGN SOFTWARE

Solidedge, Solidworks, Nastran, Hyperworks, ESATAN, Thermica

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