GETELEC

We protect your electronics

OUR SOLUTIONS FOR SPATIAL INDUSTRIES

www.getelec.com

ABOUT US

For more than 50 years, Getelec has been designing and manufacturing bespoke technical sealing solutions, EMC shielding, microwave absorbers and thermal interface material, Getelec products are particularly suitable for the protection of high-tech equipment, subject to severe environmental constraints.

Getelec has become a world specialist in elastomer formulations and,
a key partner of major customers in many industrial sectors.

OUR KNOW-HOW

Our materials are developed by our chemical engineers. From the selection of raw materials to final processing, we make specific formulations for each application and master all the processes of development.

This mastery allows us to offer you a bespoke solution adapted to your needs and respecting your specifications.

OUR MARKETS

- Aeronautical
- Automotive
- Defense
- Energy
- Industrial electronics
- Medical
- Railways
- Space industry
- Telecommunication

OUR DEPARTEMENTS

- Laboratory
- Innovation - R&D
- Industrialization
- Production

OUR SPACE INDUSTRY :

The spatial industry represent for us a major part of our investissment. In consequence, all the formulation and processing are under control. In fact, our in-house control of elastomer formulations enables us to provide our customer with bespoke solutions, maintenaining great responsiveness to customer requirements. Thanks to our team of chemical engineers and extensive range of machinery we are very flexible, able to find the dight choice of materials and process to meet your technical requirement. Our technical team also determines and designs tools adapted to your projects. This in-house expertise allows us to offer your a turnkey solution and support you througouht the duration of your projet.

More than **130 000** products in orbit

30 material qualified aerospace

Details spatial product qualifications

Standard - ISO 11359-2 :

- Thermomechanical analyzer to determine dimensional variations of a test specimen when it is subjected to a temperature program.
- Specimens measuring 6x6x6 mm
- Direction of measurement perpendicular to the flat gray faces of the specimens
- Neutral gas sweep
- Number of test pieces tested: 3

The test pieces undergo the following temperature cycle twice:
- Cooling to - 80 ° C at a speed of 5 ° C / min
- Stabilization at - 80 ° C for 5 min
- Temperature rise from - 80 to 128 ° C at 5 ° C / min
- Bearing at 128 ° C for 5 min

The expansion coefficients are measured on the second cycle of temperature rise

Standard ESA-ECSS-Q-ST-70-02C (replace ESA PSS 01-702) :

Maximum admissible values for spatial use:
• TML (Total Mass Loss): loss of mass during vacuum degassing. <1%
• RML (Recovered mass Loss): loss of mass after returning to atmospheric pressure. <1%
• CVCM (Collected Volatile Condensable material): condensates. <0.1%

OUR PARTNERS :

ArianeGroup · ThalesAlenia Space · cnes · TRYO Aerospace

INTRODUCTION

Combining more than 50 years of experience in EMC shielding, heat dissipation and environmental sealing solutions, GETELEC teams see and deliver innovative solutions for orbital infrastructures.

The space sector is a high-tech industry with many constraints to the end product and its evolution in a hostile universe. Today, the miniaturization of equipment and the environment is made of EMC, heat dissipation and microwave absorption of high precision.

GETELEC, you propose unique solutions, adapted to your needs in terms of product range designed to comply with the requirements of the ESA standard.

SATELLITES & EMBEDDED SYSTEMS

Embedded electronic subassemblies operate in harsh environments where electronics are subject to significant problems. To overcome these constraints, GETELEC has developed specific products to address degassing rate issues and the requirements of the ESA standard.

ROBOTS

Robots are an integral part of the conquest of space. More and more autonomous, these robots are confronted with important CEM constraints and a microwave shielding of electronic systems is essential for the proper functioning of the equipment. These constraints are as many design challenges as GETELEC raises through its range dedicated to the world of space.

RADAR ANTENNAS

GETELEC is also involved in ground-based systems for communicating and processing data from orbital infrastructures.

Subject to multiple constraints such as the environment and electromagnetic compatibility, GETELEC's technical teams support you in choosing your solutions from a wide range of products and ensure you a tailor-made realization for your equipment.

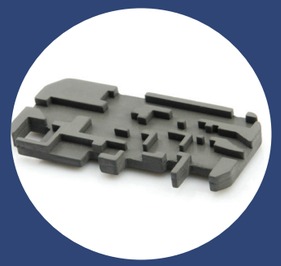
RANGE OF PRODUCTS

EMI CONDUCTIVE SILICONE GASKETS (SPACE GRADE)

GETELEC develops its own conductive mixtures meeting the requirements of MIL G 83528, MIL STD 285, GAM EG-13 and ESA with mixtures specifically developed to comply with the requirements of low degassing rate. Our EMC experts are at your disposal to assist you in the definition of your projects. All of these seals are available as molded, cut flat, extruded, and overmolded seals.

Volume Resistivity of 0.0016 Ω.cm to 2.7 Ω.cm

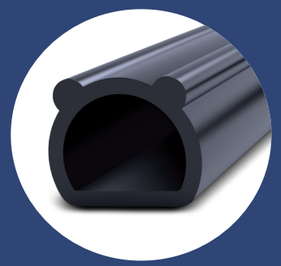
Shielding effectiveness between 80dB to 140dB (20MHz - 10GHz)



MICROWAVE ABSORBERS (SPACE GRADE)

Microwave absorbers consists of flexible silicone materials filled of magnetic particles. These materials ensure an excellent attenuation performance over given frequency bands, which can reach an attenuation greater than 20 dB of the incident wave.
Our laboratory has developed several formulations composed of epoxy type rigid microwave absorbers, silicone-based flexible microwave absorbers and foams of different thicknesses.

Range of natural frequencies of absorptions between 1 GHz and 40 GHz.



ENVIRONMENTAL SEALING SILICONE

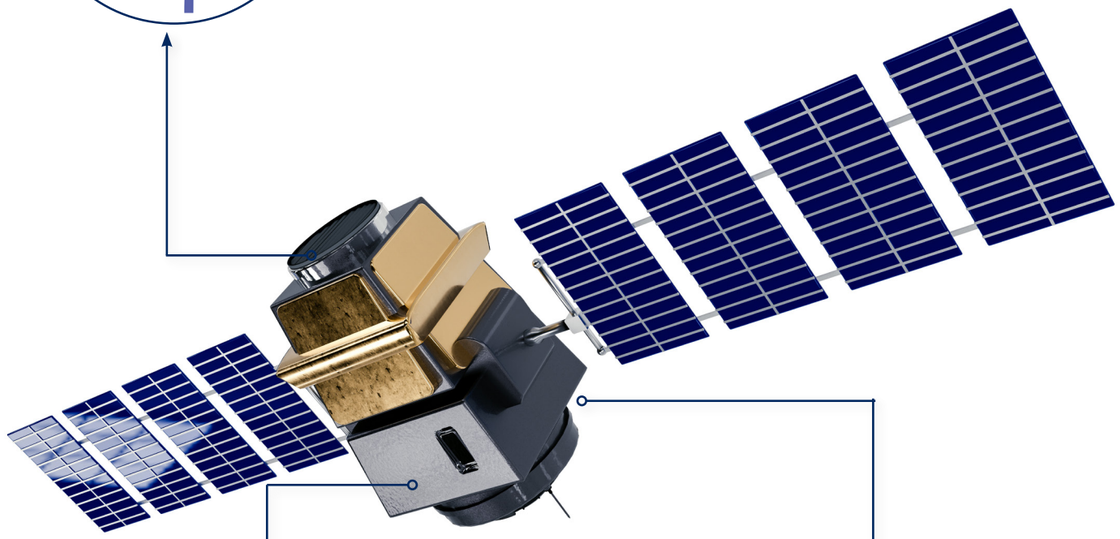
GETELEC formulates its own silicone mixtures and masters the transformation, allowing it to offer a tailor-made solution to its customers.

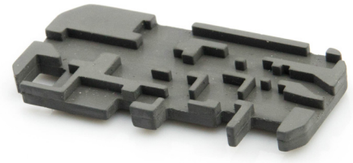
The use of specific silicone grade allows us to offer a complete range of silicone and **fluorosilicone low degassing available at hardness between 20 and 90 Shore A.**

APPLICATION FOR THE SPATIAL INDUSTRY

Electronic module

EMI shielding gasket for electronic module
Conductive silicone : Attenuation up to 140 dB

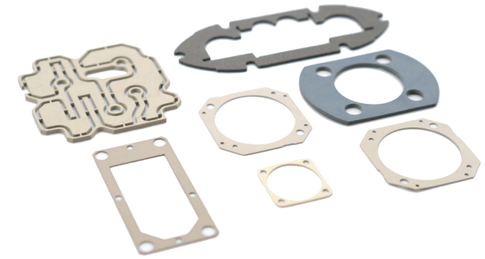




Microwave absorbers on embedded calculator
Silicone absorber

Environmental sealing gasket with low degassing rate
Fluorosilicone

EMI CONDUCTIVE SILICONE GASKETS



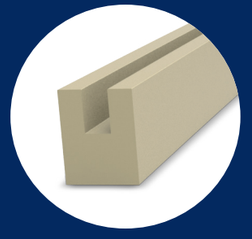
Our conductive materials are developed in every respect by our chemical engineers. From the selection of raw materials to the final transformation, they make specific formulations for each application and master all the processes of development.

This mastery allows us to define the material according to your equipment, in order to offer you a bespoke solution adapted to your needs.

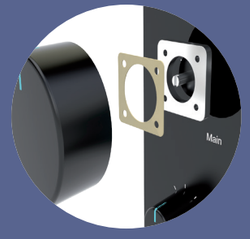
Properties	Standards	GT 1000	GT 2020
Type MIL G 83528		K	-
Elastomer		Silicone	Silicone
Conductive filler		Silver-plated copper	Pure silver
Volume resistivity Ω.cm	MIL G 83528	< 0.005	< 0.006
Hardness shore A	ASTM D 2240	82	75
Density g/cm^3	ASTM D 792 Method A	3.40	3.90
Break resistance (Mpa)	ASTM D 412 Method A C	2.80	4.61
ELongation at break (%)	ASTM D 412 Method A C	250	355
Tear strength (N/mm)	ASTM D 624 Method C	13.44	13.73
Residual deformation after 70 hours at 100°C (%)	ASTM D 395 Method B	17.50	33.12
Working temperature (°C)		-55 °C to +125°C	- 55°C to +160°C
Shielding performance 20 MHz 100 MHz 500 MHz 2 GHz 10 GHz		 130 dB 140 dB 120 dB 120 dB 120 dB	 110 dB 110 dB 110 dB 110 dB 110 dB
Color		Grey	Light Beige
Certified ESA-ECS-Q-ST-Q-70-02C TML RML (<1%) CVCM (<0.1%)		Yes	

All these products may be available in fluorinated version on demand.

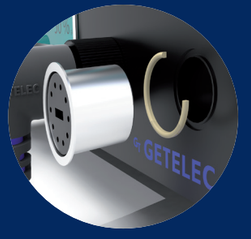
AVAILABLE FORMATS :



Extruded



Cut

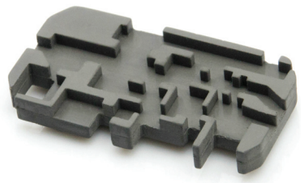


Molded

MICROWAVE ABSORBERS

Flexible silicone microwave absorbers

GT602 range have narrowband performance but also high-power density performance (>1W / cm2) for positioning on antennas or high-power equipment. Thanks to its low de-gassing properties, our GT602 range is suitable for space applications. These absorbers are frequently used with adhesives for simplified implementation. Homogeneity is ensured by a complex mixture developed internally by GETELEC.



Our entire product range is available in sheet form or custom cut pieces.

Attenuation guide

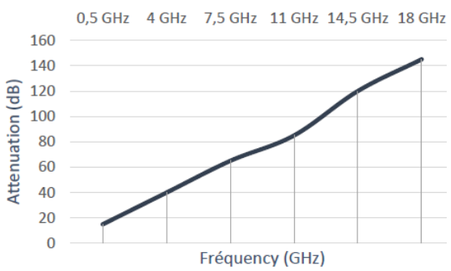
Attenuation	Percentage absorbed
- 5 dB	68.38 %
-10 dB	90.00 %
-15 dB	96.84 %
-20 dB	99.00 %
-40 dB	99.99 %

GETELEC material reference	Thickness (mm)	Resonance frequency	Attenuation	Certified ESA-ECSS-Q-ST-Q-70-02C TML RML (<1%) CVCM (<0.1%)
GT 602 R90	4.5	1 GHz	25 dB	-
GT 602 R90	3.2	2 GHz	25 dB	-
GT 602 R90	2.4	3 GHz	25 dB	-
GT 602 R90	2.2	4 GHz	29 dB	-
GT 602 R88	2	5 GHz	28 dB	-
GT 602 R85	2	6 GHz	28 dB	Yes
GT 602 R85	1.8	7 GHz	27 dB	Yes
GT 602 R85	1.6	8 GHz	21 dB	Yes
GT 602 R85	1.5	9 GHz	27 DB	Yes
GT 602 R85	1.3	10 GHz	27 dB	Yes
GT 602 R74	1.7	11 GHz	25 dB	-
GT 602 R71	1.6	12 GHz	30 dB	-
GT 602 R71	1.5	13 GHz	23 dB	-
GT 602 R71	1.45	14 GHz	23 dB	-
GT 602 R71	1.4	15 GHz	23 dB	-
GT 602 R71	1.3	16 GHz	25 dB	-
GT 602 R65	1.2	17 GHz	25 dB	Yes
GT 602 R65	1.15	18 GHz	25 dB	Yes
GT 602 R64	1.1	24 GHz	25 dB	-
GT 602 R63	0.95	28 GHz	25 DB	-
GT 602 R62	1.1	35 GHz	29 dB	-

Sheets or finished parts are available, on request, in versions with or without adhesive

Rigid microwave absorbers - Epoxy

Properties	Standards	GT 502
Material		Epoxy
Hardness shore D	ASTM D 2240	95
Density g/cm^3	ASTM D 792 Method A	4.57
Tensile strength Mpa	NF EN ISO 527-1	56
Elongation at break %	NF EN ISO 527-1	2.4
Working temperature °C		-180 °C to + 200°C
ESA standard compliance	ASTM E 395	Yes



ENVIRONMENTAL SEALING SILICONE

Using specific silicone grades, forming the basis of our formulations, has allowed us to develop two main product families: Fluorinated silicones and non-fluorinated silicones, within our complete range of environmental sealing silicones.

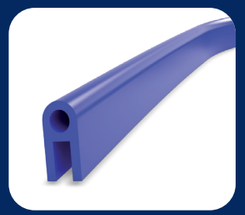
The family of fluorinated silicones: FVMQ type (ASTM D1418), these elastomers offer excellent resistance to solvents, fuels, organic oils and silicone oils, while maintaining their mechanical properties over a wide range of temperatures (-60°C to + 230°C).

The family of non-fluorinated silicones: Of the VMQ type (ASTM D 1418), these elastomers allow the production of molded parts, extruded joints, flat seals cut or adhesively vulcanized. They retain their mechanical properties over a wide range of temperatures (-73°C to + 232°C).

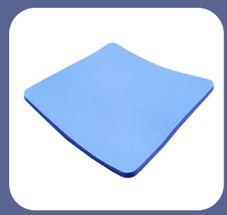
Properties	Standards	GT 40 ED	GT 50 ED	GT 60 ED
Elastomer		Silicone	Silicone	Silicone
Hardness Shore A	ASTM D 2240	40	50	60
Density g/cm^3	ASTM D 792 Method A	1.12	1.21	1.38
Break resistance (MPa)	ASTM D 412 Method AC	8.14	8.78	6.40
Elongation at break (%)	ASTM D 412 Method AC	753	729	461
Tensile strength (N/mm)	ASTM D 624 Method C	38.60	37.07	32.20
Working temperature (°C)		-73°C to +232 °C		
Color		Orange *	White *	White *
ESA standard compliance	ASTM D E 395	Yes		

*Customizable color on request

AVAILABLE FORMATS :



Extruded



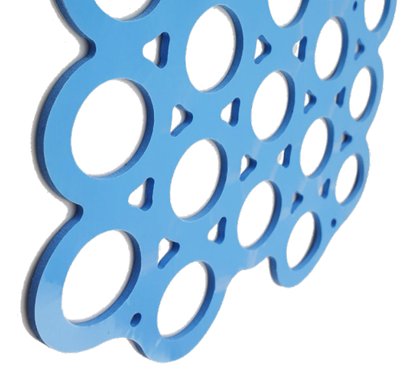
Cut

Molded

THERMAL GAP FILLER PAD

The GTG range includes highly conductive thermal pad ideal for applications requiring high thermal conductivity. Its specific formulations developed by our laboratory, as well as its loads, give these silicone elastomers and exceptional thermal conductivity.

Thanks to their great flexibility and ease of installation, they follow the surface ireegularities between the power component and the cooler as soon as they are assembled which helps to dissipate heat and protect your equipment.



Thermal conductivity	Reference	Color	Hardness Shore 00	Thickness mm	Flame retardant	RoHs	Working temperature (°C)	Density g/cm3	Elongation %	Thermal conductivity W/m.k	Dielectric strength kV/mm	Breakdown voltage kV/mm	Volume resistivity Ohm.m	Dielectric constant @1Mhz	Dissipation factor @1MHz
Standards			ASTM D2240		UL 94			ASTM D792	ASTM D412	ASTM D 7984 Modified transient plane source(MTPS)	ASTM D149	ASTM D149	ASTM D257	ASTM D150	ASTM D150
1 W/m.K	GTG 1-40	Grey	40 ± 2	0.5 to 20 mm	V0	Yes	-60°C to +200°C	2.6	< 200	1 ± 0.1	11	17	10^{13}	4	0.006
	GTG 1.3-45		45 ± 2							1.3 ± 0.1	5	18			
	GTG 1-60		60 ± 2						200	1 ± 0.1	11	17			
	GTG 1-75		75 ± 2												
	GTG 1-85		85 ± 2												
2 W/m.K	GTG 2-40	Blue	40 ± 2	0.5 to 20 mm	V0	Yes	-45 °C to +200°C	2.7	< 100	2 ± 0.1	14	17	10^{12}	4.2	0.005
	GTG 2.5-50		50 ± 2					2.75		2.5 ± 0.1	18	16			
	GTG 2-60		60 ± 2						100	2 ± 0.1	14	17			
	GTG 2-75		75 ± 2					2.7							
	GTG 2-85		85 ± 2												
3 W/m.K	GTG 3-35	Light Blue	35 ± 2	0.5 to 20 mm	V0	Yes	-40°C to + 200 °C	2.9	< 100	3 ± 0.1	11	15	10^{11}	5.5	0.005
	GTG 3-40		40 ± 2												
	GTG 3.5-50		50 ± 2					2.95		3.5 ± 0.1					
	GTG 3-60		60 ± 2												
	GTG 3-75		75 ± 2					2.9	100	3 ± 0.1					
	GTG 3-85		85 ± 2												
4 W/m.K	GTG 4-40	Green	40 ± 2	0.8 to 20 mm	V0	Yes	-40°C to + 200 °C	3.09	< 100	4 ± 0.1	16	18	10^{11}	7	0.008
	GTG 4-60		60 ± 2												
	GTG 4-75		75 ± 2						100						
	GTG 4-85		85 ± 2												
5 W/m.K	GTG 5-40	Green	40 ± 2	0.8 to 20 mm	V0	Yes	-40°C to +200°C	3.12	< 50	5 ± 0.1	15	18	10^{11}	7.5	0.006
	GTG 5-60		60 ± 2												
	GTG 5-75		75 ± 2						50						
	GTG 5-85		85 ± 2												
6 W/m.K	GTG 6-40	Green	40 ± 2	0.8 to 20 mm	V0	Yes	-40°C to +200°C	3.23	< 50	6 ± 0.1	14	17	10^{11}	8.1	0.007
	GTG 6-55		55 ± 2												
	GTG 6-75		75 ± 2						50						
	GTG 6-85		85 ± 2												
7 W/m.K	GTG 7.5-35	Light grey	35 ± 2	0.8 to 20 mm	V0	Yes	-40°C to +200°C	3.22	< 40	7.5 ± 0.1	10	16	10^{11}	7.9	0.013
	GTG 7.5-55		55 ± 2												
	GTG 7.5-75		75 ± 2						40						
	GTG 7.5-85		85 ± 2												
8 W/m.K	GTG 8-65	Light grey	65 ± 2	1 to 20 mm	V0	Yes	-40°C to +200°C	3.3	< 30	8 ± 0.1	8	14	10^{11}	7	0.02

THERMAL GAP FILLER PAD GTS 8-65

The GTS 8-65 is ideal for aerospace applications requiring high thermal conductivity. It's specific formulations developed by our laboratory, as well as load, give these silicone elastomers and exceptional thermal conductivity.

- **ECSS-ST-70-02C compliance**
- **French bespoke solutions**
- **High thermal conductivity**
- **Great flexibility**
- **Follow the surface irregularities**
- **Ready to use**

Thanks to a spatial qualification according to the ESA-ECSS-Q-ST-70-02C TML RML (<1%) et CVCM (<0.1%), the GTS 8-65 is suitable for **aerospace applications.**

PROPERTIES	Standards - Tests	GTS 8-65
Hardness (Shore 00)	ASTM D 2240	65 ± 5
Density (g/cm^3)	ASTM D 792	3.02 ± 0.01
Elongation at break (%)	ASTM D 412	> 20
Thermal conductivity (W.m^{-1}.K^{-1}) Modified Transient Plane Source (MTPS)	ASTM D 7984	8.2 ± 0.1
Volume resistivity (Ω.m^{-1})	ASTM D 257	1*10^{11}
Dielectric strength (kV.mm^{-1})	ASTM D 149	10
Breakdown voltage (kV.mm^{-1})		16
Dielectric Constant (f=1 MHz)		7.9
Dissipation factor (f= 1MHz)		0.013
TML (%)	ECSS-ST-70-02C	0.04
RML (%)	ECSS-ST-70-02C	0.04
CVCM (%)	ECSS-ST-70-02C	0.02
Color		Grey
Working temperature		-120°C to +300°C
Thickness		1.5 mm to 10 mm

RoHS 3 COMPLIANT

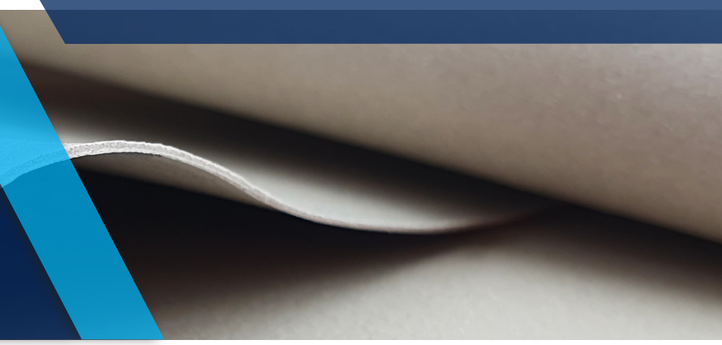
AVAILABLE FORMATS :

- Sheet : 150x150 mm
- Cut

THERMALLY AND ELECTRICALLY CONDUCTIVE SILICONE - GT 901

The GT 901 is a silicone elastomer loaded with silver plated copper particles, particularly recommended for thermal exchanges, between radiators and circuit boards with heat-emitting components.

- **Vulcanising the product direct to the radiator ensures the best possible thermal exchange.**

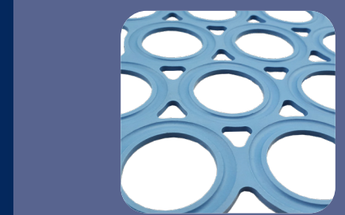


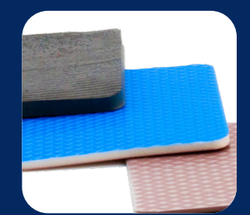
	GT 901/60	GT 901/45
Thermal conductivity W/m.K	2.89	1.63
Electrical resistivity Ω/cm/cm²	< 0.015	<0.015
Hardness shore A ±5	60	45
Density g/cm^3	3.50	3.00
Working temperature	-50°C to +125°C	-50°C to +125°C

Standard dimensions :
Standard Sheets : 300x300 mm
Standard thickness : From 0.5 mm to 10 mm

AVAILABLE FORMATS :

- Molded
- Cut
- Vulcanization-Bonding
- Sheet





SUMMARY OF DEGASSING MEASUREMENTS

Products	Unit	Standard	Characteristics	Typical results
GT901/60*	%	ESA PSS 01-702	TML RML CVCM	0.25 0.24 0.08
GT1000**	%	ECSS-Q-ST-70-02C	TML RML CVCM	0.30 0.29 0.07
GT2020	%	ECSS-Q-ST-70-02C	TML RML CVCM	0.08 0.07 0.03
GT602R85 + Adhésif	%	ESA PSS 01-702	TML RML CVCM	0.386 0.380 0.097
GT602R65	%	ECSS-Q-ST-70-02C	TML RML CVCM	0.21 0.19 0.07
GT602R65 + Adhésif	%	ECSS-Q-ST-70-02C	TML RML CVCM	0.27 0.25 0.10
GT602R63	%	ECSS-Q-ST-70-02C	TML RML CVCM	0.25 0.24 0.10
GT602R63 + Adhésif	%	ECSS-Q-ST-70-02C	TML RML CVCM	0.31 0.29 0.12
GT40SP	%	ECSS-Q-ST-70-02C	TML RML CVCM	0.393 0.373 0.131
GTS 8-65	%	ECSS-Q-ST-70-02C	TML RML CVCM	0.04 0.04 0.02

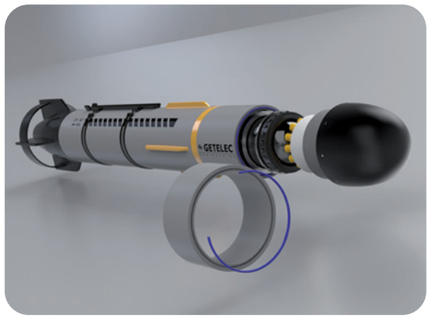
NOTE : The standard ESA-ECSS-Q-ST-70-02C replace the standard ESA PSS 01-702.

The maximum values for spatial application are :
- TML (Total Mass Loss) : < 1%
- RML (Recovered Mass Loss) : < 1%
- CVCM (Collected Volatile condensable material) : < 0.10%

*In the temperature range -50°C to +150°C, the coefficient of linear expansion is : $3.94x10^{-4}$ mm / mm x°C for the GT901/60.

For a non conductive silicone, the coefficient of linear expansion is : 5.9 to 7.9 $x10^{-4}$ mm/mm x °C .

TECHNICAL SEALING EXPERTISE

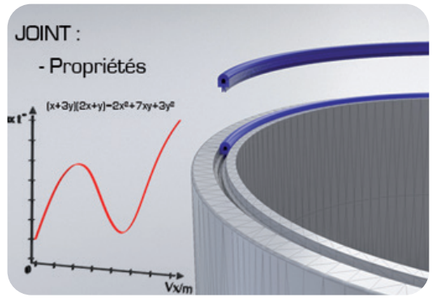


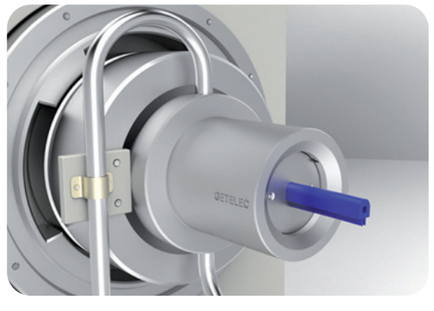
Requirements analysis

Our engineers help you to specify the product and develop a diagnostic, based on your requirements. Wether it is an extruded seal or a technical moulded item, our experts will use their know-how to guide you through design and production.

R&D : Formulation and processing

Our in-house control of elastomer formulations enables us to provide our customers with bespoke solutions, maintenaining great responsiveness to customer requirements. Thanks to our team of chemical engineers and extensive range of machinery, we are very flexible, able to find the right choice of materials and process to meet your technical requirements.





Tooling design

Our technical team determines and designs tools adapted to your projects. This in-house expertise allows us to offer your a turnkey solution, and support you throughout the duration of your project.

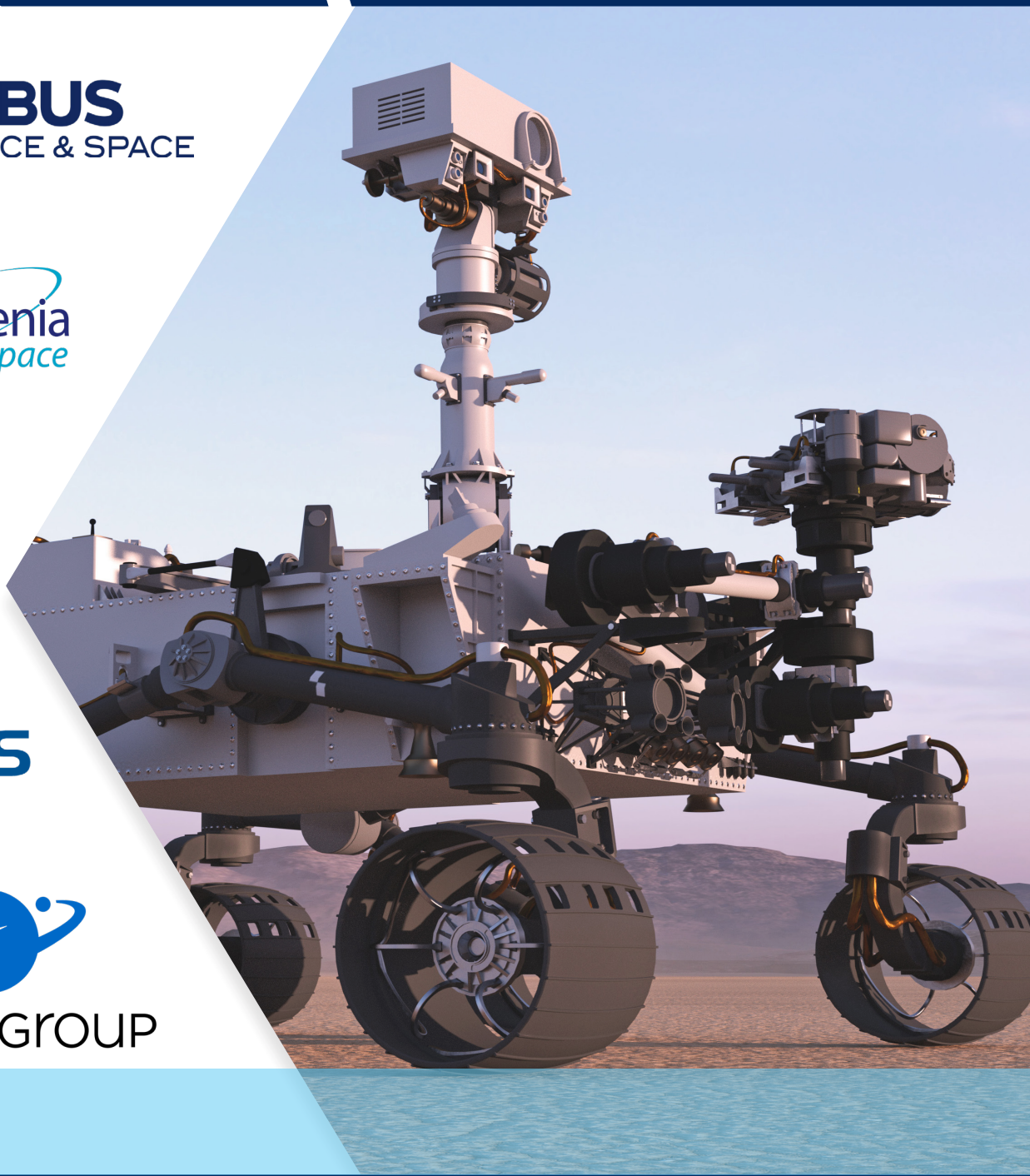
THEY TRUST US :

AIRBUS DEFENCE & SPACE

ThalesAlenia Space
A Thales / Finmeccanica Company

cnes

arianeGROUP



GETELEC
We protect your electronics

375 avenue Morane Saulnier
78530 - Buc | FRANCE

Tel : +33 1 39 20 42 42

info@getelec.com

MADE IN FRANCE