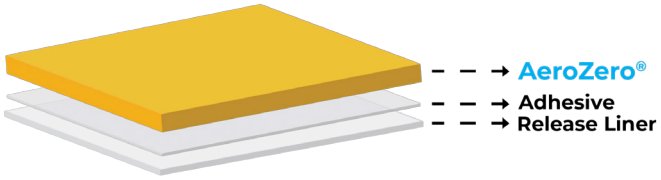
AeroZero® Thermal Protection Systems

AZ-TPS Product Portfolio

Product Description

The AZ-TPS portfolio consists of a range of products that includes at least one layer of 165 micron (6.5 mil) AeroZero® polyimide aerogel film with at least one adhesive bonding layer. The adhesive has a release layer that is peeled off before application to a substrate. Potential substrates include stainless steel, aluminum, glass, carbon fiber, and polymer substrates such as polyimides, polyether ketones, polyurethanes, and polyesters. Typical use is thermal barrier/protection of parts in the Aerospace, Defense and Electronic industries.



Pictured: AZ-TPS 100

Applications

Prior to peeling the release liner from the adhesive, ensure the surface is clean and free of loose particles. Standard application temperature is 25 °C (77 °F) and the recommended set time for optimal adhesion is 3 days prior to testing. The minimum application temperature is 10 °C (50 °F) and minimum set time is 24 hours before performing any tests. Increasing temperature and dwell time may increase adhesion strength.

Features

- Ultra-thin thermal protection system (TPS)
- Flexible application onto complex parts
- Enhances thermal performance of substrates
- Easy application with permanent bonding
- Flame retardant
- Lightweight

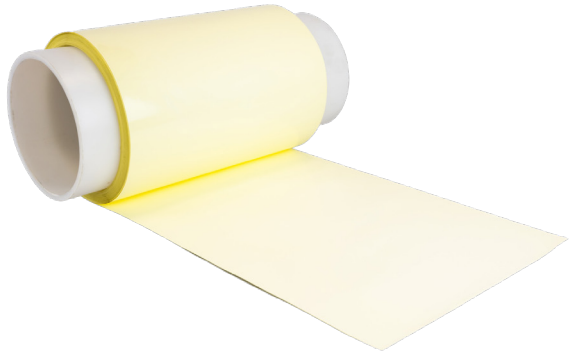
Standard Dimensions

- Test Sample: 216 x 356 mm (8.5 x 11 in)
- Sample Roll: 304 mm x 3.05 m (1 x 10 ft)
- Standard Roll: 304 mm x 30.5 m (1 x 100 ft)

Storage

Recommended Storage Conditions:

- Temperature: below 25 °C (77 °F)
- Relative Humidity: below 50%



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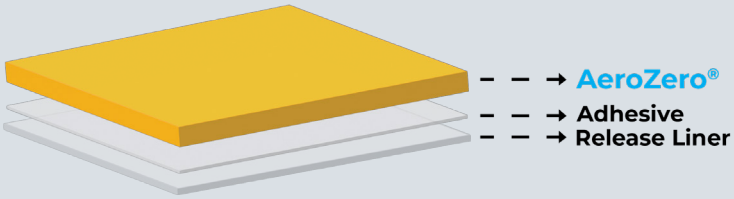
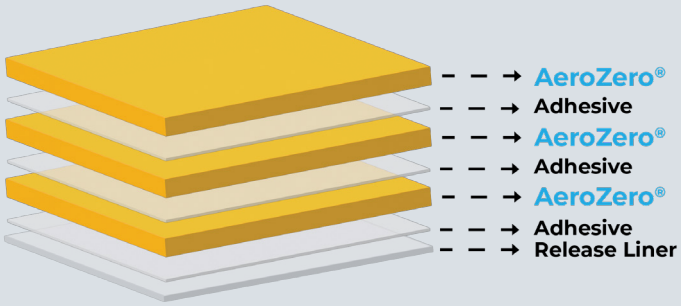
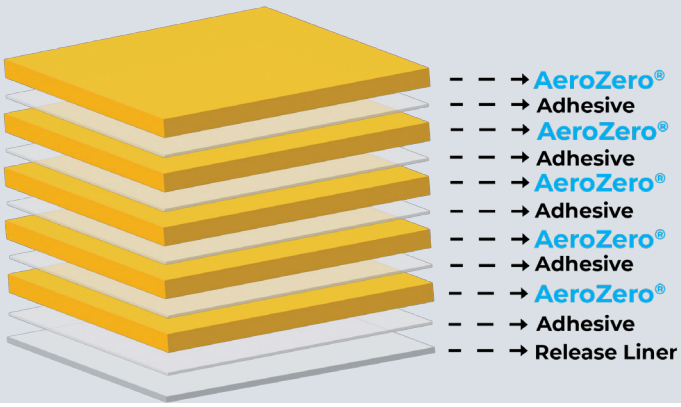
AeroZero® Thermal Protection Systems

AZ-TPS Product Portfolio







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Section 1:
AeroZero TPS

AeroZero® Thermal Protection Systems

AZ-TPS 100 Data

Physical and Mechanical Properties	Method	Value
Product Code	-	2000-01S1-000
Thickness, µm (mil)	ASTM D374/D374M	190 (7.5)
Tensile Strength, MPa (ksi)	ASTM D882	7.2 (1.0)
Young's Modulus, MPa (ksi)	ASTM D882	250 (36)
Tensile Elongation at Break, %	ASTM D882	6.8
Density, g/cm^3	ASTM D202	0.38
Basis Weight, g/m^2	ASTM D202	78

Thermal Properties	Method	Value
Thermal Conductivity (25 °C), W/m•K	ASTM C518	0.038
Specific Heat Capacity (25 °C), J/g•°C	ASTM C1784	1.08

Thermomechanical Properties	Method	Value
Glass Transition Temp (AZ T_g, DMA), °C (°F)	ASTM E1640	305 (580)
Decomposition Temp (10 wt% loss, TGA), °C (°F)	ASTM 2550	410 (770)

Additional Properties	Method	Value
Adhesive Strength: 180 °peel/3 day-RT dwell time AZ film on 50.8 micron (2 mil) Al Foil N/m (Lbf/in)	ASTM D3330	>300 (1.7)
UL Flammability Rating	UL94 VTM0	VTM-0
Adhesive Type:	-	Silicone

Data within this table are typical values for the standard AeroZero® TPS product family.
Product Code # 2000-01S1-000

AZ-TPS 100

AeroZero (AZ): 165 micron (6.5 mil)
Silicone Adhesive (PSA): 25.4 micron (1 mil)

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AeroZero® Thermal Protection Systems

AZ-TPS 101 Data

Physical and Mechanical Properties	Method	Value
Product Code		2000-10S1-000
Thickness, µm (mil)	ASTM D374/D374M	216 (8.5)
Tensile Strength, MPa (ksi)	ASTM D882	5.3 (1.0)
Young's Modulus, MPa (ksi)	ASTM D882	160 (23)
Tensile Elongation at Break, %	ASTM D882	9
Density, g/cm^3	In-House Method	0.50

Thermal Properties	Method	Value
Thermal Conductivity (25 °C), W/m•K	ASTM C518	0.040
Specific Heat Capacity (25 °C), J/g•°C	ASTM C1784	1.20

Thermomechanical Properties	Method	Value
Glass Transition Temp (AZ T_g, DMA), °C (°F)	ASTM E1640	305 (580)
Decomposition Temp (10 wt% loss, TGA), °C (°F)	ASTM 2550	380 (716)

Additional Properties	Method	Value
Adhesive Strength: 180 °peel/3 day-RT dwell time AZ film on 50.8 micron (2 mil) Al Foil N/m (Lbf/in)	ASTM D3330	>300 (1.7)
UL Flammability Rating	UL94 VTM0	VTM-0
Adhesive Type:	-	Silicone

Data within this table are typical values for the AeroZero® TPS product family.
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AZ-TPS 101

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AeroZero® Thermal Protection Systems

AZ-TPS Low Outgassing Configurations

		AZ-TPS 102	AZ-TPS 103	AZ-TPS 104
Physical and Mechanical Properties	**Method**	**Value**	**Value**	**Value**
Product Code	-	2000-01A1-000	2000-01A2-000	2000-01A3-000
Thickness, µm (mil)	ASTM D374/ D374M	223.5 (8.8)	292.1 (11.5)	190.5 (7.5)
Tensile Strength, MPa (ksi)	ASTM D882	6.5 (0.94)	4.4 (0.64)	7.5 (1.09)
Young's Modulus, MPa (ksi)	ASTM D882	200	150	250
Tensile Elongation at Break, %	ASTM D882	7.7	5.8	6.5
Density, g/cm^3	ASTM D202	0.50	0.62	0.40
Basis Weight, g/m^2	ASTM D202	105	178	78
Thermal Properties	**Method**	**Value**	**Value**	**Value**
Thermal Conductivity (25 °C), W/m•K	ASTM C518	0.041	0.049	0.037
Specific Heat Capacity (25 °C), J/g•°C	ASTM C1784	1.55	1.61	1.35
Thermomechanical Properties	**Method**	**Value**	**Value**	**Value**
Glass Transition Temp (AZ T_g, DMA), °C (°F)	ASTM E1640	305 (580)	305 (580)	305 (580)
Decomposition Temp (10 wt% loss, TGA), °C (°F)	ASTM 2550	261 (501.8)	273 (523.4)	255 (491)
Additional Properties	**Method**	**Value**	**Value**	**Value**
Adhesive Strength: 72 hour Peel Strength to 2 mil Aluminum Foil, N/m (Lbf/in)	ASTM D3330	>300 (1.7)	>200 (1.1)	>300 (1.7)
NASA Outgassing Total Mass Loss (TML), %	ASTM E595	<1%	<1%	<1%
Collected Volatile Condensable Material, CVCM	ASTM E595	<0.1%	<0.1%	<0.1%
Adhesive Type	-	Acrylic	Acrylic	Acrylic

Data within this table are typical values for the standard AeroZero® TPS product family.
Product Codes #2000-01A1-000, 2000-01A2-000, 2000-01A3-000

AZ-TPS 102

AeroZero (AZ): 165 micron (6.5 mil)
Acrylic adhesive: 50.8 micron (2 mil)

AZ-TPS 103

AeroZero (AZ): 165 micron (6.5 mil)
Acrylic adhesive: 127 micron (5 mil)

AZ-TPS 104

AeroZero (AZ): 165 micron (6.5 mil)
Acrylic adhesive: 25.4 micron (1 mil)

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Section 2:
TripleZero TPS

TripleZero™ Thermal Protection System

TripleZero™ TPS 300 Data

Physical and Mechanical Properties	Method	Value
Product Code	-	2000-03S1-000
Thickness, µm (mil)	ASTM D374/D374M	570 (22.4)
Tensile Strength, MPa (ksi)	ASTM D882	7.1 (1.0)
Young's Modulus, MPa (ksi)	ASTM D882	200 (29)
Tensile Elongation at Break, %	ASTM D882	9.8
Density, g/cm^3	ASTM D202	0.40
Basis Weight, g/m^2	ASTM D202	230

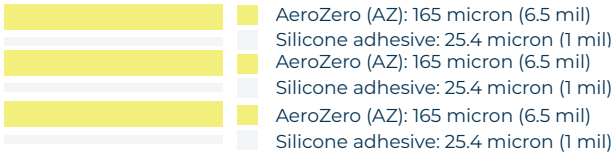
Thermal Properties	Method	Value
Thermal Conductivity (25 °C), W/m·K	ASTM C518	0.036

Thermomechanical Properties	Method	Value
Glass Transition Temperature (AeroZero T_g, DMA), °C (°F)	ASTM E1640	305 (580)
Decomposition Temperature (10 wt% loss, TGA), °C (°F)	ASTM E2550	400 (600)

Additional Properties	Method	Value
Adhesive Strength: 180 °peel/3 day-RT dwell time AZ film on 50.8 micron (2 mil) Al Foil N/m (Lbf/in)	ASTM D3330	>250 (1.7)
Flammability, 12 s vertical burn	FAR Part 25 Appx. F Part 1 (a) (1) (ii)	Pass
UL Flammability Rating	UL94 Vertical Burn	V0
Adhesive Type	-	Silicone

Data within this table are typical values for the standard TripleZero TPS product family.
Product Code # 2000-03S1-000

TripleZero TPS 300



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Section 3:
QuinZero TPS

QuinZero™ Thermal Protection System

QuinZero™ TPS 501 Data

Physical and Mechanical Properties	Method	Value
Product Code	-	2000-05A3-000
Thickness, µm (mil)	ASTM D374/D374M	952.5 (37.5)
Tensile Strength, MPa (ksi)	ASTM D882	6.5 (0.94)
Young's Modulus, MPa (ksi)	ASTM D882	200 (29)
Tensile Elongation at Break, %	ASTM D882	6.0
Density, g/cm^3	ASTM D202	0.40
Basis Weight, g/m^2	ASTM D202	390

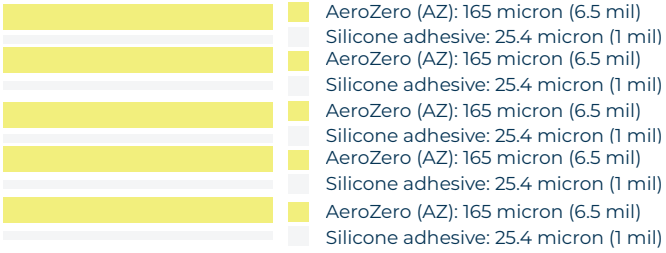
Thermal Properties	Method	Value
Thermal Conductivity (25 °C), W/m·K	ASTM C518	0.037
Specific Heat Capacity (25 °C), J/g·°C	ASTM C1784	1.35

Thermomechanical Properties	Method	Value
Glass Transition Temperature (AeroZero T_g, DMA), °C (°F)	ASTM E1640	305 (580)
Decomposition Temperature (10 wt% loss, TGA), °C (°F)	ASTM E2550	260 (500)

Additional Properties	Method	Value
Adhesive Strength: 72 hr. Peel Strength to 2 mil Aluminum Foil, N/m (Lbf/in)	ASTM D3330	>280 (1.6)
Adhesive Type	-	Acrylic

Data within this table are typical values for the standard QuinZero TPS product family.
Product Code # 2000-05A3-000

QuinZero™ TPS 501



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