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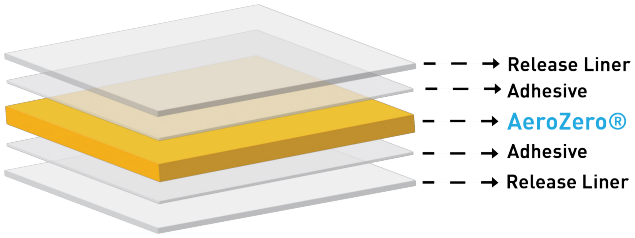
PRODUCT DATA SHEET

AeroZero® Thermal Protection Systems
AZ-TPS DS

Product Description

AZ-TPS DS consists of a standard 165 micron (6.5 mil) AeroZero® polyimide aerogel film with a 25.4 micron (1 mil) adhesive applied onto both sides of the AeroZero film. The adhesive is a high-performance engineering grade silicone pressure sensitive adhesive (PSA) with a release layer that is peeled off before application to a substrate. Potential substrates include stainless steel, aluminum, carbon fiber, glass, and polymer substrates such as polyimides, polyether ketones, polyurethanes, and polyesters. Typical use is thermal barrier/insulation of parts in the Aerospace, Defense and Electronic industries.



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
- Easy application with permanent bonding
- Flame retardant
- Lightweight

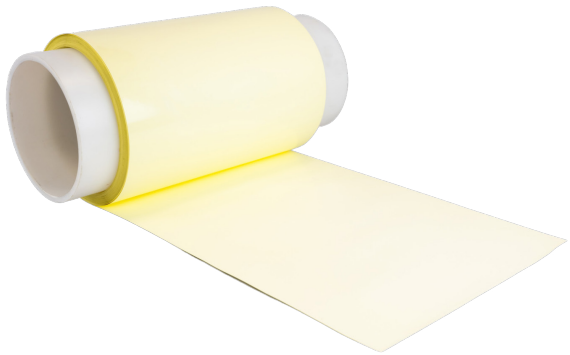
Standard Dimensions

- Test Sample: 216 x 356 mm (8.5 x 11 in)
- Sample Roll: 1 x 3.05 m (1 x 10 ft)
- Standard Roll: 1 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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PRODUCT DATA SHEET

AeroZero® Thermal Protection Systems

AZ-TPS DS Data

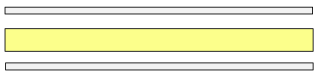
Physical and Mechanical Properties	Method	Value
Product Code	-	2000-10S1-000
Thickness, µm (mil)	In-House Method	216 ± 38 (8.5 ± 1.5)
Tensile Strength, MPa (ksi)	ASTM D882-12	5.3 ± 0.8 (1.0 ± 0.1)
Young's Modulus, MPa (ksi)	ASTM D882-12	160 ± 50 (23 ± 7)
Tensile Elongation at Break, %	ASTM D882-12	9 ± 2
Density, g/cm^3	In-House Method	0.50 ± 0.05

Thermal Properties	Method	Value
Thermal Conductivity (25 °C), W/m•K	ASTM C518-21	0.040 ± 0.003
Specific Heat Capacity (25 °C), J/g•°C	ASTM C1784-20	1.20 ± 0.05

Thermomechanical Properties	Method	Value
Glass Transition Temp (AZ T_g, DMA), °C (°F)	ASTM E1640-13	305 (580)
Decomposition Temp (10 wt% loss, TGA), °C (°F)	ASTM 2550-17	380 (716)

Additional Properties	Method	Value
Adhesive Strength:		
180 °peel/AeroZero on 50.8 micron (2 mil) Al Foil	ASTM D3330	>300 (1.7)
UL Flammability Rating	UL94 VTM0	VTM-0

Data within this table are typical values for the DS product family.
Product Code # 2000-10S1-000



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

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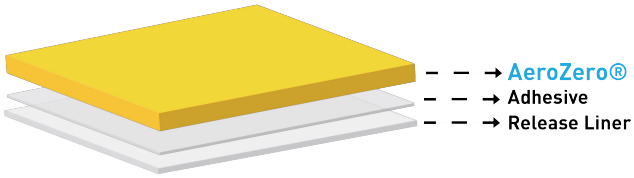
PRODUCT DATA SHEET

AeroZero® Thermal Protection Systems
AZ-TPS

Product Description

AZ-TPS consists of a 165 micron (6.5 mil) AeroZero® polyimide aerogel film with a 25.4 micron (1 mil) adhesive applied onto a single side. The adhesive is a high-performance engineering grade silicone pressure sensitive adhesive (PSA) with a release layer that is peeled off before application onto a substrate. Potential substrates include stainless steel, aluminum, glass, and polymer substrates such as polyimides, polyether ketones, polyurethanes, and polyesters. Typical use is thermal barrier/insulation of parts in the Aerospace, Defense and Electronic industries.



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

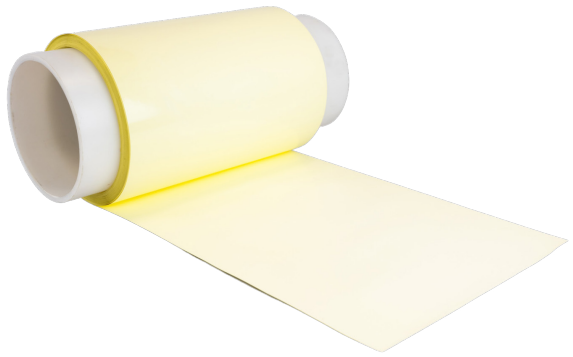
Standard Dimensions

- ◊ Test Sample: 216 x 356 mm (8.5 x 11 in)
- ◊ Sample Roll: 1 x 3.05 m (1 x 10 ft)
- ◊ Standard Roll: 1 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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PRODUCT DATA SHEET

AeroZero® Thermal Protection Systems

AZ-TPS Data

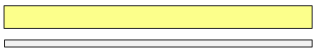
Physical and Mechanical Properties	Method	Value
Product Code	-	2000-01S1-000
Thickness, µm (mil)	In-House Method	190 ± 38 (7.5 ± 1.5)
Tensile Strength, MPa (ksi)	ASTM D882-12	7.2 ± 1.5 (1.0 ± 0.3)
Young's Modulus, MPa (ksi)	ASTM D882-12	250 ± 75 (36 ± 11)
Tensile Elongation at Break, %	ASTM D882-12	6 ± 2
Density, g/cm^3	In-House Method	0.38 ± 0.05

Thermal Properties	Method	Value
Thermal Conductivity (25 °C), W/m•K	ASTM C518-21	0.038 ± 0.003
Specific Heat Capacity (25 °C), J/g•°C	ASTM C1784-20	1.08 ± 0.06

Thermomechanical Properties	Method	Value
Glass Transition Temp (AZ T_g, DMA), °C (°F)	ASTM E1640-13	305 (580)
Decomposition Temp (10 wt% loss, TGA), °C (°F)	ASTM 2550-17	410 (770)

Additional Properties	Method	Value
Adhesive Strength:		
180 °peel/AeroZero on 2-mil Al Foil	ASTM D3330	>300 (1.7)
UL Flammability Rating	UL94 VTM0	VTM-0

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



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

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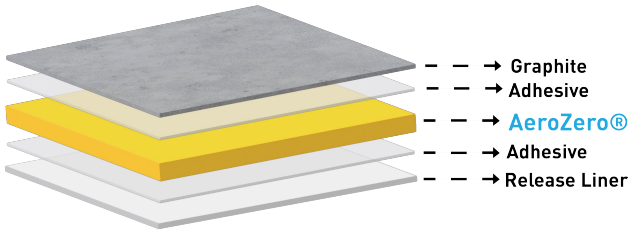
PRODUCT DATA SHEET

AeroZero® Thermal Protection Systems
AZ-TPS Graphite

Product Description

AZ-TPS Graphite consists of a 165 micron (6.5 mil) AeroZero® polyimide aerogel film with a 50.8 micron (2 mil) external graphite film joined with a 25.4 micron (1 mil) adhesive. The adhesive is a high-performance engineering grade silicone pressure sensitive adhesive (PSA) with 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.



Applications

Prior to peeling the release liner from the adhesive, ensure the substrate is clean and free of loose particles. Standard application temperature is 25 °C (77 °F) and the recommended set time for optimal adhesion is three 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)
- Excellent thermal insulator and heat spreader
- Lightweight
- Easy application with permanent bonding
- Flame retardant
- High heat resistance > 1000 °F (538 °C)

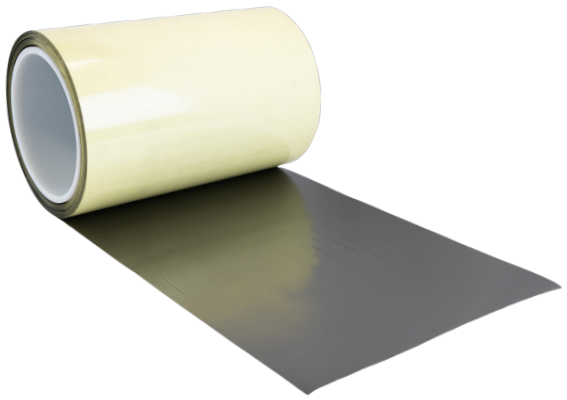
Standard Dimensions

- Test Sample: 216 x 356 mm (8.5 x 11 in)
- Sample Roll: 1 x 3.05 m (1 x 10 ft)
- Standard Roll: 1 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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PRODUCT DATA SHEET

AeroZero® Thermal Protection Systems

AZ-TPS Graphite Data

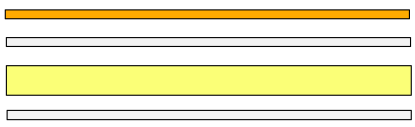
Physical and Mechanical Properties	Method	Value
Product Code	-	2020-11S1-000
Thickness, µm (mil)	In-House Method	267 ± 38 (10.5 ± 1.5)
Tensile Strength, MPa (ksi)	ASTM D882-12	4.5 ± 0.5 (0.65 ± 0.07)
Young's Modulus, MPa (ksi)	ASTM D882-12	415 ± 40 (60 ± 5.8)
Tensile Elongation at Break, %	ASTM D882-12	4 ± 1
Density, g/cm^3	In-House Method	0.70 ± 0.05

Thermal Properties	Method	Value
Thermal Conductivity (25 °C), W/m•K	ASTM C518-10	0.053 ± 0.005
Specific Heat Capacity (25 °C), J/g•°C	ASTM C1784-20	1.07 ± 0.05
IR Emissivity (Polyimide Surface)	ASTM E408-13	0.85

Thermomechanical Properties	Method	Value
Glass Transition Temp (AZ T_g, DMA), °C (°F)	ASTM E1640-13	305 (580)
Decomposition Temp (10 wt% loss, TGA), °C (°F)	ASTM 2550-17	470 (878)

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

Data within this table are typical values for the graphite product family.
Product Code # 2020-11S1-000



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

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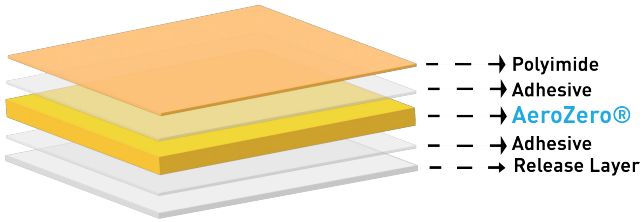
PRODUCT DATA SHEET

AeroZero® Thermal Protection Systems
AZ-TPS Polyimide

Product Description

AZ-TPS PI consists of a 165 micron (6.5 mil) AeroZero® polyimide aerogel film with a 25.4 micron (1 mil) external polyimide film joined with a 25.4 micron (1 mil) adhesive. The adhesive is a high-performance engineering grade silicone pressure sensitive adhesive (PSA) with a release layer that is peeled off before application to a substrate. Potential substrates include stainless steel, aluminum, glass, 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.



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)
- Lightweight
- RF transparent
- Flexibility enables use on complex parts
- Easy application with permanent bonding
- Flame retardant

Standard Dimensions

- Test Sample: 216 x 356 mm (8.5 x 11 in)
- Sample Roll: 1 x 3.05 m (1 x 10 ft)
- Standard Roll: 1 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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PRODUCT DATA SHEET

AeroZero® Thermal Protection Systems

AZ-TPS Polyimide Data

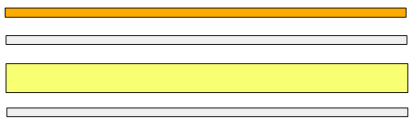
Physical and Mechanical Properties	Method	Value
Product Code	-	2010-11S1-000
Thickness, µm (mil)	In-House Method	240 ± 38 (9.5 ± 1.5)
Tensile Strength, MPa (ksi)	ASTM D882-12	15 ± 3 (2 ± 0.4)
Young's Modulus, MPa (ksi)	ASTM D882-12	450 ± 50 (65 ± 7)
Tensile Elongation at Break, %	ASTM D882-12	8 ± 2
Density, g/cm^3	In-House Method	0.58 ± 0.05

Thermal Properties	Method	Value
Thermal Conductivity (25 °C), W/m•K	ASTM C518-10	0.046 ± 0.003
Specific Heat Capacity (25 °C), J/g•°C	ASTM C1784-20	1.22 ± 0.06
IR Emissivity (Polyimide Surface)	ASTM E408-13	0.85

Thermomechanical Properties	Method	Value
Glass Transition Temp (AZ T_g, DMA), °C (°F)	ASTM E1640-13	305 (580)
Decomposition Temp (10 wt% loss, TGA), °C (°F)	ASTM 2550-17	410 (770)

Additional Properties	Method	Value
Adhesive Strength:		
180 °peel on Al Panel, N/m (lb/in)	ASTM D3330	>200 (1.1)
UL Flammability Rating	UL94 VTM0	VTM-0

Data within this table are typical values for the polyimide product family.
Product Code # 2010-11S1-000



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

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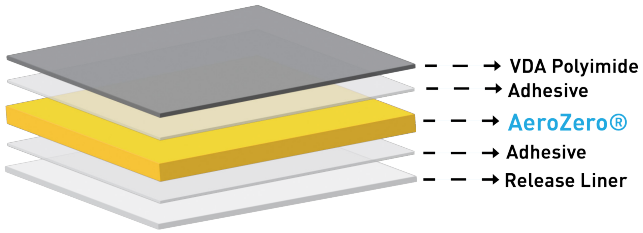
PRODUCT DATA SHEET

AeroZero® Thermal Protection Systems
AZ-TPS VDA PI

Product Description

AZ-TPS VDA consists of a 165 micron (6.5 mil) AeroZero® polyimide aerogel film with a 25.4 micron (1 mil) external polyimide film joined with a 25.4 micron (1 mil) adhesive. The polyimide film is coated with a highly reflective layer of 1000 Å Vapor Deposited Aluminum (VDA). The opposite side has a 25.4 micron (1 mil) adhesive layer for bonding to substrates. The adhesive is a high-performance engineering grade silicone pressure sensitive adhesive (PSA) with a release layer that is peeled off before application. Potential substrates include stainless steel, aluminum, glass, 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.



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
- Easy application with permanent bonding
- Flame retardant
- High reflectivity
- Lightweight

Standard Dimensions

- Test Sample: 216 x 356 mm (8.5 x 11 in)
- Sample Roll: 1 x 3.05 m (1 x 10 ft)
- Standard Roll: 1 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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PRODUCT DATA SHEET

AeroZero® Thermal Protection Systems

AZ-TPS VDA Polyimide Data

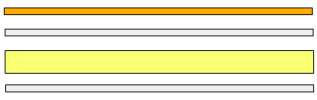
Physical and Mechanical Properties	Method	Value
Product Code	-	2045-11S1-000
Thickness, µm (mil)	In-House Method	240 ± 38 (9.5 ± 1.5)
Tensile Strength, MPa (ksi)	ASTM D882-12	15 ± 3 (2 ± 0.4)
Young's Modulus, MPa (ksi)	ASTM D882-12	500 ± 50 (73 ± 7)
Tensile Elongation at Break, %	ASTM D882-12	9 ± 2
Density, g/cm^3	In-House Method	0.60 ± 0.05

Thermal Properties	Method	Value
Thermal Conductivity (25°C), W/m•K	ASTM C518-10	0.046 ± 0.003
Specific Heat Capacity (25 °C), J/g•°C	ASTM C1784-20	1.18 ± 0.05
IR Reflectivity (VDA PI Surface)	ASTM E408-13	0.96
IR Emissivity (VDA PI Surface)	ASTM E408-13	0.04

Thermomechanical Properties	Method	Value
Glass Transition Temp (AZ T_g, DMA), °C (°F)	ASTM E1640-13	305 (580)
Decomposition Temp (10 wt% loss, TGA), °C (°F)	ASTM 2550-17	410 (770)

Additional Properties	Method	Value
Adhesive Strength:		
180 °peel on Al Panel, N/m (lb/in)	ASTM D3330	>300 (1.1)
UL Flammability Rating	UL94 VTM0	VTM-0

Data within this table are typical values for the VDA Polyimide product family.
Product Code # 2045-11S1-000



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

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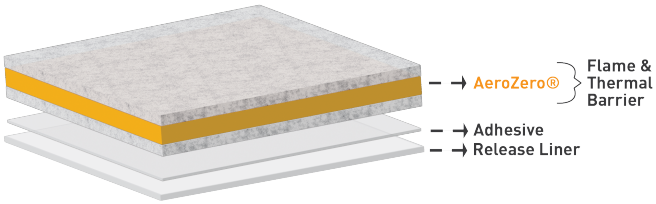
PRODUCT DATA SHEET

AeroZero® Thermal Protection Systems
AZ-TPS Flame and Thermal Barrier

Product Description

Our AZ-TPS flame and thermal barriers (FTB) include at least one layer of our AeroZero® film with a flame resistant protection system layer bonded on one or both sides of the film. Our adhesive is a 25.4 micron (1 mil) high-performance engineering grade silicone pressure sensitive adhesive (PSA) with a release layer that is peeled off before application to a substrate. The AZ-TPS FTB product family consists of two material configurations, both of which include a PSA: 2071-R3S1-000 and 2071-R4S1-000.

Typical use is fire and thermal protection of parts exposed to flames and high temperatures. Potential substrates include carbon fiber composites, metallic parts including stainless steel and aluminum, and polymeric parts such as polyether ether ketones (PEEK) and polyimides.



Features

- Ultra-thin thermal protection system (TPS)
- High flame/heat resistance
- 25+ mins, ~ 1000 °C flame & no burn through
- Reduces heat transfer during thermal events
- Flexible application onto complex parts
- Easy use with permanent bonding
- Lightweight and thin

Applications

Prior to peeling the release liner from the adhesive, ensure the substrate is clean and free of loose particles. Standard application temperature is 25 °C (77 °F) and the recommended set time for optimal adhesion is three 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.

Standard Dimensions

- Test Sample: 216 x 356 mm (8.5 x 11 in)

Storage

Recommended Storage Conditions:

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

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PRODUCT DATA SHEET

AeroZero® Thermal Protection Systems

AZ-TPS Flame and Thermal Barrier Data

Physical Properties	Methods	Value	Value
Product Code	-	2071-R3S1-000	2071-R4S1-000
Thickness, mm (mil)	In-House Method	1.16 (45.6)	1.18 (46.4)
Dielectric Strength, kV/mm	ASTM D149-20	22	22
Density, g/cm^3	In-House Method	1.09	1.20
Areal Density, g/m^2	In-House Method	1260	1350

Thermal Properties	Methods	Value	Value
Thermal Conductivity (25 °C), W/m•K	ASTM C518-10	0.085	0.089
Specific Heat Capacity (25 °C), J/g•°C)	ASTM C1784-20	1.10	1.05

Data represents average values of developmental samples provided for testing purposes.
Product Code # 2071-R3S1-000, 2071-R4S1-000

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