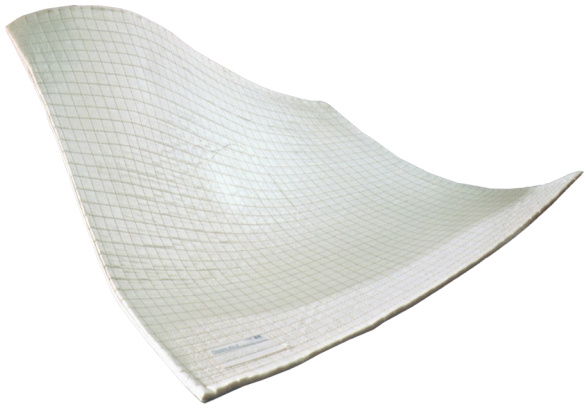
Morgan Advanced Materials

Flexible Min-K®

Product Data Sheet



Description

Flexible Min-K is a composite system consisting of a microporous core encapsulated between layers of high temperature cloth and quilted in 1" squares. The quilting maintains core distribution in high vibration environments and allows the insulation to be wrapped or bent to conform to unique geometric shapes during installation. Product thickness, core density and composition, and cloth selection vary with application.

Core and Textile Facing Selection

While thermal management requirements often dictate material thickness and core density, the maximum continuous use temperature seen in the application is the deciding factor for core and cloth selection. Because this is a composite material, the use limit is decided by the lowest use limit associated with the materials incorporated into the design.

Core

The maximum temperature limit for the microporous core depends on shrinkage and degradation of thermal conductivity. At high temperatures, the cellular structure responsible for its low thermal conductivity is compromised. Core components like SiO2 particles, metal oxides, and reinforcement fibres may melt or sinter, leading to increased solid conduction from material contact and molecular air conduction due to structural degradation.

Core Formulations

- **Mix F182** is utilized for temperatures up to 1832°F (1000°C) and where high vibration environments are seen.
- **Mix F150** is used for applications at 1200°F (649°C) and lower.
- **Mix F382** is utilized for temperatures up to 1832°F (1000°C) and where high vibration environments are seen
- **Mix F351** is utilized for temperatures up to 1832°F (1000°C) and where high vibration environments are seen

Thread

Selection is based on maximum continuous use limit of the application and consistent with the cloth.

- **E-Glass** Standard with 2116 E-Glass and S-Glass cloths
- **Quartz** Standard with higher temperature cloths

Cloth

Cloth selection depends on the application's required maximum temperature limit, as well as physical properties like rigidity, permeability, or durability. Some cloths, like Nextel®, are chosen for their status as industry-approved fire barriers. The temperature use limit is determined by the material's strength degradation. While some cloths are rated for higher temperatures in other industries, the limits here reflect the Min-K product's survivability in demanding aerospace environments.

- **2116 E-Glass** Maximum use limit of 500°F (in harsh aerospace environments) used in 501 series of materials or Standard Flexible Min-K.
- **S-Glass** Maximum use limit of 1200°F (in harsh aerospace environments) used in 1201 series of materials or Mid-Range Flexible Min-K.
- **Quartz 503** Maximum use limit of 1958°F and used in 1801 (limited by core) series of materials.
- **Quartz 593** Maximum use limit of 1958°F. Offers increased durability over Quartz 503 due to increased thickness.
- **Nextel** Maximum use limit of 2200-2500°F. Excellent strength and durability at elevated temperatures

Features

- Very low thermal conductivity
- Benefits weight and space constraints
- Flexible and lightweight
- Composite temperature use limit ranges 500 - 1832°F (260 – 1000°C)

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	Flexible Min-K 501	Flexible Min-K 1801	Flexible Min-K 1231	Flexible Min-K 1221
Physical Properties, core material composition				
Core material formulation	F150	F182	F382	F351
Density, pcf (kg/m3)	8, 10, 16 (128, 160, 256)			
Standard Tolerances				
Thickness, in (mm)	+.060 /-.030 (+1.524 / -0.762)			
Length x Width, fabricated parts, in mm	=- ± 0.125 (3.175)			
Length x Width, standard sheets, in mm	= +2.0/- 0.0 (+50.8/-0.0)			
Size Availability				
Thickness, in (mm) *1/2 in (12.7mm) available max.16 pcf (256 kg/m3)	1/8, 1/4, 3/16, 3/8, 1/2 (3.175, 6.35, 4.76, 9.52, 12.7)			
Variations of the cloth facing, hot or cold, core material, thread, and density are available. Material is supplied in 3' x 3' or 4' x 3', square stitched (1"centers) sheets. Fabricated strips, referred to as tapes, are available in widths of 1", 1-1/2" and 2-1/2", in 6 ft lengths. Customized sheet sizes and fabricated shapes are available upon request.				
Specific Heat, BTU/lb°F				
Temperature, °F (°C)				
100 (38)	0.18			
400 (204)	0.23			
800 (427)	0.26			
Acoustic performance, Hz, material 0.25 in (6.35 mm) Sound absorption values range from 0 to 1.0 with 0 representing no absorption (perfect reflections) and 1.0 representing 100 percent absorption				

	F150 8 pcf	F150 16 pcf	F182 8 pcf	
125	0.025	0.027	0.025	
150	0.032	0.025	0.032	
500	0.066	0,060	0.066	
1000	0.272	0.157	0.272	
2000	0.331	0.355	0.331	
4000	0.253	0.306	0.253	

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Thermal Conductivity, BTU•in/hr•ft2•°F Per ASTM C-177	Flexible Min-K F150[1]			Flexible Min-K F182[2]			Flexible Min-K F382[3]	Flexible Min-K F351[4]
Density,pcf	**8**	**10**	**16**	**8**	**10**	**16**	**16**	**16**
200°F	0.20	0.20	0.20	0.22	0.22	0.21	0.19	0.19
400°F	0.25	0.23	0.22	0.24	0.24	0.23	0.19	0.19
600°F	0.30	0.27	0.26	0.26	0.26	0.25	0.20	0.20
800°F	0.37	0.33	0.32	0.33	0.29	0.28	0.23	0.23
1000°F	0.45	0.40	0.37	0.39	0.34	0.31	0.26	0.27
1200°F	0.53	0.49	0.45	0.44	0.39	0.35	0.30	0.33
1400°F	0.65	0.59	0.55	0.53	0.47	0.41	0.35	0.39
1600°F				0.64	0.56	0.50	0.44	0.45
1800°F				0.75	0.66	0.59	0.60	0.61

Thermal Conductivity, W/m•K Per ASTM C-177	Flexible Min-K F150[1]			Flexible Min-K F182[2]			Flexible Min-K F382[3]	Flexible Min-K F351[4]
Density, pcf (kg/m^3)	**8 (128)**	**10 (160)**	**16 (256)**	**8 (128)**	**10 (160)**	**16 (256)**	**16 (256)**	**16 (256)**
200°C	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03
400°C	0.05	0.05	0.05	0.03	0.03	0.03	0.03	0.03
600°C	0.07	0.07	0.06	0.06	0.06	0.06	0.04	0.04
800°C				0.08	0.07	0.06	0.05	0.06

1. F 150 core, S-Glass facing, 8,10,16 pcf density
2. F 182 core, Quartz 503 facing, 8,10,16 pcf density
3. F 382 core, S-Glass facing ,16 pcf density
4. F 351 core, S-Glass facing ,16 pcf density