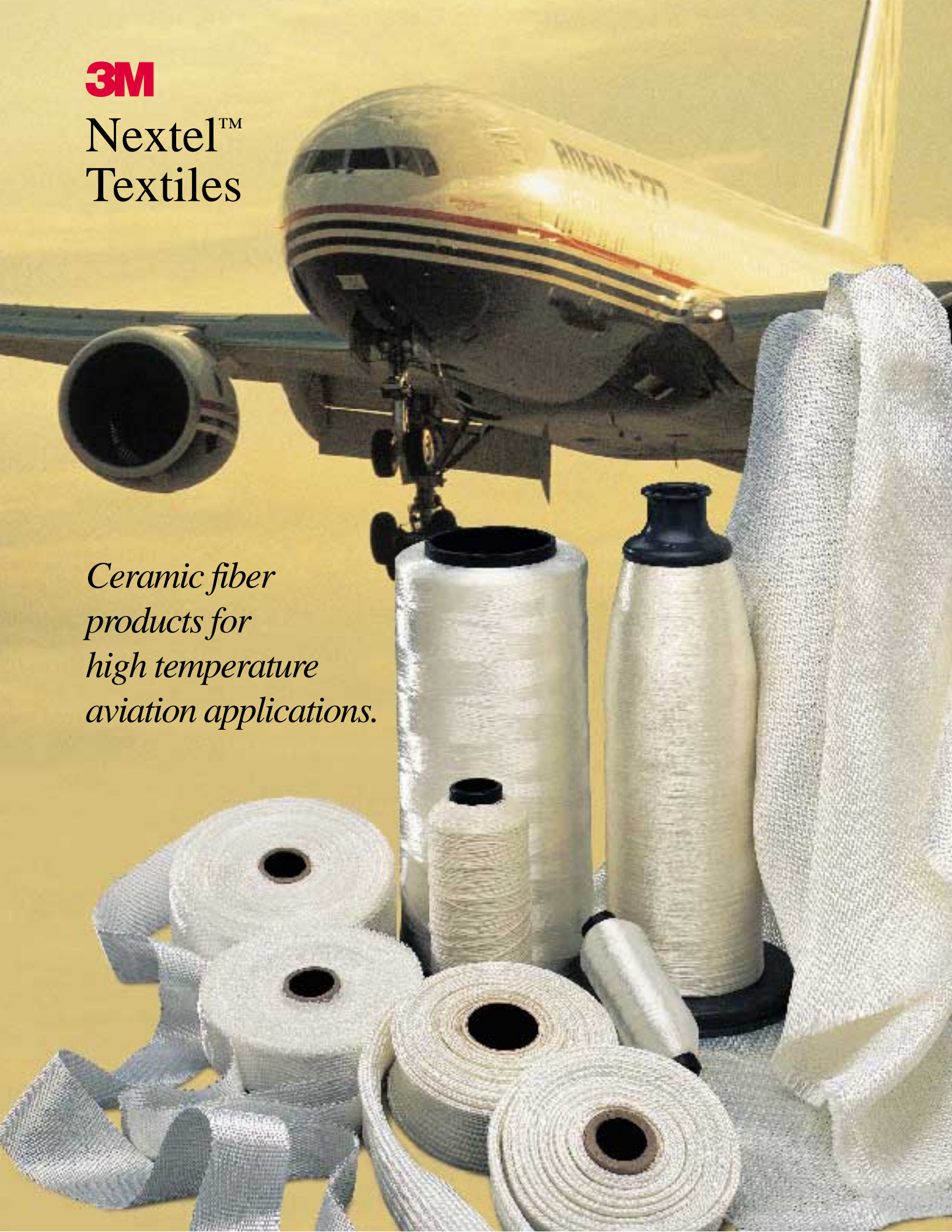


**3M**

Nextel™  
Textiles

*Ceramic fiber  
products for  
high temperature  
aviation applications.*



## ***Physical Properties***

3M™ Nextel™ Fabrics, Tapes, and Sleeveings are designed to meet the toughest thermal, mechanical and electrical performance requirements, outperforming the useful limits of other high temperature textiles. Nextel 312 Ceramic Fibers and Nextel 440 Ceramic Fibers are continuous polycrystalline metal oxide fibers suitable for producing textiles without the aid of other fiber or metal inserts.



*3M™ Nextel™ can be used as thermal insulation for wire harnesses.*

## ***Cost Competitive Solution***

Per square foot costs can be lower than competitive alternatives. Nextel quality and product lifetime add lasting value.

## ***Low Shrinkage***

Products fabricated from Nextel ceramic fibers exhibit very low shrinkage, providing excellent dimensional stability.

## ***Abrasion Resistance***

Nextel 312 fibers demonstrated excellent abrasion resistance after a 30 minute exposure at up to 2000°F (1093°C). Nextel 312 fibers lasted 2.5 to 5 times longer than leached glass in the Duplan Silk Abrasion Test.

## ***Thermal Mechanical Properties***

Products made with Nextel 312 and Nextel 440 ceramic fibers retain greater strength and flexibility at higher temperatures than other refractory textile materials.

## ***Thermal Insulation Properties***

Nextel fiber products have excellent resistance to thermal shock, have low thermal conductivity and can be fabricated into excellent high temperature thermal insulators.

## ***Non-hygroscopic***

Nextel 312 fiber's smooth, non-porous surface only gains 0.08% of its weight after 2 hours exposure to 100% humidity.

***Spray-on insulation materials require extensive downtime and present serious environmental barriers for periodic testing and repair. Removable fireproof blankets provide superior insulation and fire protection, while drastically reducing maintenance downtime – from 10 days to less than 12 hours.***

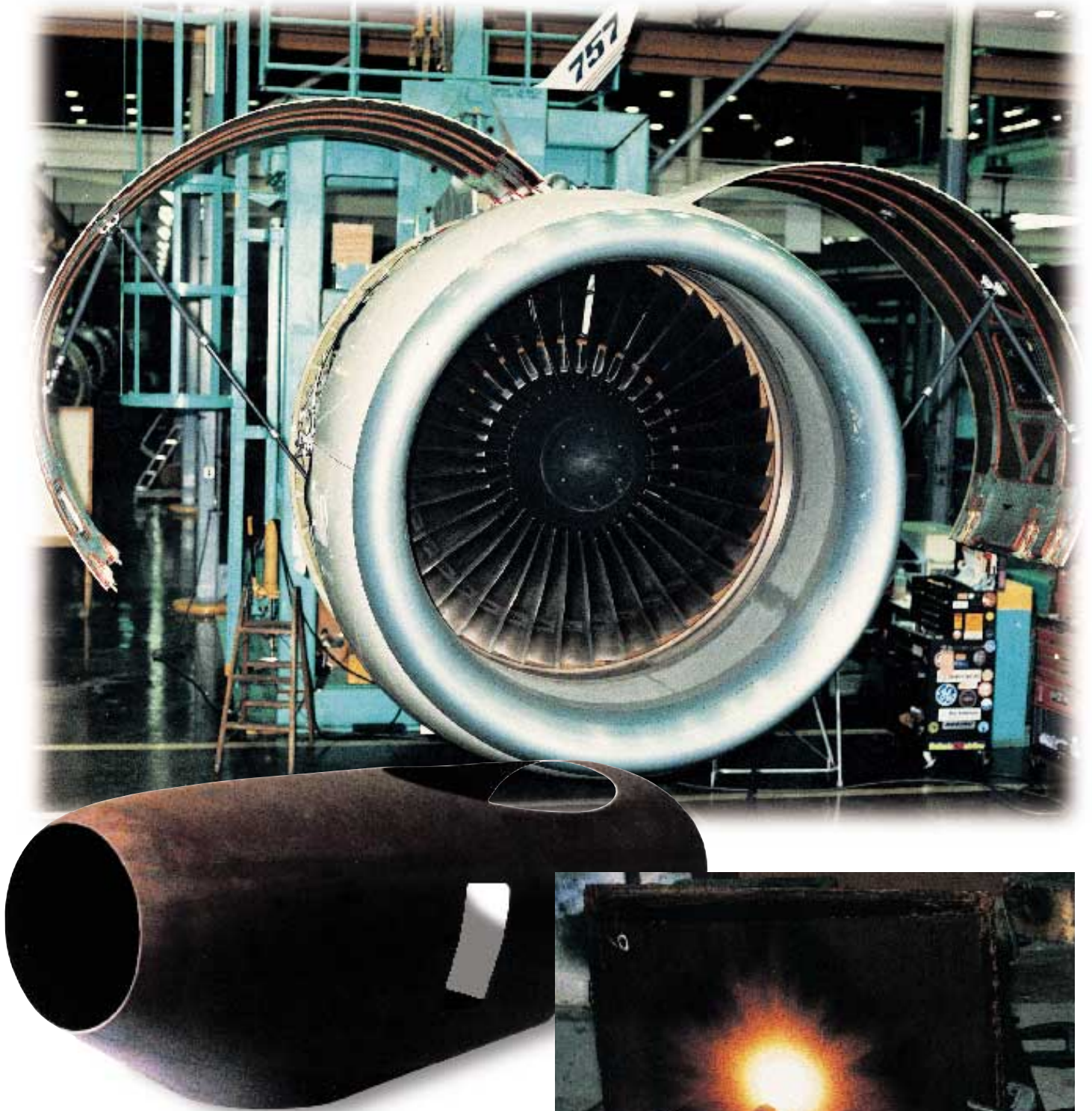
## ***Electrical Properties***

Nextel fiber's high electrical resistance at elevated temperatures, low shrinkage and low moisture absorption characteristics make it excellent for high temperature electrical insulation applications. Nextel fibers contain no residual acids or chlorides to leach out and cause etching of metal.

## ***Commercial Aviation Applications***

- Boeing 777\*    • MD90\*\*
- Boeing 747\*    • MD11\*\*
- Boeing 727\*    • DC10\*\*
- Boeing 757\*    • Airbus 300†
- MD80\*\*        • Airbus 340†

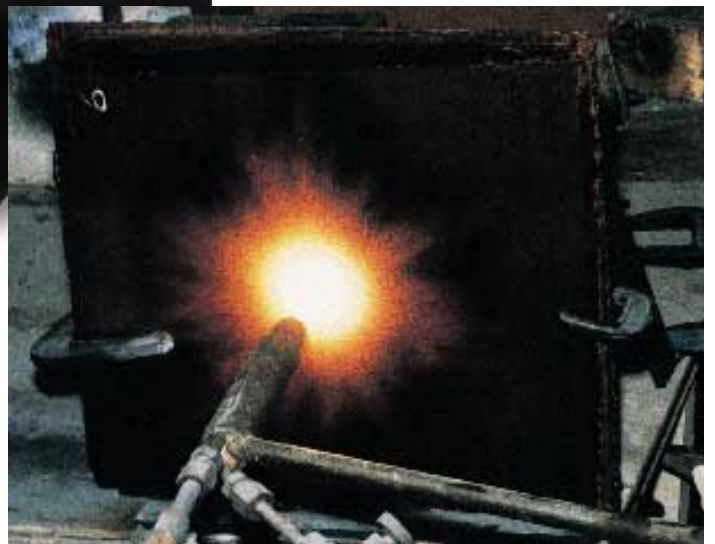




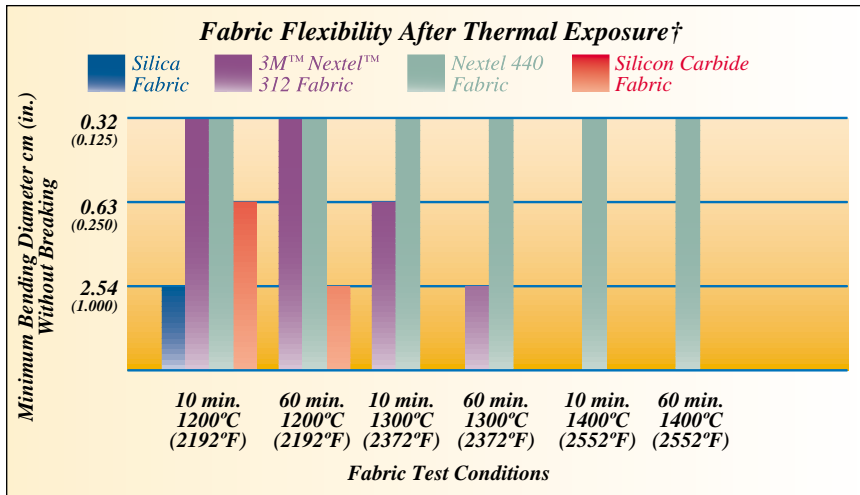
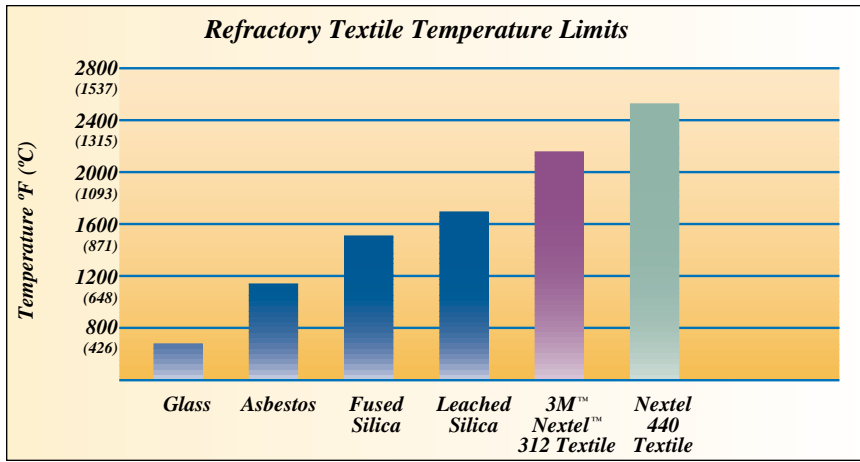
*Top: Potential aircraft applications are fan cowl door insulators, struts, thrust reversers, and in engines as fire walls.*

*Above: AOE duct can be incorporated by pre-pregger with phenolic or epoxy resin to use a laid-up composite panel or structure.*

- Engines
- Ducting
- Firewall



*Above, FAA Firewall Test: According to FAA fireproofing regulations, commercial engine cowlings must be capable of withstanding a fuel-fed flame of 2000°F for 15 minutes without flame penetration.*



### FAA Firewall Testing

Material	Backside Heat Flux	Backside Peak Temperature	Weight
Stainless Steel*	8.9 BTU/ft. <sup>2</sup> -sec. (100,9 kw/m <sup>2</sup> )	1364°F (740°C)	2.50 lbs./4ft. <sup>2</sup> (1,13 kg/m <sup>2</sup> )
3M Nextel 312 Fabric	5.5 BTU/ft. <sup>2</sup> -sec. (62,4 kw/m <sup>2</sup> )	997°F (536°C)	0.25 lbs./ft. <sup>2</sup> (0,113 kg/m <sup>2</sup> )

Thermal performance using the FAA Flame Penetration Test. Burner Flame temperature of 2054°F (1123°C) and Heat Flux of 16.0 BTU/ft.<sup>2</sup>-Sec. (181,4 kw/m<sup>2</sup>)

\*0.015 in. thickness (0,0381mm)

**Top:** 3M Nextel Textiles are the key element in:

- Gaskets and Seals
- Engines
- Ducting
- Firewalls

**Above:** Silicone coatings can easily be applied to 3M Nextel Fabrics, shown here as blankets, helping to protect against impact from environmental factors.

### Abrasion Resistance

Sample	Weave	Weight	Thickness	Stoll Flex & Abrasion Resistance*	
				w/sizing (Cycles to fail)	w/o sizing (Cycles to fail)
3M Nextel 312 Textile	harness satin	25 oz./yd. <sup>2</sup> (0,85 kg/m <sup>2</sup> )	0.039 in. (0,99 mm)	1580	400
Leached Silica	harness satin	36 oz./yd. <sup>2</sup> (1,22 kg/m <sup>2</sup> )	0.054 in. (1,37 mm)	80	70
Fused Silica	harness satin	8.4 oz./yd. <sup>2</sup> (0,28 kg/m <sup>2</sup> )	0.014 in. (0,35 mm)	25	too brittle

\* The samples were heated at 1472°F (800°C) for 1/2 hour to remove sizing or finish. The standard wear bar on the Stoll tester was replaced with a 1/4 inch (6,35 mm) hex bar for the tests on samples without sizing. The tension applied to the sample was 1/2 pound (0,226 kg) for all tests.

†Reprinted from the SAMPE Quarterly, Vol. 17, No. 1, October 1985. Strength and Flexibility Properties of Ceramic Fabrics, Paul M. Sawko and Huy Kim Tran.

Property	Units	3M™ Nextel™ 312	Nextel 440	Nextel 550	Nextel 610	Nextel 720
Use Temperature	—	2200°F	2500°F	2200°F	2200°F	2200°F
Filament Diameter	μm	10-12	10-12	10-12	10-12	10-12
Crystal Size	nm	<500	<500	<500	<500	<500
Crystal Type		9Al <sub>2</sub> O <sub>3</sub> :2B <sub>2</sub> O <sub>3</sub> + amorph. SiO <sub>2</sub>	gamma Al <sub>2</sub> O <sub>3</sub> + mullite + amorph. SiO <sub>2</sub>	gamma/delta Al <sub>2</sub> O <sub>3</sub> + amorph. SiO <sub>2</sub>	alpha Al <sub>2</sub> O <sub>3</sub>	alpha Al <sub>2</sub> O <sub>3</sub> + mullite
Density	g/cc	2.70	3.05	3.03	3.88	3.40
Filament Tensile Strength (51mm gage)	MPa	1700	2000	2000	2930	2100
Filament Tensile Modulus	GPa	150	190	193	373	260
Surface Area	m <sup>2</sup> /g	<.2	<.2	<.2	<.2	<.2
Composition	wt%	62 Al <sub>2</sub> O <sub>3</sub> 24 SiO <sub>2</sub> 14 B <sub>2</sub> O <sub>3</sub>	70 Al <sub>2</sub> O <sub>3</sub> 28 SiO <sub>2</sub> 2 B <sub>2</sub> O <sub>3</sub>	73 Al <sub>2</sub> O <sub>3</sub> 27 SiO <sub>2</sub>	>99 Al <sub>2</sub> O <sub>3</sub> .2-.3 SiO <sub>2</sub> .4-.7 FeO <sub>3</sub>	85 Al <sub>2</sub> O <sub>3</sub> 15 SiO <sub>2</sub>
Thermal Expansion (100-1100°C)	ppm/°C	3 (25-500°C)	5.3	5.3	7.9	6.0
Dielectric Constant (@ 9.375 Ghz)		5.2	5.7	~5.8	~9.0	~5.8

***3M is a technology leader in providing advanced ceramic materials for high temperature applications. Discover how our products can expand your design capabilities to meet new performance requirements.***

**IMPORTANT NOTICE TO PURCHASER**

All statements, technical information, and recommendations contained in this brochure are based on tests conducted with 3M approved equipment, and are believed to be reliable. However, the accuracy or completeness of the tests is not guaranteed. THE FOLLOWING IS MADE IN LIEU OF ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE: The seller's and manufacturer's only obligation will be to replace the quantity of the product proved to be defective. Neither the seller nor 3M will be liable for any injury, loss or damage, direct or consequential, arising out of the use of or the inability to use the product. Before using, the user must determine the suitability of the product for his or her intended use.

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\*\*Trademark of McDonald Douglas Corporation.

†Trademark of Airbus Industrie.



**Ceramic Fiber Products**

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10% post-consumer  
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