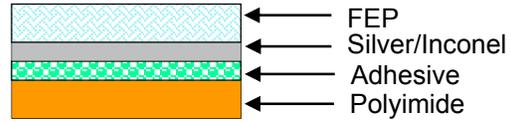


## PRODUCT BULLETIN



## Silver Coated FEP Reinforced with Polyimide

Silver coated FEP film is often used as the outer layer of a MLI blanket. In many applications, the outer layer needs to provide more structural stability than FEP film offers. We offer a family of products of polyimide reinforced FEP sheets. The typical sheet size is 46 inches (1.17 m) wide and 10 feet (3 m) long. The table below provides technical data on just two of the possible constructions. Options available for this product include:

- Choice of FEP film thickness from 2 mil to 10 mil
- Choice of polyimide film thickness from 0.5 to 5 mil or use of 100XC, 100CB, 160XC, or 275XC Kapton®
- Choice of adhesive: A528 polyester thermosetting, conductive polyester thermosetting, or acrylic 3M™ 966 pressure sensitive
- Addition of ITO to the FEP surface
- Addition of aluminum or gold coating to the polyimide surface
- Manufacturing the silver coated FEP wider than the polyimide for access to the silver coating for grounding purposes

## PRODUCT CHARACTERISTICS

| Parameter                               | Specified Value                          |  |
|---|--|--|
| FEP Thickness                           | 2 mil (51 μm)                            | 5 mil (127 μm)                           |
| Polyimide thickness                     | 2 mil (51 μm)                            | 2 mil (51 μm)                            |
| Adhesive                                | A528 Thermoset                           | A528 Thermoset                           |
| Intermittent temperature range          | -185° C to 205° C<br>(-300° F to 400° F) | -185° C to 205° C<br>(-300° F to 400° F) |
| Continuous temperature range            | -185° C to 150° C<br>(-300° F to 300° F) | -185° C to 150° C<br>(-300° F to 300° F) |
| FEP side emittance ( $\epsilon$ )       | $\geq 0.60$                              | $\geq 0.75$                              |
| FEP side solar absorptance ( $\alpha$ ) | $\leq 0.09$                              | $\leq 0.09$                              |
| Item number                             | 147371                                   | 147355                                   |

LAMINATES



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## POST PROCESSING - PERFORATION

This product may be processed after combining to enhance its functionality. To facilitate air passage during launch, the laminate may be Perforated. For constructions with ITO, the FEP may be Perforated prior to coating to provide an electrical interconnect between the ITO and the silver coatings. Standard perforation patterns are on pages 14 -22.

## WARRANTY INFORMATION

Multek warrants that our thermal control materials will meet all acceptance testing criteria for one year from the date of shipment (except Germanium, see product bulletin) if the materials have been stored indoors at standard conditions in their original packaging.

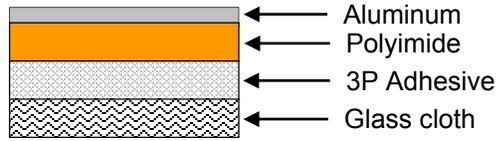
## SHELF LIFE

This product shall meet specified values for a minimum of 12 months after the date of shipment provided that the material is stored in its original unopened container at normal interior temperatures (10° C to 27° C/50° F to 80° F).

The shelf life of the material should be much longer than the warranty period. We recommend retesting any material that is more than one year old (or more than one year since most recent testing) prior to use. This will verify that the material has not been accidentally damaged. Multek offers retest services for a nominal fee.

Multek manufactures a broad range of vacuum deposited films, laminates and tapes. Ask for additional product bulletins describing other Sheldahl® Brand Materials.

The information on this product bulletin is based on data obtained by our research and is considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data and the results obtained from the use thereof. This information is furnished upon the condition that the recipient shall conduct tests to determine the suitability of the product for his or her particular application.



## PRODUCT BULLETIN

### Polyimide - Glass Cloth Laminates Using High Temperature (3P) Adhesive

Sheldahl® Brand Materials polyimide - glass cloth laminates are typically used in launch vehicle applications where resistance to very high temperatures is required. These products have been engineered to withstand temperatures as high as 700° F (370° C) when gold coatings are applied.

These products may be manufactured with any thickness of polyimide film, though 0.5 mil film is used most commonly. The laminates can be manufactured with aluminum or gold on the polyimide side, and aluminized laminates may be protected by our AOC coating for corrosion resistance. The table below gives the characteristics of the two most commonly sold constructions. Please contact our engineers for technical data on other constructions.

### PRODUCT CHARACTERISTICS

| Parameter   | Specified Value  |  |
|---|--|--|
| Construction  | VDA x 0.5 mil Kapton® x 3P adhesive x 116 glass fabric | VDA x 0.5 mil Kapton® x 3P adhesive x 112 glass fabric |
| Intermittent temperature range                          | -250° C to 315° C<br>(-420° F to 600° F)               | -185° C to 260° C<br>(-300° F to 500° F)               |
| Continuous temperature range                            | -185° C to 200° C<br>(-300° F to 400° F)               | -185° C to 200° C<br>(-300° F to 400° F)               |
| Polyimide side normal emittance ( $\epsilon_N$ )        | $\leq 0.05$  | $\leq 0.06$  |
| Polyimide side hemispherical emittance ( $\epsilon_H$ ) | $\leq 0.05$  | $\leq 0.05$  |
| Fabric side solar absorptance ( $\alpha$ )              | $\leq 0.35$  |  |
| Fabric side hemispherical emittance ( $\epsilon_H$ )    | $\leq 0.80$  |  |
| Thickness (in.)   | $\leq 0.0058$  |  |
| Weight (g/m <sup>2</sup> )                              | $\leq 153$   | 115 typ.   |
| Peel strength (lb./in. of width)                        | $\geq 1.0$   | $\geq 1.0$   |
| Tensile strength, Machine direction (PIW)               | $\geq 45$  | $\geq 35$ (fabric)                                     |
| Transverse direction                                    | $\geq 35$  | $\geq 32$ (fabric)                                     |
| Item number   | 146063   | 146066   |
| Multek Specification                                    | G103760  | G127200  |

LAMINATES



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## POST PROCESSING - PERFORATION

This product may be processed after metalizing to enhance its functionality. To facilitate air passage during launch, the laminate may be Perforated. Standard perforation patterns are on pages 14 - 22.

## WARRANTY INFORMATION

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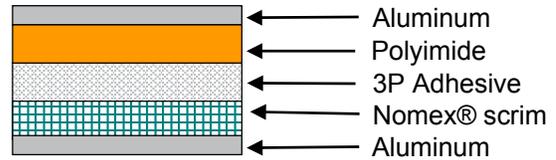
## SHELF LIFE

This product shall meet specified values for a minimum of 12 months after the date of shipment provided that the material is stored in its original unopened container at normal interior temperatures (10° C to 27° C/50° F to 80° F).

The shelf life of the material should be much longer than the warranty period. We recommend retesting any material that is more than one year old (or more than one year since most recent testing) prior to use. This will verify that the material has not been accidentally damaged. Multek offers retest services for a nominal fee.

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## PRODUCT BULLETIN

### Nomex® Reinforced Polyimide High Temperature (3P) Laminate

Sheldahl® Brand Materials reinforced polyimide laminates are often used for the innermost layer of MLI blankets to provide a light weight inner layer that will resist tearing from handling and contact with the spacecraft. This family of laminates uses our proprietary high temperature 3P adhesive to provide superior performance over an extremely broad temperature range.

These products may be manufactured with any thickness of polyimide film, though 0.5 mil film is used most commonly. It can be manufactured with aluminum coated only on the polyimide side, only on the Nomex® side, on both sides, or on neither side. This laminate may also be coated with gold instead of aluminum or we can put our corrosion resistant AOC over the aluminum. The table below gives the characteristics of the two most commonly sold constructions. Please contact our engineers for technical data on other constructions.

### PRODUCT CHARACTERISTICS

| Parameter  | Specified Value                                      |  |
|--|--|--|
| Construction   | VDA x 0.5 mil Polyimide x 3P Adhesive x Nomex® x VDA | 0.5 mil Polyimide x 3P Adhesive x Nomex® x VDA |
| Intermittent temperature range                       | -185° C to 260° C<br>(-300° F to 500° F)             | -185° C to 260° C<br>(-300° F to 500° F)       |
| Continuous temperature range                         | -185° C to 200° C<br>(-300° F to 400° F)             | -185° C to 200° C<br>(-300° F to 400° F)       |
| Polyimide side solar absorptance ( $\alpha$ )        | $\leq 0.14$  | $\sim 0.40$                                    |
| Polyimide side emittance ( $\epsilon$ )              | $\leq 0.07$  |  |
| Nomex® side absorptance ( $\alpha$ )                 | $\leq 0.30$  | $\sim 0.25$                                    |
| Nomex® side hemispherical emittance ( $\epsilon_H$ ) | $\leq 0.30$  | $\leq 0.30$                                    |
| Typical weight (g/m <sup>2</sup> )                   | 66   | 66   |
| Peel strength (lb./in. of width)                     | $\geq 0.4$   | $\geq 0.4$                                     |
| Item number  | 146071   | 146078   |
| Multek Specification                                 | G143400  | G147900  |

LAMINATES



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## **POST PROCESSING – PERFORATION**

This product may be processed after metalizing to enhance its functionality. To facilitate air passage during launch, the laminate may be Perforated. Standard perforation patterns are on pages 14 - 22.

This laminate may also be micro-Perforated (formerly called porolated). This process puts approximately 18,000 pin-prick size holes per square foot into the material and allows the blanket to vent after launch. Many customers prefer this to perforation because the micro-perforation process does not cut through any of the reinforcing threads.

## **WARRANTY INFORMATION**

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## **SHELF LIFE**

This product shall meet specified values for a minimum of 12 months after the date of shipment provided that the material is stored in its original unopened container at normal interior temperatures (10° C to 27° C/50° F to 80° F).

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