

## PRODUCT TECHNICAL DATA

### Saflex® Clear – Polyvinyl Butyral Interlayer

Saflex® interlayers are plasticized polyvinyl butyral (PVB) sheeting produced by Eastman and its affiliates. These interlayers are permanently bonded through a heat and pressure process to two or more pieces of glazing to produce laminates with impact and glass containment properties. Saflex R series formulations of PVB interlayers from Eastman Chemical Company, when in clear form, are branded as “Saflex Clear”. Laminated glasses with the properly selected type of Saflex interlayer are capable of being classified as safety glass in accordance with, but not limited to, various regulations such as ANSI Z26.1, ANSI Z97.1, AS/NZS 2208; CNS 1183, CPSC 16 CFR 1201, EN 12600 and ISO TS29584.

#### Product Overview:

Saflex Clear interlayers, have demonstrably met or exceeded many regulations for laminated safety glazing (including those listed above) when properly selected, laminated, and installed. Saflex Clear interlayers were specifically formulated to provide exceptional durability when exposed to natural weathering, especially when laminate edges are left unprotected from the elements. Saflex Clear interlayers have been shown to be compatible and durable when laminated in intimate contact with most infrared reflective, metal coated glasses. The level of adhesion should be selected in order to meet specific applications requirements. A more detailed listing of Saflex Clear formulations can be found at [www.saflex.com](http://www.saflex.com) or by contacting your local Eastman representatives.

#### Available Forms:

All Saflex interlayers are supplied in roll form on 15.2 cm (6 inch) diameter cores.

Saflex Clear interlayers are supplied in a variety of roll lengths and widths. Most common standard roll length is 250 meters (820 feet). The most common thicknesses are 0.38 mm (0.015 inch), 0.76mm (0.030 inch), 1.14mm (0.045 inch), and 1.52mm (0.060 inch).

Saflex Clear interlayers are produced in various adhesion levels to meet fabrication needs. Saflex Clear interlayers are available only as our conventional R series formulation in clear form. Please contact your Saflex Sales Manager, Technical Service Representative, Customer Service Representative or visit [www.saflex.com](http://www.saflex.com) for further information.

#### Storage Conditions:

Saflex Clear interlayers should be stored inside the moisture barrier bag that the roll is shipped in and maintained within the temperatures recommended in the Saflex laminating guide. It is recommended that the interlayer be used within a two-year period from purchase to minimize the sheet adhering to itself on the roll (blocking).

#### Laminating Conditions:

Eastman makes available to our fabricating customers, a Saflex Laminating Guide which details nominal methods for storage, handling, and lamination. This technical guide is available only from a Saflex Technical Service (TS) Representative or Saflex Sales Manager. To find the name of the Saflex representative for your organization, call 1-800-636-8670.

### Select Saflex® Clear Properties<sup>1</sup>:

| Test         | Technical Data Property          | Test Method     | Units                | Conditions  | Saflex® Clear interlayer |
|--------------|----------------------------------|-----------------|----------------------|-------------|--------------------------|
| Flammability | Extent of Burning                | ASTM D635       | mm                   | -           | 7.9                      |
|              | Flame Spread Index               | ASTM E84        | -                    | -           | 10                       |
|              | Heat of Combustion               | ASTM E1354      | Joules/Kg            | -           | 37                       |
|              | Rate of Burning                  | ASTM D 635      | mm/min<br>°C         | -           | <25                      |
|              | Self-Ignition                    | ASTM D1929      | °C                   | -           | 760                      |
|              | Smoke Density                    | ASTM D2842      | %                    | -           | 5                        |
| Mechanical   | Coefficient of Thermal Expansion | ASTM E831       | 10 <sup>-6</sup> /°C | 30-100°C    | 155                      |
|              | Conductivity, Thermal, K         | ASTM F433       | W/m-°K               | 65°C        | 0.20                     |
|              | Elongation at Failure            | JIS K6771       | %                    | 23°C/50% RH | 205                      |
|              | Emissivity                       | ASTM C1371      |                      | 19.5°C      | 0.94                     |
|              | Modulus of Elasticity (E)        | Calculated      | MPa                  | 60°C/1 Hz   | 1.56                     |
|              | Poisson's Ratio                  | ASTM D638       |                      | 23°C/50% RH | 0.5                      |
|              | Shear Modulus (G') <sup>2</sup>  | See Table Below |                      |             |                          |
|              | Tear Resistance                  | ASTM D1004      | N/cm                 | -           | 112                      |
|              | Tensile strength                 | JIS K6771       | MPa                  | 23°C/50% RH | 27                       |
|              | Young's Modulus (E) <sup>2</sup> | See Table Below |                      |             |                          |

1 - Data supplied on Saflex RB (0.76 mm) formulation in 3 mm clear glass unless otherwise specified.

2 - Shear modulus (G) and Young's modulus data for other temperatures and durations are provided in a separate table at the end of this document.

| Technical Data | Property                     | Test Method | Units             | Test Conditions                            | Saflex® Clear interlayer |
|----------------|------------------------------|-------------|-------------------|--------------------------------------------|--------------------------|
| Optical        | Haze                         | ASTM D1003  | -                 | Clear 3 mm Glass                           | <1                       |
|                | Refractive Index             | ASTM D542   |                   | 23°C                                       | 1.478                    |
|                | Visible Transmittance        | NFRC 300    | D65               | Clear 3 mm Glass                           | 89%                      |
|                | Yellowness Index             | ASTM E313   | -                 | Clear 3 mm Glass                           | <1                       |
| Physical       | Glass Transition Temperature | ---         | °C                | Frequency 1 Hz<br>Heating Rate 3°<br>C/min | 30°C±1                   |
|                | Hardness                     | ASTM2240    | Shore D           | cut/stacked to<br>12.5 mm                  | 52                       |
|                | Moisture                     | EMN         | %                 | -                                          | Target ± 0.05            |
|                | Plasticizer                  | EMN         | PHR               | -                                          | Target ± 2               |
|                | Roll Length                  | EMN         | m                 | -                                          | ordered minimum          |
|                | Specific Gravity/Density     | ASTM D792   | g/cm <sup>3</sup> | 23°C                                       | 1.07                     |
|                | Specific Heat                | ASTM E1269  | Joules/Kg<br>-°K  | 50°C                                       | 1980                     |
|                | Thickness                    | EMN         | mm                | 0.38, 0.76 &<br>1.14 mm<br>1.52 mm         | ±0.025 mm<br>±0.038 mm   |
| Width          | EMN                          | cm          | -                 | Ordered minimum                            |                          |

### Impact Data<sup>3</sup>

| Test                             | Test Method                     | Conditions                           | Saflex® Clear interlayer |
|----------------------------------|---------------------------------|--------------------------------------|--------------------------|
| 5-lb (2,227g) Ball Impact        | ANSI Z26.1; ASTM F3006; ECE R43 | ANSI Z26.1; ASTM F3006; ECE R43      | Comply                   |
| Twin Tyre                        | ISO 29584; EN12600              | 1B1                                  | Comply                   |
| 100 lb (45,359g) Shot Bag Impact | ANSI Z97.1; CPSC 16 CFR 1201    | Class B; Cat I<br>667 N (150 ftlb)   | Comply                   |
| 100 lb (45,359g) Shot Bag Impact | ANSI Z97.1; CPSC 16 CFR 1201    | Class A; Cat II<br>1779 N (400 ftlb) | Comply                   |

3 - Impact data tested on nominal 0.76 mm Saflex R series interlayer.

### Solar Data<sup>4</sup>

| Property                                    | Test Method               | Visible             | Solar             |
|---------------------------------------------|---------------------------|---------------------|-------------------|
| Transmittance                               | ISO 9050/EN410            | 89%                 | 72%               |
| Reflectance                                 | ISO 9050/EN410            | 8%                  | 7%                |
| Absorptance                                 | ISO 9050/EN410            | 4%                  | 21%               |
| Property                                    | Test Method               | Units               | Performance Value |
| Solar Heat Gain Coefficient (SHGC; G value) | NFRC 300                  | n/a                 | 0.79              |
| Sun Protection Factor (SPF)                 | Calculated                | n/a                 | 50+               |
| Light to Solar Gain (LSG)                   | Calculated                | n/a                 | 1.12              |
| U Factor                                    | NFRC 100                  | W/m <sup>2</sup> -K | 5.66              |
| UV Factors                                  | Damage Weighted (Tdw-K)   | 300-500 nm          | 0.30              |
|                                             | Damage Weighted (Tdw-ISO) | 300 – 600 nm        | 0.62              |
|                                             | Transmitted UV NFRC 300   | 300 - 380 nm        | <1%               |

4 - Solar, Thermal, Optical and Color data based on 0.76 mm clear Saflex R interlayer with clear nominal 3 mm glass. Calculations performed using OPTIC and WINDOW 6.0 by Lawrence Berkeley National Laboratory.

**Saflex® Clear - PVB interlayer Shear Storage Modulus**

| Load Duration | Temperature |      |      |      |      |      |      |      |      |
|---------------|-------------|------|------|------|------|------|------|------|------|
|               | 20°C        | 25°C | 30°C | 35°C | 40°C | 45°C | 50°C | 55°C | 60°C |
|               | MPa         |      |      |      |      |      |      |      |      |
| 1 sec         | 26          | 6.9  | 2.1  | 1    | 0.7  | 0.6  | 0.5  | 0.5  | 0.4  |
| 3 sec         | 14          | 3.4  | 1.2  | 0.8  | 0.6  | 0.5  | 0.5  | 0.4  | 0.4  |
| 30 sec        | 3.5         | 1.1  | 0.7  | 0.5  | 0.5  | 0.4  | 0.4  | 0.3  | 0.3  |
| 1 min         | 2.4         | 1    | 0.6  | 0.5  | 0.5  | 0.4  | 0.4  | 0.3  | 0.3  |
| 5 min         | 1.1         | 0.6  | 0.5  | 0.4  | 0.4  | 0.3  | 0.3  | 0.2  | 0.2  |
| 10 min        | 0.9         | 0.6  | 0.5  | 0.4  | 0.4  | 0.3  | 0.2  | 0.2  | 0.2  |
| 30 min        | 0.7         | 0.5  | 0.4  | 0.4  | 0.3  | 0.2  | 0.2  | 0.2  | 0.1  |
| 1 hour        | 0.6         | 0.5  | 0.4  | 0.4  | 0.3  | 0.2  | 0.2  | 0.1  | 0.1  |
| 6 hours       | 0.5         | 0.4  | 0.4  | 0.3  | 0.2  | 0.1  | 0.1  | 0.1  | 0.1  |
| 12 hours      | 0.5         | 0.4  | 0.3  | 0.2  | 0.2  | 0.1  | 0.1  | 0.1  | --   |
| 1 day         | 0.5         | 0.4  | 0.3  | 0.2  | 0.1  | 0.1  | 0.1  | --   | --   |
| 5 days        | 0.4         | 0.3  | 0.2  | 0.1  | 0.1  | --   | --   | --   | --   |
| 1 week        | 0.4         | 0.3  | 0.2  | 0.1  | 0.1  | --   | --   | --   | --   |
| 3 weeks       | 0.3         | 0.2  | 0.1  | 0.1  | 0.1  | --   | --   | --   | --   |
| 1 month       | 0.3         | 0.2  | 0.1  | 0.1  | --   | --   | --   | --   | --   |
| 1 year        | 0.2         | 0.1  | 0.1  | --   | --   | --   | --   | --   | --   |
| 10 years      | 0.1         | 0.1  | --   | --   | --   | --   | --   | --   | --   |
| 15 years      | 0.1         | 0.1  | --   | --   | --   | --   | --   | --   | --   |
| 50 years      | 0.1         | --   | --   | --   | --   | --   | --   | --   | --   |

### Saflex® Clear - PVB interlayer Young's Modulus<sup>5</sup>

| Load Duration | Temperature |      |      |      |      |      |      |      |      |
|---------------|-------------|------|------|------|------|------|------|------|------|
|               | 20°C        | 25°C | 30°C | 35°C | 40°C | 45°C | 50°C | 55°C | 60°C |
|               | MPa         |      |      |      |      |      |      |      |      |
| 1 sec         | 78          | 21   | 6.3  | 3.0  | 2.1  | 1.8  | 1.5  | 1.5  | 1.2  |
| 3 sec         | 42          | 10   | 3.6  | 2.4  | 1.8  | 1.5  | 1.5  | 1.2  | 1.2  |
| 30 sec        | 11          | 3.3  | 2.1  | 1.5  | 1.5  | 1.2  | 1.2  | 0.9  | 0.9  |
| 1 min         | 7.2         | 3.0  | 1.8  | 1.5  | 1.5  | 1.2  | 1.2  | 0.9  | 0.9  |
| 5 min         | 3.3         | 1.8  | 1.5  | 1.2  | 1.2  | 0.9  | 0.9  | 0.6  | 0.6  |
| 10 min        | 2.7         | 1.8  | 1.5  | 1.2  | 1.2  | 0.9  | 0.6  | 0.6  | 0.6  |
| 30 min        | 2.1         | 1.5  | 1.2  | 1.2  | 0.9  | 0.6  | 0.6  | 0.6  | 0.3  |
| 1 hour        | 1.8         | 1.5  | 1.2  | 1.2  | 0.9  | 0.6  | 0.6  | 0.3  | 0.3  |
| 6 hours       | 1.5         | 1.2  | 1.2  | 0.9  | 0.6  | 0.3  | 0.3  | 0.3  | 0.3  |
| 12 hours      | 1.5         | 1.2  | 0.9  | 0.6  | 0.6  | 0.3  | 0.3  | 0.3  | --   |
| 1 day         | 1.5         | 1.2  | 0.9  | 0.6  | 0.3  | 0.3  | 0.3  | --   | --   |
| 5 days        | 1.2         | 0.9  | 0.6  | 0.3  | 0.3  | --   | --   | --   | --   |
| 1 week        | 1.2         | 0.9  | 0.6  | 0.3  | 0.3  | --   | --   | --   | --   |
| 3 weeks       | 0.9         | 0.6  | 0.3  | 0.3  | 0.3  | --   | --   | --   | --   |
| 1 month       | 0.9         | 0.6  | 0.3  | 0.3  | --   | --   | --   | --   | --   |
| 1 year        | 0.6         | 0.3  | 0.3  | --   | --   | --   | --   | --   | --   |
| 10 years      | 0.3         | 0.3  | --   | --   | --   | --   | --   | --   | --   |
| 15 years      | 0.3         | 0.3  | --   | --   | --   | --   | --   | --   | --   |
| 50 years      | 0.3         | --   | --   | --   | --   | --   | --   | --   | --   |

5 - Young's modulus  $E'$  is calculated using formula  $E' = 2G'(1+\nu)$  where  $\nu$  = Poisson's ratio of approximately 0.50 for isotropic polymeric material.

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