

3M™ Scotch-Weld™ AF 3090 TEF

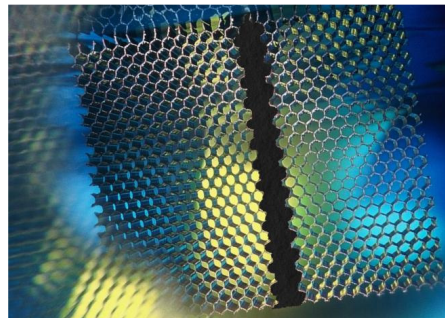
Core Splice Film

Product Description

3M™ Scotch-Weld™ AF 3090 TEF is an epoxy based, heat curing, expandable adhesive film, designed to give very good bond properties in both metal and composite bonding. Within the core splice film product class, it features unique impact and peel strength which makes it very tough and resistant to cracking and fracturing. Therefore, AF 3090 TEF is an outstanding product for edge-finishing of sandwich structures to eliminate cracking and repairs during manufacturing and use of these structures. Impact forces are dampened due to the flexible nature of the material. Scotch-Weld™ AF 3090 TEF provides excellent wide-bondline and gap-filling properties as it expands up to 120 % during cure. It is used for core splicing, reinforcing honeycomb, or filling of mismatched bond surface areas.

Key Features

- Low density, expandable adhesive film
- Curable / co-curable between 120 °C and 180 °C
- Unique impact and peel strength due to flexibility
- Excellent gap-filling properties
- 12 months shelf life at -18 °C, 20 days shop life



Product Characterization

All technical data and information in this data sheet should be considered representative or typical only and should not be used for specification purposes.

General properties

Form	Unsupported film
Colour	Black
Chemical base	Modified epoxy
Film thickness	1.27 ± 0.13 mm (50 mil)
Mass per unit area	1375 ± 150 g/m ²
Volatiles content	< 1 % (120 °C or 180 °C cure)
Available packaging sizes	Sheets (560 x 300 mm ²)

Product Performance

Properties of cured film	120 °C cure	180 °C cure	Test method
Expansion during cure ^(a)	40 – 70 %	60 – 120 %	EN 2667-3
Vertical flow during cure	< 0.5 mm	< 0.5 mm	EN 2667-4
Density (typical values)	0.75 g/cm ³	0.67 g/cm ³	

^(a) depending on heat-up rate

Tube shear strength and ageing properties

The tube shear strength has been determined on Scotch-Weld™ AF 3090 TEF using the procedures outlined in EN 2667-2. Specimens were prepared by placing 50 g ± 0.2 g of AF 3090 TEF between the walls of two 228 mm long tubes. Tube shear resistance is calculated by the following formula:

$$\sigma [MPa] = \frac{F}{\pi d_{inner} h}$$

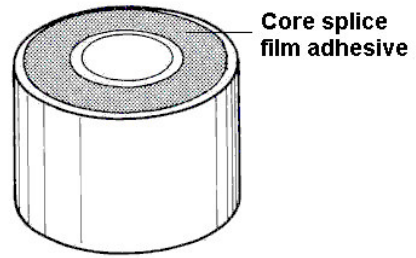
Aluminium tubes were sulfochromic etched before use.

The adhesive film in the tubes was cured under atmospheric pressure using two different cure cycles:

Cure cycle A: 125 °C for 60 minutes, heat-up rate 3 °C/min

Cure cycle B: 175 °C for 60 minutes, heat-up rate 3 °C/min.

To investigate ageing properties of Scotch-Weld™ AF 3090 TEF, tube shear specimens were prepared as described above. The samples were exposed to different media and temperatures for the given times.



Outer and inner tubes: 230 mm long tubes, aluminium alloy 5052-0 bare. Outer tube: diameter 25.0 mm, thickness 1.25 mm. Inner tube: diameter 12.5 mm, thickness 1.25 mm.

	Test temperature	Exposure time	Medium and temperature	Cure cycle A	Cure cycle B
Tube shear strength EN 2667-2	-55 °C	--	Initial	10.1 MPa	7.0 MPa
	23 °C	--	Initial	11.1 MPa	10.3 MPa
	80 °C	--	Initial	6.6 MPa	6.6 MPa
Tube shear strength after ageing EN 2667-2	23 °C	1000 h	Dry heat, 80 °C	10.2 MPa	9.6 MPa
	23 °C	750 h	Dry heat, 120 °C	10.4 MPa	--
	23 °C	1000 h	Demineralized water, 23 °C	9.5 MPa	8.9 MPa
	23 °C	750 h	Demineralized water, 40 °C	9.5 MPa	--
	23 °C	750 h	95 % humidity, 70 °C	9.4 MPa	--
	23 °C	750 h	5 % NaCl salt spray, 35 °C	10.6 MPa	--
	23 °C	1000 h	Jet fuel F35, 23 °C	10.6 MPa	9.7 MPa
	23 °C	1000 h	Tri-N-butyl phosphate, 23 °C	9.3 MPa	8.3 MPa
	23 °C	1000 h	Lubrication oil O-160, 23 °C	11.2 MPa	10.0 MPa

Overlap shear strength

Overlap shear strength of Scotch-Weld™ AF 3090 TEF has been determined on sulfochromic etched aluminium panels. A defined gap, which had to be filled by the expanding film during cure, was adjusted by placing metal shims between the substrates. The adhesive was cured 60 minutes at 127 °C with a heat-up rate of 5 °C/min. Failure mode was cohesive in each case.

	Test temperature	Gap to be filled	Results
Overlap shear strength ASTM D1002 Clad aluminium 2024 T3, 1.6 mm thick Overlap: 25.4 mm x 12.7 mm	24 °C	0.07 mm	32 MPa
	24 °C	Wedged bond line: 0.18 – 0.34 mm	20 MPa
	24 °C	0.64 mm	17 MPa
	24 °C	Wedged bond line: 0.67 – 0.71 mm	19 MPa
	24 °C	1.6 mm	14 MPa

The following table contains overlap shear data for different temperatures, hot-wet ageing and different gap sizes.

	Test temperature	Gap to be filled	Ageing	Results
Overlap shear strength ASTM D1002 Clad aluminium 2024 T3, 1.6 mm thick Overlap: 25.4 mm x 25.4 mm	-54 °C	0.8 mm	--	15 MPa
	24 °C	0.8 mm	--	14 MPa
	82 °C	0.8 mm	--	12 MPa
	24 °C (wet)	0.8 mm	30 days 95 – 100 % r. h. at 49 °C	14 MPa
	-54 °C	1.6 mm	--	12 MPa
	24 °C	1.6 mm	--	15 MPa
	82 °C	1.6 mm	--	9 MPa
	24 °C (wet)	1.6 mm	30 days 95 – 100 % r. h. at 49 °C	14 MPa

Floating roller peel strength

Floating roller peel samples were prepared analogue to the method described in the preceding chapter.

	Test temperature	Gap to be filled	Results
Floating roller peel strength ASTM D5167 Clad aluminium 2024 T3 Rigid: 1.6 mm, flexible: 0.6 mm thick	-54 °C	0.8 mm	114 N / 25 mm
	24 °C	0.8 mm	109 N / 25 mm
	82 °C	0.8 mm	144 N / 25 mm
	-54 °C	1.5 mm	92 N / 25 mm
	24 °C	1.5 mm	101 N / 25 mm
	82 °C	1.5 mm	145 N / 25 mm

The influence of different cure cycles has been investigated on samples with a gap of approximately 0.4 mm.

Cure cycle A: 125 °C for 60 minutes, heat-up rate 3 °C/min

Cure cycle B: 175 °C for 60 minutes, heat-up rate 3 °C/min.

	Test temperature	Cure cycle A	Cure cycle B
Floating roller peel strength EN 2243-2 Clad aluminium 2024 T3, rigid: 1.6 mm, flexible: 0.6 mm thick	23 °C	293 N / 25 mm	195 N / 25 mm

Impact properties

Impact strength was determined using modified ASTM D-950 test method and etched 2024 T3 bare aluminium specimens with a 25 x 25 mm² bond area (cure cycle A, pressure 100 kPa). Hard shims were used to control expansion to a certain level.

	Test temperature	35 % expanded	10 % expanded
Impact strength ASTM D-950	23 °C	22 kJm ²	64 kJm ²

Handling, Application, Storage

Precautionary Information

Refer to product label and Material Safety Data Sheet (MSDS) for health and safety information before using this product. For MSDS visit our website www.3M.com/msds.

Instructions for use

Process step	Instruction
Surface preparation	<p>A thoroughly cleaned, dry, grease-free surface is essential for maximum performance. Cleaning methods which will produce a continuous water film on a metal surface are generally satisfactory. However, the necessary amount of surface preparation depends on the user's required bond strength and environmental ageing resistance. The results given in this data sheet were determined using an optimized FPL etching process:</p> <ol style="list-style-type: none">1) Degrease with methyl ethyl ketone.2) Immerse 10 to 20 minutes in alkaline degreasing 8 % Oakite 164 solution at 85 ± 5 °C.3) Rinse in tap water.4) Sulfochromic immersion (10 minutes) at 70 ± 2 °C: 27.5 wt.% of H₂SO₄; 7.5 wt.% of Na₂Cr₂O₇ · 2 H₂O; 65 wt.% of demineralised water; 0.5 g/l aluminium; 1.5 g/l CuSO₄ · 5 H₂O.5) Rinse in tap water.6) Dry 15 minutes at 23 ± 2 °C.7) Dry 10 minutes minimum at 60 C maximum. <p>Caution: Use adequate respiratory, eye and skin protection when using etch solutions.</p>
Film application	<p>Care must be taken when handling AF 3090 TEF at low temperatures because it can easily crack. Warm AF 3090 TEF to ambient conditions in the sealed package to prevent moisture condensation on the adhesive surface.</p> <ol style="list-style-type: none">1) Cut portion of film to be used with protective liners in place.2) Remove paper liner from one side of the film.3) Place film on metal or edge of honeycomb core using the remaining liner as a protective cover.4) On metal surfaces, roll film into position with a rubber roller to ensure that no air is entrapped between the film and the metal5) Remove second protective liner.6) Assemble parts and cure.
Suggested cure cycle	<p>The tack, flow, and cure initiation temperature of Scotch-Weld™ AF 3090 TEF is a time-temperature relationship and depends upon the rate of heat input. The rate of heat input also affects the degree of expansion.</p> <p>To obtain optimum performance, the core splice adhesive film should be cured under pressure, using an autoclave or a heat press. Cure time: 60 minutes at a temperature between 120 °C and 180 °C. Heat-up rate: 3 – 5 °C/min.</p>
Storage	<p>When stored at -18 °C or below, this product has a shelf life of 12 months from date of shipment. Scotch-Weld™ AF 3090 TEF offers a room temperature stability of 20 days when exposed in controlled conditions (23 ± 2 °C, 50 ± 5 % r. h.). Please note that room temperature exposures are accumulative.</p>

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Reference: 127