Scotch-Weld™
Core Splice Adhesive Film
AF 3002

Technical Data

Introduction
3M™ Scotch-Weld™ Core Splice Adhesive Film AF 3002 is a 250-350°F (121-177°C) curing, low density, expandable product designed for the purpose of filling mismatched areas, and for splicing and reinforcing honeycomb core. Scotch-Weld AF 3002 is compatible with many 3M™ Scotch-Weld™ Structural Adhesive bonding films, including AF 110, AF 111, AF 126, AF 126-2, AF 130, AF 131, AF 143, AF 147, and AF-163-2. Data developed on this product indicates that it has high performance over the -67°F to 250°F (-55°C to 121°C) temperature range when cured at 250°F (121°C) and high performance over a -67°F to 350°F (-55°C to 177°C) temperature range when cured at 350°F (177°C).

Description

<table>
<thead>
<tr>
<th>Color:</th>
<th>White to light tan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base:</td>
<td>Modified epoxy</td>
</tr>
<tr>
<td>Form:</td>
<td>Unsupported film (with a heavy green plaid printed backing liner and a thin, rose-colored polyethylene separator liner)</td>
</tr>
<tr>
<td>Normal Caliper Range:</td>
<td>50 ± 5 mils (without liners)</td>
</tr>
<tr>
<td>Normal Uncured Density Range:</td>
<td>50 ± 5 lbs./cubic foot</td>
</tr>
<tr>
<td>Normal Weight Range:</td>
<td>0.165 - 0.255 lbs./sq. ft. (calculated from above caliper and density ranges)</td>
</tr>
<tr>
<td>Volatile Loss on Cure:</td>
<td>Less than 1% after 1 hour at 250°F (121°C) with a 10°F/minute warmup rate.</td>
</tr>
<tr>
<td>Suggested Cure Cycle for a 50 mil Thickness:</td>
<td>250°F (121°C) for 60 minutes with a 10°F/minute warmup rate</td>
</tr>
<tr>
<td>Cured Film Thickness:</td>
<td>a.) 250°F (121°C Cure, 70 mils (approx.)</td>
</tr>
<tr>
<td></td>
<td>b.) 350°F (177°C Cure, 80 mils (approx.)</td>
</tr>
</tbody>
</table>

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.
Scotch-Weld™
Core Splice Adhesive Film
AF 3002

<table>
<thead>
<tr>
<th>Product Performance</th>
<th>Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.</th>
</tr>
</thead>
</table>

1. **Cured Density:**

   The free film cured density for 3M™ Scotch-Weld™ Core Splice Adhesive Film AF 3002 has been determined using the specific gravity method outlined in 3M Test Method C-2310-2.

   **Cure Cycle A:** 250°F (121°C) – 0 psig – 60 min. – 10°F/min. warmup.
   **Cured Density:** 40 lbs./cubic foot (approx.).

   **Cure Cycle B:** 350°F (177°C) – 0 psig – 60 min. – 10°F/min. warmup.
   **Cured Density:** 35 lbs./cubic foot (approx.).

2. **Per Cent Expansion During Cure:**

   The free film per cent volume expansion during cure for Scotch-Weld AF 3002 has been determined from the change in specific gravity in going from the uncured to the cured state as outlined in 3M Test Method C-276.

   **Cure Cycle A:** 250°F (121°C) – 0 psig – 60 min. – 10°F/min. warmup.
   **Per Cent Volume Expansion:** 35% (approx.).

   **Cure Cycle B:** 350°F (177°C) – 0 psig – 60 min. – 10°F/min. warmup.
   **Per Cent Volume Expansion:** 55% (approx.).

3. **Splice Delamination Strength:**

   Splice delamination strength has been determined on Scotch-Weld AF 3002 in accordance with the procedure outlined in MIL-C-7438F para. 4.7.9.

   **Core:** 5052 alloy – 1/4" cell – 0.004" foil – 5/8" thick – nonperforated.

   **Specimen:** 5" x 10" (core ribbon perpendicular to ten inch dimension).

   **Splice Position:** Centered and perpendicular to the 10" dimension running the full width of the specimen.

   **No. of layers:** Two (for smaller cell sizes single layers of film are suggested).

   **Load Rate:** 0.25"/minute.

   **A. Cure Cycle:** 250°F (121°C) – 0 psig – 60 min. – 10°F/min. warmup.

   **B. Cure Cycle:** 350°F (177°C) – 0 psig – 60 min. – 10°F/min. warmup.

<table>
<thead>
<tr>
<th>Test Temperature</th>
<th>MIL-C-7438F Requirement</th>
<th>Cure A strength</th>
<th>Cure B strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>75°F (24°C)</td>
<td>40 lbs.</td>
<td>50-100 lbs. Core failure</td>
<td>50-100 lbs. Core failure</td>
</tr>
</tbody>
</table>

**Note:** Width of range is a result of strength variation of core node bonds which normally fail at lower loads than the strength of the splice.
Product Performance (continued)

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

4. Overlap Shear Strength:

The overlap shear strength of 3M™ Scotch-Weld™ Core Splice Adhesive Film AF 3002 has been determined using the procedures outlined in MMM-A-132A and under the following conditions.

Metal: 2024T3 Alclad aluminum 4" x 7" x 0.063".

Cure Cycle: 250°F (121°C) – 50 psi – 60 min. – 10°F/min. warmup.

Load Rate: 0.1"/minute.

Specimen Size: 0.5 inch lap joint.

Results: The following typical, individual results were obtained at the temperature specified after 10 minutes at that temperature.

<table>
<thead>
<tr>
<th>Test Temperature</th>
<th>-67°F (-55°C)</th>
<th>75°F (24°C)</th>
<th>180°F (82°C)</th>
<th>250°F (121°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1820 psi</td>
<td>1760 psi</td>
<td>1980 psi</td>
<td>1060 psi</td>
</tr>
<tr>
<td></td>
<td>1780 psi</td>
<td>1660 psi</td>
<td>1900 psi</td>
<td>1050 psi</td>
</tr>
<tr>
<td></td>
<td>1820 psi</td>
<td>1640 psi</td>
<td>1850 psi</td>
<td>1190 psi</td>
</tr>
<tr>
<td></td>
<td>1780 psi</td>
<td>1630 psi</td>
<td>1720 psi</td>
<td>1230 psi</td>
</tr>
</tbody>
</table>

5. Core Shear Strength:

Core shear strength of Scotch-Weld AF 3002 was determined using a 3" x 8" beam flexure specimen with a splice made with Scotch-Weld AF 3002 located 2" from one end of the flexure specimen as shown below:

Face Sheets: 2024T81 bare aluminum, 0.063" thick.

Core shear strength determined according to MIL-A-24563B using the following conditions:

Load Pad: 1.5" single point load.

Reaction Pads: 3/4".

Load Rate: 0.02"/minute.

Span: 6 inches.

\[
\text{Core Shear} = \frac{P}{b (t + t_c)} \quad \text{Where: } P = \text{Load at failure} \quad t = \text{specimens thickness} \\
\text{Psi} = \frac{\text{Load}}{\text{Area}} \quad b = \text{beam width} \quad t_c = \text{core thickness}
\]
Scotch-Weld™
Core Splice Adhesive Film
AF 3002

<table>
<thead>
<tr>
<th>Product Performance (continued)</th>
<th>Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Results:</td>
</tr>
<tr>
<td></td>
<td>Test Set A</td>
</tr>
<tr>
<td>Honeycomb Adhesive:</td>
<td>Scotch-Weld AF-111 Wt. B – Film Adhesive.</td>
</tr>
<tr>
<td>Honeycomb Core:</td>
<td>1/8” cell, 1/2” thick, 5052 alloy, 0.002” foil, non-perforated.</td>
</tr>
<tr>
<td>Cure Cycle:</td>
<td>250°F (121°C) – 50 psi – 60 min. at temp. – 10°F/minute warmup rate.</td>
</tr>
<tr>
<td>Test Temperature</td>
<td>Core Shear Strength (Ave.)</td>
</tr>
<tr>
<td>-67°F (-55°C)</td>
<td>850 psi</td>
</tr>
<tr>
<td>75°F (24°C)</td>
<td>850 psi</td>
</tr>
<tr>
<td>180°F (82°C)</td>
<td>750 psi</td>
</tr>
<tr>
<td>250°F (121°C)</td>
<td>200 psi</td>
</tr>
<tr>
<td></td>
<td>Test Set B</td>
</tr>
<tr>
<td>Honeycomb Adhesive:</td>
<td>Scotch-Weld AF-131 Film Adhesive.</td>
</tr>
<tr>
<td>Honeycomb Core:</td>
<td>5052 alloy, 1/8” cell, 1/2” thick, 0.002” foil, non-perforated.</td>
</tr>
<tr>
<td>Cure Cycle:</td>
<td>350°F (177°C) – 50 psi – 60 min. – 10°F/min. warmup.</td>
</tr>
<tr>
<td>Test Temperature</td>
<td>Core Shear Strength (psi)</td>
</tr>
<tr>
<td>-67°F (-55°C)</td>
<td>925</td>
</tr>
<tr>
<td>75°F (24°C)</td>
<td>910</td>
</tr>
<tr>
<td>270°F (132°C)</td>
<td>920</td>
</tr>
<tr>
<td>350°F (177°C)</td>
<td>700</td>
</tr>
<tr>
<td></td>
<td>Test Set C</td>
</tr>
<tr>
<td>Honeycomb Adhesive:</td>
<td>Scotch-Weld AF-130 .09 wt. Film Adhesive.</td>
</tr>
<tr>
<td>Honeycomb Core:</td>
<td>2024 alloy, 1/8” cell, 1/2” thick, 0.002” foil, non-perforated.</td>
</tr>
<tr>
<td>Cure Cycle:</td>
<td>350°F (177°C) – 50 psi – 60 min. – 10°F/minute warmup.</td>
</tr>
<tr>
<td>Test Temperature</td>
<td>Core Shear Strength (Ave.)</td>
</tr>
<tr>
<td>350°F (177°C)</td>
<td>716 psi</td>
</tr>
<tr>
<td>400°F (204°C)</td>
<td>565 psi</td>
</tr>
<tr>
<td></td>
<td>Test Set D</td>
</tr>
<tr>
<td>Honeycomb Adhesive:</td>
<td>Scotch-Weld AF-130 .09 wt. Film Adhesive.</td>
</tr>
<tr>
<td>Honeycomb Core:</td>
<td>5052 alloy, 1/8” cell, 1/2” thick, 0.002” foil, non-perforated.</td>
</tr>
<tr>
<td>Core Splice:</td>
<td>2/1/2” from one end, 2 layers of adhesive in a .080” gap.</td>
</tr>
<tr>
<td>Cure Cycle:</td>
<td>350°F (177°C) – 45 psi – 60 min. – 2.5°F and 10°F/min. warmup.</td>
</tr>
<tr>
<td>Test Temperature</td>
<td>Core Shear Strength (Ave.)</td>
</tr>
<tr>
<td>75°F (24°C)</td>
<td>975 psi</td>
</tr>
<tr>
<td>350°F (177°C)</td>
<td>715 psi</td>
</tr>
</tbody>
</table>
Scotch-Weld™
Core Splice Adhesive Film
AF 3002

Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

6. Tube Shear Strength:

The tube shear strength has been determined on 3M™ Scotch-Weld™ Core Splice Adhesive Film using the procedure outlined in 3M Test Method C-280. Tube shear specimens are prepared by placing 45 ± 0.2 grams of Scotch-Weld AF-3002 between the walls of two 9 inch long tubes and curing in an oven.

\[
\text{Test Specimen} \quad \frac{\text{Tube Shear (PSI)}}{0.784} = \frac{P}{P}
\]

Outer Tube – 1” OD, 0.049” thick
5052-0 bare

Inner Tube – 1/2” OD, 0.049” thick
5052-0 bare

\[
\begin{array}{|c|c|c|}
\hline
\text{Cure Cycle A:} & 250^\circ\text{F (121}\ ^\circ\text{C}) & -0 \text{ psig} & -120 \text{ min.} & -7.5^\circ\text{F/min. warmup.} \\
\hline
\text{Cure Cycle B:} & 350^\circ\text{F (177}\ ^\circ\text{C}) & -0 \text{ psig} & -60 \text{ min.} & -7.5^\circ\text{F/min. warmup.} \\
\hline
\text{Test Temperature} & \text{Cure Cycle A} & \text{Cure Cycle B} \\
\hline
75^\circ\text{F (24}\ ^\circ\text{C}) & 1520 \text{ psi} & 2200 \text{ psi} \\
350^\circ\text{F (177}\ ^\circ\text{C}) & 920 \text{ psi} & 1200 \text{ psi} \\
\hline
\end{array}
\]

Tube Density (determined by dividing the volume inside the tubes by the weight of Scotch-Weld AF 3002) = 43 lbs./cu. ft.

Product Application

The product performance data were developed using the following suggested procedures.

I. Surface Preparation

A thoroughly cleaned, dry, grease-free surface is recommended for maximum performance. Cleaning methods which will produce a breakfree water film on metal surfaces are generally satisfactory.

A. Aluminum Skins (3M Company optimized FPL etch, 3M Test Method C-2803).

1. Vapor Degrease – Suspend skins in condensing vapors of perchloroethylene for 5 minutes.
2. Alkaline Degrease – Immerse skins in Oakite No. 164 solution (9-11 oz./gallon water) at 180°F - 200°F (82°C - 93°C) for 10-12 minutes. Rinse in generous quantities of clear, running water.
3. Acid Etch – Place panels in the following solution for 10 min. at 150°F ± 5°F (66°C ± 2°C).

\[
\begin{align*}
\text{Sodium Dichromate (Na}_2\text{Cr}_2\text{O}_7\cdot2\text{H}_2\text{O)} \quad & 4.1 - 4.9 \text{ oz./gallon} \\
\text{Sulfuric Acid, 66° Be} \quad & 38.5 - 41.5 \text{ oz./gallon} \\
2024\text{T-3 aluminum (dissolved)} \quad & 0.2 \text{ oz./gallon minimum} \\
\text{Tap Water as needed to balance} \\
\text{Caution:} \quad & \text{Use adequate respiratory, eye and skin protection when using etch solutions.}
\end{align*}
\]

4. Rinse – Rinse face sheets in clear running tap water.
5. Dry – Air dry 15 minutes; force dry 10 minutes with parts at 150°F ± 10°F (66°C ± 5°C).
B. Aluminum Honeycomb Core

1. Soak in clean aliphatic naphtha* (to conform to TT-N-95A) for five minutes at room temperature. Dry 10 minutes at 150°F ± 10°F (66°C ± 5°C).
2. Optional – Immerse in etching solutions for two (2) minutes at 50°F ± 5°F (10°C ± 2°C). Rinse, air dry and force dry in similar manner to skin panels.

*Note: When using solvents, extinguish all ignition sources and follow the manufacturer’s precautions and directions for use.

II. Film:

Care should be taken to avoid contaminating adhesive and cleaned or primed aluminum by any substance which will hinder wetting action of the adhesive.

Film Application:

1. Cut portion of film to be used from roll with protective liners in place.
2. Remove liner from one side of 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 insure that no air is trapped between the film and metal.
5. Remove second protective liner.
6. Assemble parts and cure. Tack if necessary at 120-180°F (49-82°C).

III. Cure Cycle:

A. General

The tack, flow, expansion, and cure initiation temperature for 3M™ Scotch-Weld Core Splice Adhesive Film AF 3002 is a time-temperature relationship and depends upon the rate of heat input.

Normally, Scotch-Weld AF 3002 will have the following properties:

Tack Temperature: 120-180°F (49-82°C)
Flow Temperature: 180-250°F (82-121°C)
Cure Initiation Temperature: 250°F (121°C)

For a 50 mil layer of Scotch-Weld AF 3002, a minimum cure temperature of 250°F (121°C), is suggested to affect a useful cure in a reasonable length of time (approximately 60 minutes).

B. Cure Cycle (Autoclave or Platen Press) for a 50 mil layer of Scotch-Weld AF 3002.

The following cure cycle is suggested to obtain bond lines which give the strengths reported in the Test Results section.

Cure Cycle: 50 psi, 10°F/min., 60 min. @ 250°F (121°C) or below. Cool to 200°F (93°C) or below before removing pressure.
Storage and Handling

Storage at 40°F (4°C) or below is suggested for 3M™ Scotch-Weld™ Core Splice Adhesive Film AF 3002 to obtain maximum shelf life. Our data indicates, however, that no loss in mechanical properties is obtained after aging at 75°F ± 5°F (24°C ± 2°C) for 7 days.

Care must be taken when handling Scotch-Weld AF 3002 at low temperatures because it can easily crack. Warm Scotch-Weld AF 3002 to ambient conditions in the sealed package to prevent moisture condensation on the adhesive surface.

Precautionary Information

Refer to Product Label and Material Safety Data Sheet for health and safety information before using this product. For additional health and safety information, call 1-800-364-3577 or (651) 737-6501.

For Additional Information

To request additional product information or to arrange for sales assistance, call toll free (800) 235-2376. Our fax number is (417) 869-5219. Address correspondence to: 3M Aerospace Central, 3211 E. Chestnut Expressway, Springfield, MO 65802.

Important Notice

3M MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user’s method of application. Please remember that many factors can affect the use and performance of a 3M Engineered Adhesives Division product in a particular application. The materials to be bonded with the product, the surface preparation of those materials, the product selected for use, the conditions in which the product is used, and the time and environmental conditions in which the product is expected to perform are among the many factors that can affect the use and performance of a 3M product. Given the variety of factors that can affect the use and performance of a 3M product, some of which are uniquely within the user’s knowledge and control, it is essential that the user evaluate the 3M product to determine whether it is fit for a particular purpose and suitable for the user’s method of application.

Limitation of Remedies and Liability

If the 3M product is proved to be defective, THE EXCLUSIVE REMEDY, AT 3M’S OPTION, SHALL BE TO REFUND THE PURCHASE PRICE OF OR TO REPAIR OR REPLACE THE DEFECTIVE 3M PRODUCT. 3M shall not otherwise be liable for loss or damages, whether direct, indirect, special, incidental, or consequential, regardless of the legal theory asserted, including, but not limited to, contract, negligence, warranty, or strict liability.

This Engineered Adhesives Division product was manufactured under a 3M quality system registered to ISO 9002 standards.