Scotch-Weld™
Core Splice Adhesive Film
AF 3002

Technical Data **June, 2002**

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

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

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

Product Performance

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

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.

Test Temperature	MIL-C-7438F Requirement	Cure A strength	Cure B strength
75°F (24°C)	40 lbs.	50-100 lbs. Core failure	50-100 lbs. Core failure

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 .063".

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

Load Rate: 0.1"/minute.

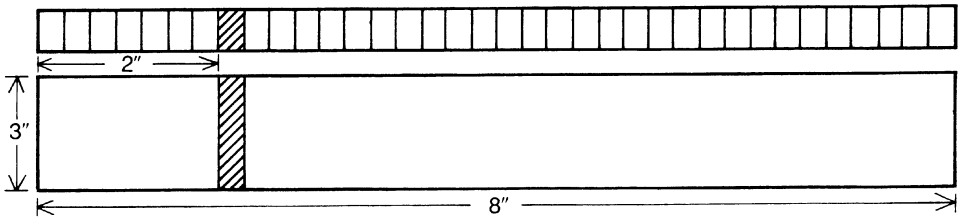
Specimen Size: 0.5 inch^2 lap joint.

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

Test Temperature:	**-67°F (-55°C)**	**75°F (24°C)**	**180°F (82°C)**	**250°F (121°C)**
	1820 psi	1760 psi	1980 psi	1060 psi
	1780 psi	1660 psi	1900 psi	1050 psi
	1820 psi	1640 psi	1850 psi	1190 psi
	1780 psi	1630 psi	1720 psi	1230 psi

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.

Core Shear (psi) $= \frac{P}{b\,(t + t_c)}$ Where: P = Load at failure, b = beam width, t = specimens thickness, t_c = core thickness

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.

Results:

Test Set A

Honeycomb Adhesive: Scotch-Weld AF-111 Wt. B – Film Adhesive.

Honeycomb Core: 1/8" cell, 1/2" thick, 5052 alloy, 0.002" foil, non-perforated.

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

Test Temperature	Core Shear Strength (Ave.)
-67°F (-55°C)	850 psi
75°F (24°C)	850 psi
180°F (82°C)	750 psi
250°F (121°C)	200 psi

Test Set B

Honeycomb Adhesive: Scotch-Weld AF-131 Film Adhesive.

Honeycomb Core: 5052 alloy, 1/8" cell, 1/2" thick, 0.002" foil, non-perforated.

Cure Cycle: 350°F (177°C) – 50 psi – 60 min. – 10°F/min. warmup.

Test Temperature	Core Shear Strength (psi)
-67°F (-55°C)	925
75°F (24°C)	910
270°F (132°C)	920
350°F (177°C)	700

Test Set C

Honeycomb Adhesive: Scotch-Weld AF-130 .09 wt. Film Adhesive.

Honeycomb Core: 2024 alloy, 1/8" cell, 1/2" thick, 0.002" foil, non-perforated.

Cure Cycle: 350°F (177°C) – 50 psi – 60 min. – 10°F/minute warmup.

Test Temperature	Core Shear Strength (Ave.)
350°F (177°C)	716 psi
400°F (204°C)	565 psi

Test Set D

Honeycomb Adhesive: Scotch-Weld AF-130 .09 wt. Film Adhesive.

Honeycomb Core: 5052 alloy, 1/8" cell, 1/2" thick, 0.002" foil, non-perforated.

Core Splice: 2½" from one end, 2 layers of adhesive in a .080" gap.

Cure Cycle: 350°F (177°C) – 45 psi – 60 min. – 2.5°F and 10°F/min. warmup.

Test Temperature	Core Shear Strength (Ave.)	
	2.5°F/min. warmup	**10°F/min. warmup**
75°F (24°C)	975 psi	980 psi
350°F (177°C)	715 psi	740 psi

Product Performance ***(continued)***

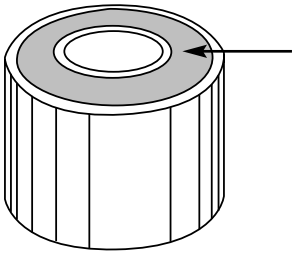
Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.

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.

Test Specimen

Tube Shear (PSI) = $\frac{P}{0.784}$



Core Splice Adhesive

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

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

Cure Cycle A: 250°F (121°C) – 0 psig – 120 min. – 7.5°F/min. warmup.

Cure Cycle B: 350°F (177°C) – 0 psig – 60 min. – 7.5°F/min. warmup.

	Tube Shear Strength	
Test Temperature	**Cure Cycle A**	**Cure Cycle B**
75°F (24°C)	1520 psi	2200 psi
350°F (177°C)	920 psi	1200 psi

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).

Sodium Dichromate ($Na_2Cr_2O_7 2H_2O$)	4.1 - 4.9 oz./gallon
Sulfuric Acid, 66° Be	38.5 - 41.5 oz./gallon
2024T-3 aluminum (dissolved)	0.2 oz./gallon minimum
Tap Water as needed to balance	

   Caution: Use adequate respiratory, eye and skin protection when using etch solutions.
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).

Product Application ***(continued)***

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.

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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 is 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.

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ISO 9002

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

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Aerospace Department
Engineered Adhesives Division
3M Center, Building 220-8E-05
St. Paul, MN 55144-1000
www.3M.com/aerospace

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