3M Scotch-Weld™ Structural Adhesive Film

AF 126-2 • AF 126-3

Technical Datasheet **December 2009**

Introduction

3M™ Scotch-Weld™ Structural Adhesive Films AF 126-2 and AF 126-3 are thermosetting, toughened epoxy adhesive films designed for structural bonding. These unique products offer the following advantages:

- Cure at temperatures as low as 180°F (82°C).
- Excellent strength in metal-to-metal, composite, and honeycomb sandwich applications.
- Low flow during cure.
- Scotch-Weld AF 126-2 Film is qualified to MIL-A-25463 and MMM-A-132.
- Low tack for easy handling.

General

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

Much of the testing for this technical datasheet was generated using the 3M™ Scotch-Weld™ Structural Adhesive Primer EC-2320, which is now obsolete. The following primers are considered to be suitable alternatives:

- 3M™ Scotch-Weld™ Structural Adhesive Primers EC-3917, EC-3924B, EC 3960, EW-5000 or EW-5000AS.

Description

	Scotch-Weld AF 126-2 Film (.03 wt)	**Scotch-Weld AF 126-2 Film (.06 wt)**	**Scotch-Weld AF 126-2 Film (.08 wt)**	**Scotch-Weld AF 126-3 Film (.06 wt)**
Form:	Matte, non-woven, scrim-supported adhesive film			
Color:	Blue/Gray	Blue/Gray	Blue	Green
Nominal Weight:	0.030 lb/ft^2 147 g/m^2	0.060 lb/ft^2 294 g/m^2	0.080 lb/ft^2 392 g/m^2	0.060 lb/ft^2 294 g/m^2
Nominal Caliper:	0.005 in. 0.13 mm	0.010 in. 0.25 mm	0.015 in. 0.38 mm	0.010 in. 0.25 mm
Volatile Content:	Less than 1%			

3M™ Scotch-Weld™
Structural Adhesive Film AF 126-2 • AF 126-3
Technical Datasheet

Product Performance

MMM-A-132 Type I Class 2 Test Data

3M™ Scotch-Weld™ Structural Adhesive Film 126-2 and 126-3 with
3M™ Scotch-Weld™ Structural Adhesive Primer EC-2320

Test Condition	MMM-A-132B Type I Class 2 & 3 Requirement Min. Average		Scotch-Weld AF 126-2 Film / EC-2320 Primer .03 wt (147 g/m²)		Scotch-Weld AF 126-2 Film / EC-2320 Primer .06 wt (294 g/m²)		Scotch-Weld AF 126-2 Film / EC-2320 Primer .08 wt (392 g/m²)		Scotch-Weld AF 126-3 Film / EC-2320 Primer .06 wt (294 g/m²)	
A. Tensile Shear	**psi**	**MPa**	**psi**	**MPa**	**psi**	**MPa**	**psi**	**MPa**	**psi**	**MPa**
1. Normal Temperature, 75°F (24°C)	3500	24.1	4760	32.8	5200	35.8	5584	38.5	5392	37.2
2. 10 minutes @ 180°F (82°C)	2000	13.8	2820	19.4	2890	19.9	3148	21.7	2731	18.8
3. 10 minutes @ -67°F (-55°C)	3500	24.1	4750	32.7	5070	34.9	5915	40.8	6167	42.5
4. Normal Temperature, 75°F (24°C) After 30 Days Salt Water Spray	—	—	4710	32.5	4970	34.2	5689	39.2	4600	31.7
5. Normal Temperature, 75°F (24°C) After 30 Days @ 120°F (49°C) and 95-100% Relative Humidity	3250	22.4	4630	31.9	5000	34.5	5600	38.6	4350	30.0
6. Normal Temperature, 75°F (24°C) After 30 Days Immersion in Tap Water	—	—	4930	34.0	5000	34.5	5726	39.5	4000	27.6
7. Normal Temperature, 75°F (24°C) After 7 Days Immersion in JP-4 Fuel	3250	22.4	4980	34.3	5400	37.2	5646	38.9	5180	35.7
8. Normal Temperature, 75°F (24°C) After 7 Days Immersion in Anti-icing	—	—	4760	32.8	5440	37.5	5711	39.3	5383	37.1
9. Normal Temperature, 75°F (24°C) After 7 Days Immersion in Hydraulic Oil	3250	22.4	4940	34.0	5210	35.9	5829	40.2	4998	34.5
10. Normal Temperature, 75°F (24°C) After 7 Days Immersion in Type III Hydrocarbon Fluid	—	—	5030	34.7	5300	36.5	5706	39.3	4790	33.0

B. Creep Rupture	**Max. Deformation**				
11. Normal Temperature, 75°F (24°C) 192 Hours @ 1600 psi (11.0 MPa)	0.015 inches	0.0001 inches	0.0000 inches	0.0000 inches	0.0000 inches
12. 180°F (85°C) 192 Hours @ 800 psi (5.5 MPa)	0.015 inches	0.0033 inches	0.0026 inches	0.0011 inches	0.0016 inches

C. Fatigue					
13. Normal Temperature, 75°F (24°C) 750 psi @ 10^6 Cycles	no glue line failure	no glue line failure	no glue line failure	no glue line failure	no glue line failure

D. Other Tests						
14. Normal Temperature 75°F (24°C) T-Peel	Class 2:	15 piw (66 N/25mm)	28.5 piw (125 N/25mm)	41.5 piw (182 N/25mm)	35 piw (153 N/25mm)	35.7 piw (156 N/25mm)
	Class 3:	None	None	None	None	None
15. Tensile Shear, 75°F (24°C) Blister Detection	Class 2:	3250 psi (22.4 MPa)	4850 psi (33.4 MPa)	4900 psi (33.8 MPa)	5139 psi (35.4 MPa)	4620 psi (31.9 MPa)
	Class 3:	None	None	None	None	None

Product Performance
MIL-A-25463 Type I Class 1 & 2 Test Data
3M™ Scotch-Weld™ Structural Adhesive Film 126-2 with
3M™ Scotch-Weld™ Structural Adhesive Primer EC-2320

Test Conditions	MIL-A-25643B Type I Requirement Minimum Average		Scotch-Weld 126-2 Film / EC-2320 Primer Average .08 wt. (392 g/m^2)	
1. 75°F (24°C) Sandwich Peel Strength	12.5 in•lb/in	55.6 mN/m	39.5 in•lb/in	175.7 mN/m
2. 180°F (82°C) Sandwich Peel Strength	10.0 in•lb/in	44.5 mN/m	19.7 in•lb/in	87.6 mN/m
3. -67°F (-55°C) Sandwich Peel Strength	10.0 in•lb/in	44.5 mN/m	26.1 in•lb/in	116.1 mN/m
4. 75°F (24°C) Flatwise Tensile Strength	750 psi	5.2 MPa	1150 psi	7.9 MPa
5. 180°F (82°C) Flatwise Tensile Strength	400 psi	2.8 MPa	535 psi	3.7 MPa
6. -67°F (-55°C) Flatwise Tensile Strength	800 psi	5.5 MPa	1427 psi	9.8 MPa
7. 75°F (24°C) Flexural Strength	2100 lb	9340 N	2418 lb	10755 N
8. 180°F (82°C) Flexural Strength (short term)	1275 lb	5671 N	1323 lb	5885 N
9. 180°F (82°C) Flexural Strength (long term)	1500 lb	6672 N	1617 lb	7192 N
10. -67°F (-55°C) Flexural Strength	2150 lb	9563 N	2538 lb	11289 N
11. 75°F (24°C) Creep Deflection in Flexure after 192 hours under 1000 lb (4.45kN) load	0.025 in max	635 microns	0.0018 in max	45.7 microns
12. 180°F (82°C) Creep Deflection in Flexure after 192 hours under 800 lb (3.56kN) load	0.050 in max	1270 microns	0.0018 in max	45.7 microns
13. 75°F (24°C) Flexure Strength after 30 days in 90-100% Humidity @ 120°F (49°C)	1800 lb	8006 N	2339 lb	10404 N
14. 75°F (24°C) Flexure Strength after 30 days in Salt Spray (Fed. Test Method Std. No. 151, method 811)	—	—	2149 lb	9559 N
15. 75°F (24°C) Flexure Strength after 30 days Immersion in Hydrocarbon Fluid (Spec. MIL-S-3136 Type III)	—	—	2377 lb	2377 N

Miscellaneous Test Data

Overlap Shear tests were made as follows:
Material was aged at both 0°F (-18°C), 40°F (4°C) and 75°F (24°C) for the number of days listed. Overlap Shear test coupons were then made as follows: 1/2" (12.7 mm) lap joint specimens of 0.063" (1.6mm) clad 2024-T3 aluminum, using 3M™ Scotch-Weld™ Structural Adhesive Film AF 126-2 - 0.03 wt (147 g/m^2), 0.06 wt (294 g/m^2) and 0.08 wt (392 g/m^2) - with 3M™ Scotch-Weld™ Structural Adhesive Primer EC-2320.

Storage Time and Temperature	Test Condition	Scotch-Weld AF 126-2 Film / EC-2320 Primer .03 wt (147 g/m^2)		Scotch-Weld AF 126-2 Film / EC-2320 Primer .06 wt (294 g/m^2)		Scotch-Weld AF 126-2 Film / EC-2320 Primer .08 wt (392 g/m^2)	
		psi	MPa	psi	MPa	psi	MPa
90 days @ 0°F (-18°C)	75°F (24°C) Shear	5158	35.5	4950	34.1	5150	35.5
	180°F (81°C) Shear	3176	21.9	2373	16.3	3100	21.4
	75°F (24°C) Shear after 30 days immersion in salt spray	5375	37	5125	35.3	5136	35.4
30 days @ 40°F (4.4°C)	75°F (24°C) Shear	5096	35.1	5081	35	5200	35.8
	180°F (81°C) Shear	3240	22.3	3091	21.3	3098	21.3
	75°F (24°C) Shear after 30 days immersion in salt spray	4898	33.7	5233	36.1	5174	35.6
10 days @ 75°F (24°C)	75°F (24°C) Shear	5100	35.1	5283	36.4	5341	36.8
	180°F (81°C) Shear	3353	23.1	3348	23.1	3196	22
	75°F (24°C) Shear after 30 days immersion in salt spray	5134	35.4	5198	35.8	5216	35.9

Overlap Shear Strengths at Elevated Temperatures
Scotch-Weld AF 126-2 Film .06 wt (294 g/m^2) / Scotch-Weld EC-2320 Primer

Test Temperature		Overlap Shear Strength	
		psi	MPa
250°F	121°C	1055	7.3
300°F	149°C	545	3.8
350°F	177°C	310	2.1
400°F	204°C	270	1.9
450°F	232°C	195	1.3
500°F	260°C	170	1.2

Aluminum to Aluminum T-Peel Bonds

The following data shows typical values obtained with the Scotch-Weld AF 126-2 Film / Scotch-Weld EC-2320 Primer system. T-Peel specimens consist of two 8" x 12" x 0.020" (203 mm x 304 mm x 0.508 mm) sheets of 2024-T3 alclad aluminum bonded to each other from which one inch (25.4 mm) strips are cut for testing. Jaw separation rate was 3"/minute (76.2 mm/minute) during testing.

Test Temperature		Scotch-Weld AF 126-2 Film / EC-2320 Primer		Scotch-Weld AF 126-2 Film / EC-2320 Primer		Scotch-Weld AF 126-2 Film / EC-2320 Primer	
		.03 wt	147 g/m^2	.06 wt	294 g/m^2	.08 wt	392 g/m^2
-67°F	-55°C	20 piw	89.0 N/25mm	20 piw	89.0 N/25mm	20 piw	89.0 N/25mm
75°F	24°C	27 piw	120.2 N/25mm	35 piw	155.8 N/25mm	35 piw	155.8 N/25mm
180°F	82°C	25 piw	111.3 N/25mm	20 piw	89.0 N/25mm	20 piw	89.0 N/25mm

Cure Cycle: 1 hour @ 250°F, 50 psi 6-8°F/minute rise (1 hour @ 121°C, 0.35 MPa, 3.3-4.4°C/minute rise).

Miscellaneous Test Data *(continued)*

Titanium (6-4 alloy, 50 mils [1.27 mm])
3M™ Scotch-Weld™ Structural Adhesive Film AF 126-2 .06 wt (294 g/m^2)

3M™ Scotch-Weld™ Structural Adhesive Primer	Average Overlap Shear Strength					
	-67°F	-55°C	75°F	24°C	180°F	82°C
EC-3901	5780 psi	39.8 MPa	4950 psi	34.1 MPa	2950 psi	20.3 MPa
EC-2320	6030 psi	41.5 MPa	4587 psi	31.6 MPa	2410 psi	16.6 MPa
No Primer	5775 psi	39.8 MPa	4413 psi	30.4 MPa	2000 psi	13.8 Mpa

Cure Cycle: 1 hour @ 250°F, 50 psi, 6-8°F/minute rise (1 hour @ 121°C, 0.35 MPa, 3.3-4.4°C/minute rise).

Effect of 350°F (177°C) Post Cure (Etched Aluminum)
Scotch-Weld AF 126-2 Film .06 wt (294 g/m^2) / Scotch-Weld EC-2320 Primer

350°F (177°C) Post Cure Time	75°F (24°C) Overlap Shear	
1 hour	5967 psi	41.1 MPa
Control	5950 psi	41.0 MPa
5 hours	5850 psi	40.3 MPa
Control	6000 psi	41.3 MPa
7 hours	5876 psi	40.4 MPa
Control	6083 psi	41.9 MPa

Cure Cycle: 1 hour @ 250°F, 50 psi, 6-8°F/minute rise (1 hour @ 121°C, 0.35 MPa, 3.3-4.4°C/minute rise).

Blister Detection on Chromic Acid Anodized Panels
Scotch-Weld AF 126-2 Film .06 wt (294 g/m^2) / Scotch-Weld EC-2320 Primer

Test Temperature		Blister Detection (Overlap Shear) Strength	
-67°F	-55°C	3635 psi	25.0 MPa
75°F	24°C	4532 psi	31.2 MPa
180°F	82°C	2232 psi	15.4 MPa

Cure Cycle: 1 hour @ 265°F, 50 psi, 4-5°F/minute rise (1 hour @ 129°C, 0.35 MPa, 2.2-2.8°C/minute rise).

Chromic Acid Anodize After Environmental Aging
Scotch-Weld AF 126-2 Film .06 wt (294 g/m^2) / Scotch-Weld EC-2320 Primer

	Control		Immersed	
Overlap Shear After 30 Days in Salt Spray. Tested at 75°F (24°C)	5830 psi	40.2 MPa	4775 psi	32.9 MPa
Overlap Shear after 30 Days in 100% Relative Humidity. Tested at 75°F (24°C)	6330 psi	43.6 MPa	5275 psi	36.3 MPa

Cure Cycle: 1 hour @ 265°F, 50 psi, 4-5°F/minute rise (1 hour @ 129°C, 0.35 MPa, 2.2-2.8°C/minute rise).

Note: Values are an average of 4 immersed specimens. There was no evidence of undercutting or corrosion on any specimen.

Miscellaneous Test Data *(continued)*

3M™ Scotch-Weld™ Structural Adhesive Film AF 126-2 .06 wt (294 g/m²) / 3M™ Scotch-Weld™ Structural Adhesive Primer EC-2320 L/T Ratios

L/T Ratio Overlap Length	Test Temperature					
	-67°F	-55°C	75°F	24°C	160°F	71°C
8 (0.50", 12,7 mm)	6135 psi	42.3 MPa	6262 psi	43.1 MPa	4295 psi	29.6 MPa
16 (1.00", 25.4 mm)	3712 psi	25.6 MPa	3756 psi	25.9 MPa	3340 psi	23.0 MPa
24 (1.50", 38.1 mm)	2655 psi	18.3 MPa	2607 psi	18.0 MPa	2492 psi	17.2 MPa
40 (2.50", 63.5 mm)	1650 psi	11.4 MPa	1618 psi	11.1 MPa	1552 psi	10.7 MPa
48 (3.00", 76.2 mm)	1380 psi	9.5 MPa	1358 psi	9.4 MPa	1318 psi	9.1 MPa

Cure Cycle: 1 hour @ 250°F, 50 psi, 6-8°F/minute rise (1 hour @ 121°C, 0.35 MPa, 3.3-4.4°C/minute rise).

Metal to Metal Climbing Drum Peel

Scotch-Weld AF 126-2 .06 Film wt (294 g/m²) on Etched Aluminum with Scotch-Weld EC-2320 Primer 20-40 mil (0.508-1.016 mm) face sheets (ASTM D 1781)

Test Temperature		.03 wt	147 g/m²	.06 wt	294 g/m²
75°F	24°C	75 in•lb/in	334 mN/m	95 in•lb/in	423 mN/m

Cure Cycle: 1 hour @ 250°F, 50 psi, 6-8°F/minute rise (1 hour @ 121°C, 0.35 MPa, 3.3-4.4°C/minute rise).

Metal to Metal Climbing Drum Peel

Scotch-Weld AF 126-2 Film .06 wt (294 g/m²) on Chromic Acid Anodized Aluminum with Scotch-Weld EC-2320 Primer 20-40 mil (0.508-1.016 mm) face sheets (ASTM D 1781)

Test Temperature		.03 wt	147 g/m²	.06 wt	294 g/m²
75°F	24°C	73 in•lb/in	325 mN/m	90 in•lb/in	400 mN/m

Cure Cycle: 1 hour @ 250°F, 50 psi, 6-8°F/minute rise (1 hour @ 121°C, 0.35 MPa, 3.3-4.4°C/minute rise).

Overlap Shear

Scotch-Weld AF 126-2 Film .06 wt (294 g/m²) on Etched Aluminum with Scotch-Weld EC-3960 Primer

Test Temperature		.03 wt	147 g/m²
-67°F	-55°C	4900 psi	33.8 MPa
75°F	24°C	5700 psi	39.3 MPa
180°F	82°C	1500 psi	10.3 MPa

Cure Cycle: 1 hour @ 250°F, 50 psi, 6-8°F/minute rise (1 hour @ 66°C, 0.35 MPa, 3.3-4.4°C/minute rise).

Miscellaneous Test Data *(continued)* **Note: The following technical information and data should be considered representative or typical only and should not be used for specification purposes.**

T-Peel Strength

3M™ Scotch-Weld™ Structural Adhesive Film AF 126-2 .06 wt (294 g/m^2) on Etched Aluminum with 3M™ Scotch-Weld™ Structural Adhesive Primer EC-3960

Test Temperature		.06 wt	294 g/m^2
75°F	24°C	40 piw	178 N/25 mm

Volatile Condensible Material for Scotch-Weld AF 126-2 Film

As per NASA SP-R-0022 "Specification-Vacuum Stability Requirements for Polymeric Material for Space Craft Application."

	TWL	VCM
Scotch-Weld AF 126-2 Film	2.62	1.34

TWL = Total weight loss in percent as measured per SP-R-0022A procedure.

VCM = Volatile condensible materials in percent measured using SP-R-0022A procedure.

Aluminum to Aluminum Overlap Shear

All properties were measured on 1" (25.4 mm) wide, 1/2" (12.7 mm) overlap specimens cut from 0.063" x 4" x 7" (1.600 mm x 102 mm x 178 mm) of 2024 T3 alclad aluminum. Tests were conducted per MIL-A-5090D.

Test Temperature		MIL-A-5090D Type I Requirement		Scotch-Weld AF 126-3 Film Unprimed	
-67°F	-55°C	2500 psi	17.2 MPa	5500 psi	37.9 MPa
75°F	24°C	2500 psi	17.2 MPa	5500 psi	37.9 MPa
180°F	82°C	1250 psi	8.61 MPa	2500 psi	17.2 MPa
250°F	121°C	—	—	500 psi	3.45 MPa

Cure Cycle: 1 hour @ 265°F, 50 psi, 4-5°F/minute rise (1 hour @ 129°C, 0.35 MPa, 2.2-2.8°C/minute rise).

Aluminum to Aluminum T-Peel Bonds

The following data shows typical values obtained with the Scotch-Weld AF 126-3 Film. T-Peel specimens consist of two 8" x 8" x 0.020" (203 mm x 203 mm x 0.508 mm) sheets of 2024-T3 alclad aluminum bonded to each other from which one inch (25.4 mm) strips are cut for testing. Jaw separation rate was 3"/minute (76.2 mm/minute)

Test Temperature		Scotch-Weld AF 126-3 Film Unprimed	
-67°F	-55°C	30 piw	134 N/25mm
75°F	24°C	35 piw	156 N/25mm
180°F	82°C	25 piw	111 N/25mm

Cure Cycle: 1 hour @ 265°F, 50 psi, 4-5°F/minute rise (1 hour @ 129°C, 0.35 MPa, 2.2-2.8°C/minute rise).

Miscellaneous Test Data *(continued)*

Aluminum to Aluminum Blister Detection

All properties were measured on 1" (25.4 mm) wide, 1/2" (12.7 mm) overlap blister detection shear specimens cut from 0.063" x 6" x 8" (1.600 mm x 152 mm x 203 mm) of 2024 T3 bare aluminum. Aluminum was FPL etched only. Tests were conducted per MMM-A-132.

Test Temperature FPL etch only		MIL-A-132B Type I, Class 2 Req.		3M™ Scotch-Weld™ Structural Adhesive Film AF 126-3 Unprimed	
-67°F	-55°C	N/A	N/A	4300 psi	29.6 MPa
75°F	24°C	3250 psi	22.4 MPa	4500 psi	31.0 MPa
180°F	82°C	N/A	N/A	2500 psi	17.2 MPa

Cure Cycle: 1 hour @ 265°F, 50 psi, 4-5°F/minute rise (1 hour @ 129°C, 0.35 MPa, 2.2-2.8°C/minute rise).

Floating Roller Peel (ASTM D 3167)

Bare Aluminum to Bare Aluminum

90° peel specimens consist of one 0.063" x 6" x 8" (1.600 mm x 152 mm x 203 mm) of 2024 T3 bare aluminum panel bonded to one 0.025" x 8" x 10" (0.635 mm x 203 mm x 254 mm) 2024 T3 bare aluminum panel which 1/2" (12.7 mm) wide strips are cut for testing. Jaw separation rate was 6"/minute (152 mm/minute).

Test Temperature FPL etch only		Scotch-Weld AF 126-3 Film Unprimed	
-67°F	-55°C	55 piw	245 N/25mm
75°F	24°C	65 piw	289 N/25mm
180°F	82°C	60 piw	267 N/25mm
FPL Etch and Anodize			
-67°F	-55°C	40 piw	178 N/25mm
75°F	24°C	50 piw	223 N/25mm
180°F	82°C	50 piw	223 N/25mm

Cure Cycle: 1 hour @ 265°F, 50 psi, 4-5°F/minute rise (1 hour @ 129°C, 0.35 MPa, 2.2-2.8°C/minute rise).

Miscellaneous Test Data *(continued)*

Honeycomb Sandwich Peel

Honeycomb peel specimens consist of a 1/2" thick 3" x 8" section of honeycomb core to which 0.020" x 3" x 8" (0.508 mm x 76.2 mm x 203 mm) and 0.020" x 3" x 10" (0.508 mm x 76.2 mm x 254 mm) face sheets have been bonded. One face sheet is then peeled from the core on a climbing drum peel test fixture. Jaw separation is 1"/minute (25.4mm/minute) which peels the face sheet from the core at 4"/minute (102 mm/minute).

core: 1/4" (6.35 mm) cell, non-perforated, 1/2" (12.7 mm) thick
5052 alloy, 0.004" (0.102 mm) foil

skins: One (1) 0.020" x 3" x 8" (0.508 mm x 76.2 mm x 203 mm) 2024 T3 bare aluminum
One (1) 0.020" x 3" x 10" (0.508 mm x 76.2 mm x 254 mm) 2024 T3 bare aluminum

Test Temperature FPL etch only		MIL-A-25463 Type I, Required		3M™ Scotch-Weld™ Structural Adhesive Film AF 126-3 Unprimed	
-67°F	-55°C	2 in•lb/in	9 mN/m	17 in•lb/in	75.6 m/Nm
75°F	24°C	8.5 in•lb/in	38 mN/m	17 in•lb/in	75.6 m/Nm
180°F	82°C	5 in•lb/in	22 mN/m	9 in•lb/in	40 m/Nm

Cure Cycle: 1 hour @ 265°F, 50 psi, 4-5°F/minute rise (1 hour @ 129°C, 0.35 MPa, 2.2-2.8°C/minute rise).

Product Application

Surface Preparations

A thoroughly cleaned, dry, grease-free surface is essential for maximum performance. Cleaning methods that produce a break-free water film on metal surfaces are generally satisfactory. Surface preparations should be fully evaluated with the adhesive, especially if resistance to specific environments is anticipated.

Suggested Cleaning Procedures for Aluminum

Aluminum Sheet

1. Alkaline Degrease – Oakite® Aluminum Cleaner 164 solution (9-11 oz/gallon water) at 190°F ± 10°F (88°C ± 5.6°C) for 10-20 minutes. Rinse immediately in large quantities of cold running water.
2. Optimized FPL Etch Solution (1 liter):

Material	Amount
Distilled Water	700 ml plus balance of liter (see below)
Sodium Dichromate	28 to 67.3 grams
Sulfuric Acid	287.9 to 310.0 grams
Aluminum Chips	1.5 grams/liter of mixed solution

To prepare 1 liter of this solution, dissolve sodium dichromate in 700 ml of distilled water. Add sulfuric acid and mix well. Add additional distilled water to fill to 1 liter. Heat mixed solution to 66 to 71°C (150 to 160°F). Dissolve 1.5 grams of 2024 bare aluminum chips per liter of mixed solution. Gentle agitation will help aluminum dissolve in about 24 hours.

To FPL etch panels, place them in the above solution at 150 to 160°F (66 to 71°C) for 12 to 15 minutes.

Note: Review and follow component supplier safety and handling recommendations prior to preparation of this etch solution.

Product Application ***(continued)***

3. Rinse – Rinse panels in clear running water.
4. Dry – Air dry 15 minutes, force dry 10 minutes (minimum) at 140°F (60°C) maximum.
5. It is advisable to bond the freshly cleaned surfaces within 4 hours after surface preparation.

Adhesive Lay-Up

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

Film Application

1. Cut portion of film to be used from roll with protective liner in place.
2. Place film on the primed metal using the separating liner as a protective cover.
3. Roll film into position with a rubber roller insuring that no air is trapped between surface and film.
4. Remove protective liner.
5. Assembly parts and cure.

Primer Application

Priming of bonding surfaces offers two distinct advantages: (1) Priming insures complete wetting of metal surfaces which normally results in superior environmental and low temperature properties and (2) Priming simplifies production by protecting cleaned parts until bonding can be completed. The following system is suggested for spray application.

Spray Gun	DeVilbiss JGA	
Air Cap	Number 78	
Nozzle	AV-15-FX	
Needle	FX	
Line Pressure	35 psi	2.4 bar
Cup Pressure	1-2 psi	.07-.14 bar
Distance from Panel	9 ± 3 inches	22.8 ± 76.2 mm
Primer Thickness (dry)	0.00005-0.0002 inches	0.00127-0.00508 mm

If part design permits, parts may be primed by dipping and draining.

Dry Cycle

The following dry cycle for 3M™ Scotch-Weld™ Structural Adhesive Primer EC-2320 is suggested for use with 3M™ Scotch-Weld™ Structural Adhesive Films AF 126-2 and AF 126-3.

Air Dry:	Air dry at 75-85°F (24-29°C) for a minimum of 30 minutes.
Plus Force Dry:	Circulating air oven with part at 200°F (93°C) for 30 minutes.
OR	
Alternate Dry:	Air dry at 75-85°F (24-29°C) for a minimum of 2 hours.

Product Application ***(continued)***

Cure Cycle

General Cure Requirements

Time, temperature and pressure determine the final bond properties. These properties may also be affected by the type of curing equipment used for each specific application. Curing ovens must be vented to the outdoors. In general, the cure properties of 3M™ Scotch-Weld™ Structural Adhesive Film AF 126-2 and AF 126-3 are as follows:

Cure Pressure

Pressure is required during cure to keep parts in alignment and to overcome distortion and thermal expansion in the adherends. When bonding honeycomb sandwiches utilizing non-perforated core, pressure is required to overcome the thermal expansion of the air contained in each cell of the honeycomb. Honeycomb sections have been bonded successfully with Scotch-Weld AF 126-2 Film using perforated or non-perforated core under pressure of 10-25 psi (68.9-172.3 kPa)

Cure Temperature

The cure temperature may be varied from 180 to 350°F (82-177°C) depending upon the materials being bonded, equipment available and bond properties desired. The film will soften as temperatures are increased and will wet the surface and fillet the core to which it has been applied. A chemical cure will be initiated at 180°F (82°C) and a low strength gel formed. Continued heating chemically converts this gel into a high strength, solvent resistant bond. Cure temperatures in excess of 350°F (177°C) yield usefully, but lower than optimum strengths.

Cure Time

Cure time depends on the cure temperature used, methods of heat application, production, limitations and bond properties required. Since no two bonding operations are exactly alike, it is suggested that a few simple experiments be conducted varying both temperature and cure time to determine optimum conditions for the particular application.

The following cure cycle is suggested to obtain dense glue lines and was used to obtain the strengths reported in the Test Results section:

1. Apply a pressure of 50 psi (0.35 MPa) prior to reaching a bond line temperature of 150°F (66°C) and maintain throughout the cure cycle.
2. Raise the bond line temperature from ambient to 250°F at a rise rate of 6-8°F/minute (121°C @ 3.3-4.4°C/minute).
3. Cure for 60 minutes at 250°F (121°C).
4. Cool to below 200°F (93.3°C) bond line temperature prior release of pressure.

Storage

3M™ Scotch-Weld™ Structural Adhesive Films AF 126-2 and AF 126-3 must be stored at 0°F (-17.8°C) or lower. Allow these product to return to room temperature before using to prevent moisture condensation on the adhesive surface or cracking during handling. Refrigerated storage at 40°F ± 5°F (4.4°C ± 2.2°C) is suggested for 3M™ Scotch-Weld™ Structural Adhesive Primer EC-2320. Primer should be permitted to thoroughly warm to room temperature before using in order to prevent moisture condensation.

The 3M Standard Shelf Life for Scotch-Weld AF 126-2 and AF 126-3 Films are 3 months at 0°F (-18°C) or below.

The out time of* Scotch-Weld AF 126-2 and AF 126-3 Films are:

1. at 40°F (4.4°C) – 30 days
2. at 75°F (24°C) – 10 days
3. at 90°F (32.2°C) – 5 days

*as measured by peel test values.

3M™ Scotch-Weld™
Structural Adhesive Film AF 126-2 • AF 126-3
Technical Datasheet

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, please visit www.3M.com/msds or call 1-800-364-3577 or (651) 737-6501.

For Additional Information

In the U.S., call toll free 1-800-235-2376, or fax 1-800-435-3082 or 651-737-2171. For U.S. Military, call 1-866-556-5714. If you are outside of the U.S., please contact your nearest 3M office or one of the following branches:

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Technical Information

The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.

Product Use

Many factors beyond 3M's control and uniquely within user's knowledge and control can affect the use and performance of a 3M product in a particular application. Given the variety of factors that can affect the use and performance of a 3M product, user is solely responsible for evaluating the 3M product and determining whether it is fit for a particular purpose and suitable for user's method of application.

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