Scotch-Weld™
Structural Adhesive Film
AF 30 (5, 10 and 12 mil)

Technical Data **June, 2002**

Introduction

3M™ Scotch-Weld™ Structural Adhesive Film AF 30 is an unsupported, thermosetting film adhesive developed for structural bonding of metals and high strength plastic laminates (epoxy and phenolic). Some of the advantages of Scotch-Weld AF 30 are:

- High shear strength.
- High peel strength.
- Excellent flexibility and toughness.
- Can be pressure, heat or solvent tacked in position.
- Excellent retention of strength after aging in many environments.
- Excellent adhesion to most metals including aluminum, titanium, stainless steel, cadmium, nickel, brass and others (Must use high pressure).
- Extremely low flow.

Description

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

	5 mil	10 mil	12 mil
Form:	Flexible unsupported film, protected by suitable liner		
Color:	Light Brown	Light Brown	Light Brown
Nominal Caliper:[1]	.005" (.127 mm)	.010" (.254 mm)	.012" (.305 mm)
Weight: (lbs./sq. ft.)	.023-.035 (113-172 g/m^2)	.0500-.0630 (245-309 g/m^2)	.063-.075 (309-368 g/m^2)
Volatile Content:[2]	Less than 6.0%	Less than 6.0%	Less than 6.0%
Shrinkage:[3]	3% maximum	5% maximum	5% maximum

1. Nominal (cured).
2. 2-4 grams sample cured 1 hour @ 350°F (177°C).
3. 24 hours at 75°F (24°C) in a horizontal position.

Scotch-Weld™
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AF 30 (5, 10 and 12 mil)

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

The following product performance data has been obtained in the 3M Laboratory under the conditions specified. All data reported in this section except as noted, were developed under a cure cycle using 150 psi (1.034 MPa) bonding pressure applied by a platen press. A 200°F/minute (111°C/minute) bond line temperature rise from 80°F to 350°F (27°C to 177°C) with 60 ± 1 minutes at 350° ± 2°F (177° ± 1.1°C) was used.

A. Aluminum to Aluminum Overlap Bonds

The following data show typical values obtained with 3M™ Scotch-Weld™ Structural Adhesive Film AF 30 (5 mil) in aluminum overlap bonds. All properties were measured on 1" wide (25.4 mm), 1/2" (12.7 mm) overlap specimens cut from .063" thick 4" x 7" (1.600 mm thick 101.6 mm x 177.8 mm) bonded panels of 2024-T3 clad aluminum. Tests were conducted according to MMM-A-132 and primed with 3M™ Scotch-Weld™ Structural Adhesive Primer EC-1660 (5% solids).

Test	Test Temperature		Min. MMM-A-132 Type I Requirement		Average		Type Failure
Shear Strength	-67 ± 2°F	(-55 ± 1.1°C)	2500 psi	(17.2 MPa)	3400 psi	(23.4 MPa)	Cohesive
	75 ± 2°F	(24 ± 1.1°C)	2500 psi	(17.2 MPa)	4000 psi	(27.6 MPa)	Cohesive
	180 ± 2°F	(82 ± 1.1°C)	1250 psi	(8.6 MPa)	2350 psi	(16.2 MPa)	Cohesive
	250°F	(121°C)	N/A		1400 psi	(9.6 MPa)	Cohesive
	300°F	(149°C)	N/A		1100 psi	(7.6 MPa)	Cohesive

B. Aluminum to Aluminum T-Peel Bonds

T-Peel bonds consist of two primed Scotch-Weld EC-1660 (5% solids) 8" x 8" x .020" (203.2 mm x 203.2 mm x .508 mm) 2024-T3 clad panels together with a 6" x 8" (152.4 mm x 203.2 mm) section of film. This panel is then cut into 1" x 8" (25.4 mm x 203.2 mm) T-Peel specimens which are peeled at a 90° angle to the bond line with a jaw separation rate of 20"/minute (508 mm/minute).

Test Temperature		T-Peel	
-67°F	(-55°C)	8 lb/inch	(35 N/25 mm)
75°F	(24°C)	35 lb/inch	(156 N/25 mm)
180°F	(82°C)	18 lb/inch	(80 N/25 mm)

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.

MMM-A-132 Type I Class 2 Test Data – 3M™ Scotch-Weld™ Structural Adhesive Film AF 30 (10 mil)/ 3M™ Scotch-Weld™ Structural Adhesive Primer EC-1660

The following is a summary and a list of average test results for the structural adhesive system Scotch-Weld AF 30 (10 mil) with primer when bonded specimens were prepared and tested in accordance with Military Specification MMM-A-132, Type 1 Class 2.

Test Condition	MMM-A-132 Type I Class 2 & 3 Requirement Min. Ave.		Scotch-Weld AF 30 (10 mil) with Scotch-Weld EC-1660	
A. Tensile Shear	**psi**	**(MPa)**	**psi**	**(MPa)**
1. Normal Temperature, 75°F (24°C)	2500	(17.2)	4218	(29.1)
2. 10 minutes @ 180°F (82°C)	1250	(8.6)	2440	(16.8)
3. 10 minutes @ -67°F (-55°C)	2500	(17.2)	4140	(28.5)
4. Normal Temperature 75°F (24°C) after 30 days immersion in Salt Water Spray	2250	(15.5)	4000	(27.6)
5. Normal Temperature 75°F (24°C) after 30 days immersion @ 120°F (49°C) and 95-100% Relative Humidity	2250	(15.5)	4240	(29.2)
6. Normal Temperature, 75°F (24°C) after 30 days immersion in Tap Water	2250	(15.5)	4050	(27.9)
7. Normal Temperature, 75°F (24°C) after 7 days immersion in JP-4 Fuel (MIL-T-5624)	2250	(15.5)	3960	(27.3)
8. Normal Temperature, 75°F (24°C) after 7 days immersion in Anti-icing Fluid (MIL-F-5566)	2250	(15.5)	4130	(28.5)
9. Normal Temperature, 75°F (24°C) after 7 days immersion in Hydraulic Oil (MIL-H-5606)	2250	(15.5)	4070	(28.0)
10. Normal Temperature, 75°F (24°C) after 7 days immersion in Type III Hydrocarbon Fluid (MIL-S-3136)	2250	(15.5)	3940	(27.1)
B. Creep Rupture				
11. Normal Temperature, 75°F (24°C) 192 hrs @ 1600 psi (11.0 MPa)	0.015 inches (.381 mm) max. deformation		0.003 inches (.076 mm)	
12. 180°F (82°C), 192 hrs @ 800 psi (5.5 MPa)	0.015 inches (.381 mm) max. deformation		0.006 inches (.152 mm)	
C. Fatigue				
13. Normal Temperature, 75°F (24°C) 750 psi (5.2 MPa) @ 10^6 cycles	No glue line failure		No glue line failure	
D. Other Tests				
14. Normal Temperature, 75°F (24°C) T-Peel	Class 2: 15 piw (66.7 N/25 mm) Class 3:none		37 piw (164.6 N/25 mm)	
15. Tensile Shear, 75°F (24°C) Blister Detection	Class 2: 2250 psi (15.5 MPa) Class 3:none		3885 psi (26.8 MPa)	

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.

Miscellaneous Test Data – 3M™ Scotch-Weld™ Structural Adhesive Film AF 30 (10 mil) / 3M™ Scotch-Weld™ Structural Adhesive Primer EC-1660

Scotch-Weld AF 30 (10 mil) on Anodized Aluminum

Overlap Shear (psi) – Cured @ 330°F, 60 minutes, 100 psi, 5-6°F/minute rise (@ 166°C, 60 minutes, 689 KPa, 2.8-3.3°C/minute rise)

Test Temperature		Scotch-Weld AF 30 / Scotch-Weld EC-1660 (5% solids)	
-67°F	(-55°C)	2300 psi	(15.8 MPa)
75°F	(24°C)	4400 psi	(30.3 MPa)
180°F	(82°C)	2600 psi	(17.9 MPa)
250°F	(121°C)	1855 psi	(12.8 MPa)
300°F	(149°C)	1700 psi	(11.7 MPa)
350°F	(177°C)	1430 psi	(9.9 MPa)

Scotch-Weld AF 30 (10 mil) Low Temperature Cure Test Data

Cured 2 hours @ 250°F, 90 psi, 10°F/minute rise (121°C, 620 KPa, 5.6°C/minute rise)

Test Temperature		Scotch-Weld AF 30 / Scotch-Weld EC-1660 (5% solids)	
-67°F	(-55°C)	1870 psi	(12.9 MPa)
75°F	(24°C)	4290 psi	(29.6 MPa)
180°F	(82°C)	1835 psi	(12.6 MPa)
250°F	(121°C)	1245 psi	(8.6 MPa)
300°F	(149°C)	870 psi	(6.0 MPa)
350°F	(177°C)	1025 psi	(7.1 MPa)

Coefficient of Thermal Expansion – Scotch-Weld AF 30 (10 mil) (Per ASTM D 696)

Below 0°F (-18°C)	540 x 10^{-7}/°F
Above 0°F (-18°C)	1050 x 10^{-7}/°F

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.

Miscellaneous Test Data – 3M™ Scotch-Weld™ Structural Adhesive Film AF 30 (10 mil)/ 3M™ Scotch-Weld™ Structural Adhesive Primer EC-1660

Storage Life Testing

Individual results of static shear tests made on 1/2" (12.7 mm) lapjoint specimens of 0.063" (1.60 mm) clad 2024-T3 aluminum bonded with the Scotch-Weld AF 30/Scotch-Weld EC-1660 system stored 90 days at standard temperature (70-80°F [21-27°C]) prior to bonding.

1. Overlap shear at 75°F ± 2°F (24°C ± 1.1°C) average of 21 specimens – 4130 psi (28.4 MPa).
2. Overlap shear at 180°F ± 2°F (82°C ± 1.1°C) average of 21 specimens – 2280 psi (15.7 MPa).

Individual shear strength results after 30 day exposure to salt spray were made on 1/2" (12.7 mm) lapjoint specimens of 0.063" clad 2024-T3 aluminum bonded with Scotch-Weld AF 30/Scotch-Weld EC-1660 stored 90 days at standard temperature (70-80°F [21-27°C]) prior to bonding.

1. Tested at 75°F ± 2°F (24°C ± 1.1°C) average of 12 specimens – 4040 psi (27.8 MPa).
2. Controls tested at 75°F ± 2°F (24°C ± 1.1°C) – 4020 psi (27.7 MPa).

Aluminum to Aluminum T-Peel (In addition to MMM-A-132 requirements)

T-Peel bonds consist of two Scotch-Weld EC-1660 primed 8" x 8" x .020" (203.2 mm x 203.2 mm x .508 mm) 2024-T3 clad panels bonded together with a 6" x 8" (152.4 mm x 203.2 mm) section of film. This panel is then cut into 1" x 8" (25.4 mm x 203.2 mm) T-Peel specimens which are peeled at a 90° angle to the bond line with a jaw separation rate of 20"/minute (508 mm/minute).

Platen Press Cure: 350°F, 60 minutes, 50 psi, 10°F/minute (177°C, 60 minutes, 344.5 KPa, 5.6°C/minute) Temperature Rise Rate

Test Temperature		T-Peel	
-67°F ± 2°F	(-55°C ± 1.1°C)	8 lb/inch	(36 N/25 mm)
75°F ± 2°F	(24°C ± 1.1°C)	37 lb/inch	(165 N/25 mm)
180°F ± 2°F	(82°C ± 1.1°C)	21 lb/inch	(93 N/25 mm)
250°F ± 2°F	(121°C ± 1.1°C)	10 lb/inch	(45 N/25 mm)

Scotch-Weld AF 30/Scotch-Weld EC-1660 after aging for 1, 2, and 3 years in Southern Florida

Test Temperature		Control		1 Year		2 Years		3 Years	
-67°F	(-55°C)	2700 psi	(18.6 MPa)	3400 psi	(23.4 MPa)	3700 psi	(25.5 MPa)	3400 psi	(23.4 MPa)
75°F	(24°C)	4000 psi	(27.6 MPa)	3800 psi	(26.2 MPa)	3820 psi	(23.3 MPa)	3895 psi	(26.8 MPa)
180°F	(82°C)	2350 psi	(16.2 MPa)	2500 psi	(17.2 MPa)	2330 psi	(16.1 MPa)	2400 psi	(16.5 MPa)
250°F	(121°C)	1850 psi	(12.7 MPa)	1340 psi	(9.2 MPa)	1470 psi	(10.1 MPa)	1590 psi	(11.0 MPa)
300°F	149°C)	1600 psi	(11.0 MPa)	1060 psi	(7.3 MPa)	1120 psi	(7.7 MPa)	1140 psi	(7.9 MPa)

Aluminum to Aluminum Overlap Shear (In addition to MMM-A-132 requirements)

The following data shows typical values obtained with Scotch-Weld AF 30 (10 mil) with Scotch-Weld EC-1660 when tested at temperatures other than those required by MMM-A-132. All properties were measured on 1" (25.4 mm) wide, 1/2" (12.7 mm) overlap specimens cut from .063" (1.60 mm) thick, 4" x 7" (101.6 mm x 177.8 mm) primed and bonded panels of 2024-T3 clad aluminum. Tests were conducted per MMM-A-132 Type 1 requirements.

Test Temperature		Scotch-Weld AF 30 (10 mil)/Scotch-Weld EC-1660 Overlap Shear Strength	
250°F	(121°C)	1860 psi	(12.8 MPa)
350°F	(177°C)	1100 psi	(7.6 MPa)
400°F	(204°C)	970 psi	(6.7 MPa)
500°F	(260°C)	530 psi	(3.7 MPa)

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.

MMM-A-132 TEST DATA – 3M™ Scotch-Weld™ Structural Adhesive Film AF 30 (12 mil)/ 3M™ Scotch-Weld™ Structural Adhesive Primer EC-1660

The following is a summary and a list of average test results for the structural adhesive system Scotch-Weld AF 30 (12 mil) with Scotch-Weld EC-1660 when bonded specimens were prepared and tested in accordance with Specification MMM-A-132, Type 1 Class 2.

Test Condition	MMM-A-132 Type I Class 2 & 3 Requirement Min. Ave.		Scotch-Weld AF 30 (12 mil) with Scotch-Weld EC-1660	
A. Tensile Shear	**psi**	**(MPa)**	**psi**	**(MPa)**
1. Normal Temperature, 75°F (24°C)	2500	(17.2)	4000	(27.6)
2. 10 minutes @ 180°F (82°C)	1250	(8.6)	2400	(16.5)
3. 10 minutes @ -67°F (-55°C)	2500	(17.2)	4100	(28.2)
4. Normal Temperature 75°F (24°C) after 30 days immersion in Salt Water Spray	2250	(15.5)	3950	(27.2)
5. Normal Temperature 75°F (24°C) after 30 days immersion @ 120°F (49°C) and 95-100% Relative Humidity	2250	(15.5)	4000	(27.6)
6. Normal Temperature, 75°F (24°C) after 30 days immersion in Tap Water	2250	(15.5)	4030	(27.8)
7. Normal Temperature, 75°F (24°C) after 7 days immersion in JP-4 Fuel (MIL-T-5624)	2250	(15.5)	3970	(27.4)
8. Normal Temperature, 75°F (24°C) after 7 days immersion in Anti-icing Fluid (MIL-F-5566)	2250	(15.5)	4090	(28.2)
9. Normal Temperature, 75°F (24°C) after 7 days immersion in Hydraulic Oil (MIL-H-5606)	2250	(15.5)	4000	(27.6)
10. Normal Temperature, 75°F (24°C) after 7 days immersion in Type III Hydrocarbon Fluid (MIL-S-3136)	2250	(15.5)	4050	(27.9)

B. Creep Rupture		
11. Normal Temperature, 75°F (24°C) 192 hrs @ 1600 psi (11.0 MPa)	0.015 inches (.381 mm) max. deformation	0.003 inches (.076 mm)
12. 180°F (82°C), 192 hrs @ 800 psi (5.5 MPa)	0.015 inches (.381 mm) max. deformation	0.008 inches (.203 mm)

C. Fatigue		
13. Normal Temperature, 75°F (24°C) 750 psi (5.2 MPa) @ 10^6 cycles	No glue line failure	No glue line failure

D. Other Tests		
14. Normal Temperature, 75°F (24°C) T-Peel	Class 2: 15 piw (67 N/25 mm) Class 3:none	35 piw (155.7 N/25 mm)
15. Tensile Shear, 75°F (24°C) Blister Detection	Class 2: 2250 psi (6 MPa) Class 3:none	3520 psi (24.3 MPa)

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.

Miscellaneous Test Data – 3M™ Scotch-Weld™ Structural Adhesive Film AF 30 (12 mil)/ 3M™ Scotch-Weld™ Structural Adhesive Primer EC-1660

Aluminum to Aluminum T-Peel (In addition to MMM-A-132 requirements)

T-Peel bonds consist of two Scotch-Weld EC-1660 primed 8" x 8" x .020" (203.2 mm x 203.2 mm x .508 mm) 2024-T3 clad panels bonded together with a 6" x 8" (152.4 mm x 203.2 mm) section of film. This panel is then cut into 1" x 8" (25.4 mm x 203.2 mm) T-Peel specimens which are peeled at a 90° angle to the bond line with a jaw separation rate of 20"/minute (508 mm/minute).

Platen Press Cure: 350°F, 60 minutes, 50 psi, 10°F/minute (177°C, 60 minutes, 344.5 KPa, 5.6°C/minute Temperature Rise Rate

Test Temperature		T-Peel	
-67°F ± 2°F	(-55°C ± 1.1°C)	9 lb/inch	(40 N/25 mm)
75°F ± 2°F	(24°C ± 1.1°C)	45 lb/inch	(200 N/25 mm)
180°F ± 2°F	(82°C ± 1.1°C)	18 lb/inch	(89 N/25 mm)
250°F ± 2°F	(121°C ± 1.1°C)	11 lb/inch	(49 N/25 mm)

Aluminum to Aluminum Overlap Shear (In addition to MMM-A-132 requirements)

The following data shows typical values obtained with Scotch-Weld AF 30 (10 mil) with Scotch-Weld EC-1660 when tested at temperatures other than those required by MMM-A-132. All properties were measured on 1" (25.4 mm) wide, 1/2" (12.7 mm) overlap specimens cut from .063" (1.60 mm) thick, 4" x 7" (101.6 mm x 177.8 mm) primed and bonded panels of 2024-T3 clad aluminum. Tests were conducted per MMM-A-132 Type 1 requirements.

Test Temperature		Scotch-Weld AF 30 (12 mil)/Scotch-Weld EC-1660 Overlap Shear Strength	
250°F	(121°C)	1820 psi	(12.5 MPa)
350°F	(177°C)	1050 psi	(7.2 MPa)
400°F	(204°C)	950 psi	(6.5 MPa)
500°F	(260°C)	500 psi	(3.4 MPa)

Scotch-Weld AF 30 Modulus of Elasticity @ 75°F (24°C) 19,000 psi (130.9 MPa)

Scotch-Weld AF 30 Tensile Strength @ 75°F (24°C) 3,000 psi (20.7 MPa)

Scotch-Weld™
Structural Adhesive Film
AF 30 (5, 10 and 12 mil)

Product Application

Surface Preparations

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

Suggested Cleaning Procedure for Aluminum

1. Alkaline Degrease – Oakite 164 solution (9-11 oz/gallon water) at 190°F ± 10°F (87.8°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.
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 coat the freshly cleaned surfaces with primer within 4 hours after surface preparation.

Note: Read and follow safety and precautioning recommendations for the components of this etch solution prior to preparation.

Primer Application

Advantages –

Priming of adherends offer two distinct advantages: (1) insures complete wetting of metal surfaces which normally results in superior environmental properties, and (2) simplifies production by protecting cleaned parts until bonding can be completed. Primers have been applied successfully by flow coating, brushing and spraying.

For additional information, please refer to the 3M™ Scotch-Weld™ Structural Adhesive Primer EC-1660 (5%) Technical Data sheet.

Primer Dry

A primer dry which will result in a solvent free coating is generally satisfactory. Drying temperatures above 300°F (149°C) should be avoided, since a primer overcure will hinder the wetting action of the adhesive film to the primer.

The following chart lists suggested dry cycles for primers:

	Air Dry	Force Dry	Force Dry Temperature
Scotch-Weld EC-1660	30 minutes	30 minutes	225°F (107°C)

The primed surface, after cooling to ambient temperatures, is ready for adhesive bonding. The primed surface should be protected from contamination introduced by dust, fingerprints, oil, etc.

Film Application

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

1. Cut portion of film to be used from roll with protective liner in place.
2. Place film on metal using the liner as a protective cover.
3. Roll film into position with a rubber roller insuring that no air is trapped between primer and film.

Product Application *(continued)*

4. Remove protective liner.
5. Assemble parts and cure.

Excess primer and equipment may be cleaned up, prior to curing, with ketone* type solvent.

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

Cure Cycle

General Cure Requirements

Time, temperature and pressure determine the final bond properties and may be effected by the type of curing equipment used for each specific application. In general, the cure properties of 3M™ Scotch-Weld™ Structural Adhesive Film AF 30 are as follows:

Tack, Flow and Cure Initiation Temperatures

The tack, flow and cure initiation temperatures for Scotch-Weld AF 30 are a time-temperature relationship and depend upon the rate of heat input. Normally, Scotch-Weld AF 30 has the following properties:

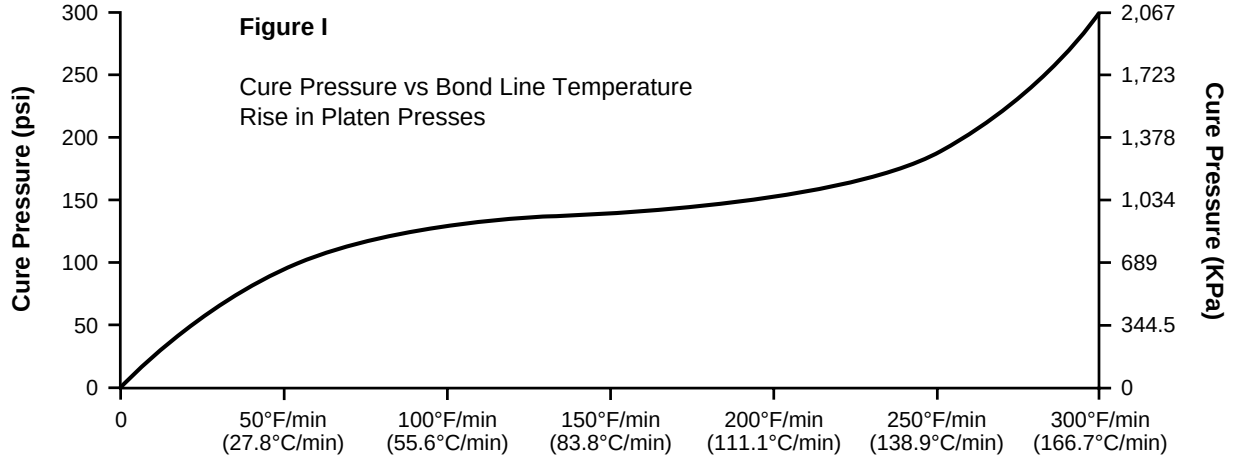
Tack Temperature:	160°F-180°F (71°C-82°C)
Flow Temperature:	180°F-220°F (82°C-104°C)
Cure Initiation Temp.:	220°F-270°F (104°C-132°C)

Cure Pressure

Pressure is required during cure to form the part being bonded and contain any volatiles given off by the adhesive. Cure pressure may be applied in any matter which will insure uniform constant pressure throughout the bond area. *Pressure must be uniformly applied before the curing reaction begins and maintained until a complete set has been effected.* (i.e., the bond line temperature has reached approximately 300°F (149°C). After this point is reached, the cure may be completed without pressure if the hot strength of the adhesive is sufficient to maintain contact of the parts being bonded. The pressure required to contain volatiles is dependent on the rate at which bond line temperature is brought to the cure temperature. The bond line temperature rise rate for Scotch-Weld AF 30 can be varied from 1°F to 300°F/minute (0.6°C to 166.7°C/minute). Rise rate (and cure pressure required) will depend on application, cure temperature, bonding equipment, method of heat application, production limitations and bond properties required. Figure I depicts typical pressure required for various bond line temperature rise rate in platen presses.

Figure I

Cure Pressure vs Bond Line Temperature Rise in Platen Presses



Product Application *(continued)*

Cure Temperature

The cure temperature may be varied from 250°F to 450°F (121°C to 232°C), depending upon the materials being bonded, equipment available and bond properties desired. The desired pressure must be applied before the glue line reaches 160°F (71°C). The film will soften as temperature is increased to 180-210°F (82-98.9°C) and will wet the surface to which it has been applied. A chemical cure will be initiated between 220°F and 270°F (104°C and 132°C) and a low strength gel formed. Continued heating chemically converts this gel into a high strength, solvent resistant bond. 3M™ Scotch-Weld™ Structural Adhesive Film AF 30 will change color only slightly upon application of heat. Edges of the bond which are exposed to air will change from yellow to rusty brown.

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. Figure II is a guide from which an approximate cure cycle can be taken for various cure times or temperatures.

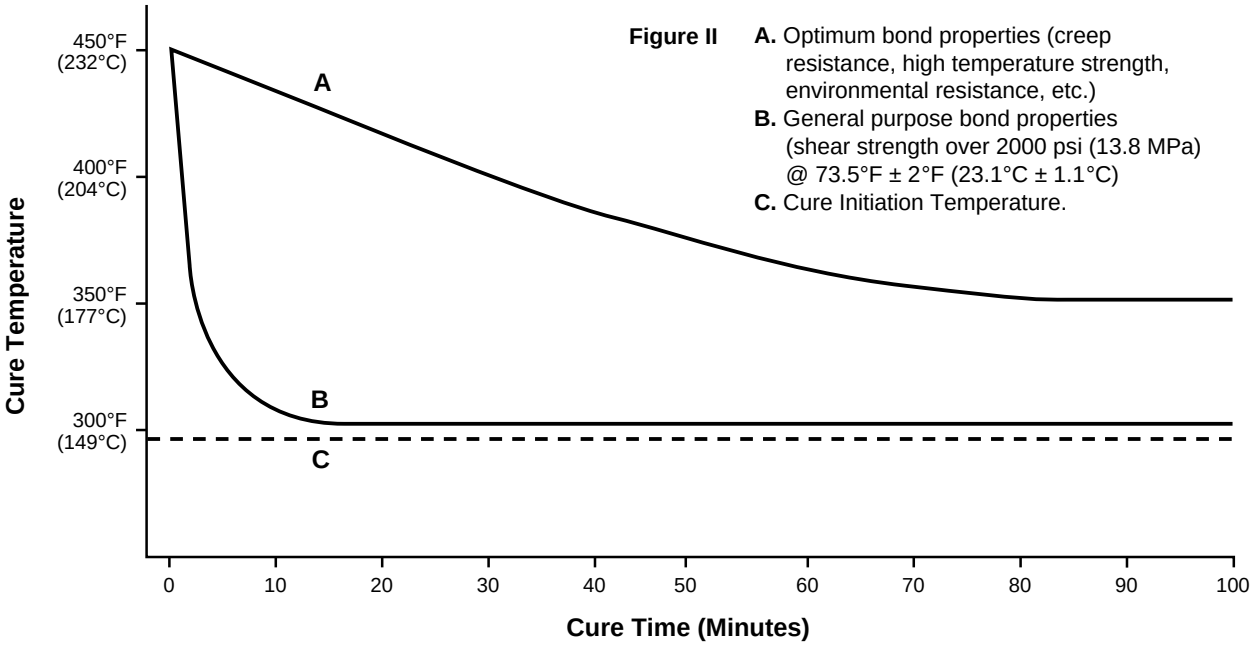


Figure II **A.** Optimum bond properties (creep resistance, high temperature strength, environmental resistance, etc.)
B. General purpose bond properties (shear strength over 2000 psi (13.8 MPa) @ 73.5°F ± 2°F (23.1°C ± 1.1°C)
C. Cure Initiation Temperature.

Suggested Cure Cycle

The following press cure cycle is suggested to obtain dense glue lines.

1. Apply a pressure of 100 psi (689 MPa) prior to reaching a bond line temperature of 150°F (66°C) and maintain throughout the press cure cycle.
2. Raise the bond line temperature from ambient to 350°F (177°C) at a rate of 10°F-12°F (5.6°C-6.7°C) per minute.
3. Cure for 60°F ± 1 minute at 350°F (177°C).
4. Cool to below 200°F (93°C)/bond line temperature prior to release of pressure. (In lab tests, panels have been removed at 350°F (177°C) with no adverse effects.)

Storage

Storage at 40°F (4°C) or below is suggested for 3M™ Scotch-Weld™ Structural Adhesive Film AF 30 and 3M™ Scotch-Weld™ Structural Adhesive Primer EC-1660 to obtain maximum shelf life. Rotate stock on a "first in-first out" basis.

Caution: Scotch-Weld AF 30 and Scotch-Weld EC-1660 should be permitted to thoroughly warm to room temperature (75°F ± 5°F [24°C ± 2.8°C]) before being used to prevent moisture condensation. Data obtained on Scotch-Weld AF 30 stored for 90 days at 70-80°F (21-28°C) is included in the test results of the Product Performance section.

Shelf Life

When stored at 40°F (4°C) or below Scotch-Weld AF 30 has a shelf life of 6 months from date of shipment from 3M.

Scotch-Weld™
Structural Adhesive Film
AF 30 (5, 10 and 12 mil)

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.

ISO 9002

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

3M

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