

3M

Scotch-Weld™

Epoxy Adhesive

DP100 Plus Clear

Technical Data

December, 2009

Product Description

3M™ Scotch-Weld™ Epoxy Adhesive DP100 Plus Clear is a fast setting, two-part, 1:1 mix ratio mercaptan-cured epoxy adhesive. It is unique among fast setting mercaptan cure epoxies in that it combines high shear strength with good peel performance properties. Scotch-Weld epoxy adhesive DP100 Plus Clear is transparent and slightly flexible when cured.

Available in bulk containers as 3M™ Scotch-Weld™ Epoxy Adhesive 100 Plus B/A Clear.

Features

- 4 minute worklife
- Slightly flexible
- High shear and peel strength
- 1:1 mix ratio

Typical Uncured Physical Properties

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

Base Resins		Epoxy/Mercaptan
Viscosity¹ Approximate @ 80°F (23°C)	Base (B) Accelerator (A)	4,000 to 11,000 cps 7,000 to 13,000 cps
Net Weight (Lbs./Gallon)	Base (B) Accelerator (A)	9.7 to 9.9 9.4 to 9.8
Color	Base (B) Accelerator (A)	Clear Clear
Mix Ratio (B:A)	By Volume By Weight	1:1 1:1
Worklife² @ 73°F (23°C)	2 gram 20 gram	4 min. 3 min.

¹ Viscosity determined using test method C-1d. Procedure involves Brookfield RVF, #7 spindle, 20 rpm and 80°F (27°C). Measurement taken after 1 minute revolution.

² Worklife determined using test method C-3180. Procedure involves periodically measuring a 2 gram mixed mass for self leveling and wetting properties. This time will also approximate the usable worklife in an 3M™ EPX™ Applicator mixing nozzle.

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Typical Cured Properties

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

Physical	
Color	Clear
Hardness (ASTM D 2240) Shore D	83
Worklife ²	3-4 minutes
Tack-free Time ³	9-10 minutes
Time to Handling Strength ⁴	20 min. @ 73°F (23°C)
Cure Time ⁵	48 hrs. @ 73°F (23°C)
Elongation ⁶	75%
Tensile Strength ⁶	1850 psi

Thermal	
Weight Loss by Thermal Gravimetric Analysis (TGA) ⁷	1% @ 116°C 5% @ 318°C
Thermal Coefficient of Expansion (TCE) by TMA ⁸ ($\infty \times 10^{-6}$ units/unit/°C) Below Tg Above Tg	93 (5-20°C range) 182 (40-140°C range)
Glass Transition Temperature (Tg) by DSC ⁹ Onset Mid-Point	23°C 29°C
Thermal Conductivity ¹⁰ (@ 110°F on .250" samples) BTU - ft./ft. ² - hr. - °F) Cal./sec. - cm - °C Watt/m - °C	.077 .32 x 10 ⁻³ .133
Thermal Shock Resistance ¹¹ Potted Washer Olyphant Test (Test Method C-3174 + 100°C [air] to -50°C [liquid])	Pass 5 cycles without cracking

Electrical	
Dielectric Constant @ 1 KHz @ 23°C (ASTM D 150)	6.6
Dissipation Factor @ 1 KHz @ 23°C (ASTM D 150)	0.06
Dielectric Strength (ASTM D 149) Sample Thickness Approx. 30 mil.	710 volts/mil
Volume Resistivity (ASTM D 257)	6.7 x 10 ¹¹ ohm-cm

² Worklife determined using test method C-3180. Procedure involves periodically measuring a 2 gram mixed mass for self leveling and wetting properties. This time will also approximate the usable worklife in an 3M™ EPX™ Applicator mixing nozzle.

³ Tack-free time determined per test method C-3173. Involves dispensing 0.5 gram amount of adhesive onto substrate and testing periodically for no adhesive transfer to metal spatula.

⁴ Handling strength determined per test method C-3179. Time to handling strength taken to be that required to achieve a 50 psi overlap shear (OLS) strength using aluminum substrates.

⁵ The cure time is defined as that time required for the adhesive to achieve a minimum of 80% of the ultimate strength as measured by aluminum-aluminum OLS.

⁶ Tensile and Elongation. Used procedure in test method C-3094/ATSM D 882. Samples were 2 in. dumbbells with .0125 in. neck and .030 in. sample thickness. Separation rate was 2 inches per minute. Samples cured 2 hrs. RT plus 2 hrs. 160°F (71°C).

⁷ Weight loss by TGA reported as that temperature at which 5% weight loss occurs by TGA in air at 5°C rise per minute per ASTM 1131-86.

⁸ TCE determined using TMA Analyzer using a heating rate of 10°C per minute. Second heat values given.

⁹ Glass Transition Temperature (Tg) determined using DSC Analyzer with a heating rate of 20°C per minute. Second heat values given.

¹⁰ Thermal conductivity determined using ASTM C177 and C-matic Instrument using 2 in. diameter samples.

¹¹ Thermal shock resistance run per test method C-3174. Involves potting a metal washer into a 2 in. x 0.5 in. thick section and cycling this test specimen to colder and colder temperatures.

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Typical Adhesive Performance Characteristics

Note: The following product performance data was obtained in the 3M laboratory under the conditions specified. The following data show typical results obtained with 3M™ Scotch-Weld™ Epoxy Adhesive DP100 Plus Clear when applied to properly prepared substrates, cured, and tested according to the specifications indicated. This data was generated using the 3M™ EPX™ Applicator System equipped with an EPX static mixer, according to manufacturer's directions. Thorough hand mixing should afford comparable results.

Overlap Shear Strength (OLS) to¹²

(Bonds cured 24 hours @ room temperature (RT) + 2 hrs @ 160°F [71°C])

Etched Aluminum	3500 psi
Sanded Aluminum (60 grit)	1800 psi
Cold Rolled Steel	1700 psi
Wood, Fir	700 psi
Glass, Borosilicate	250 psi
Glass, +3M™ Scotch-Weld™ Primer EC3901	300 psi
Polycarbonate	600 psi
Acrylic	300 psi
Fiberglass	1500 psi
ABS	280 psi
PVC	450 psi
Polypropylene	80 psi

Rate of Strength Buildup

(OLS on Etched Aluminum)¹²

Bonds tested after:

1 hr @ RT	600 psi
6 hrs @ RT	900 psi
24 hrs @ RT	1100 psi
7 days @ RT	2800 psi
1 mo @ RT	3400 psi

Environmental Aging

(OLS on Etched Aluminum)¹²

Bonds tested after:

24 hrs RT + 2 hrs @ 160°F (71°C)	3500 psi
24 hrs RT + 2 hrs @ 240°F (116°C)	4500 psi
1 wk RT + 1 wk @ 90°F (32°C)/90% RH	3900 psi
1 wk RT + 1 wk 248°F (120°C)	4500 psi
1 wk RT + 1 wk H ₂ O immersion	3500 psi

¹² Overlap shear (OLS) strengths were measured on 1 in. wide 1/2 in. overlap specimens. These bonds were made individually using 1 in. x 4 in. pieces of substrate. The thickness of the bond line was 0.005-0.008 in. All strengths were measured at 70°F (21°C) except where noted. (Test per ASTM D 1002-72.)

The separation rate of the testing jaws was 0.1 in. per minute for metals, 2 in. per minute for plastics and 20 in. per minute for rubbers. The thickness of the substrates were: steel, 0.060 in.; other metals, 0.05-0.064 in.; rubber, 0.125 in.; plastics, 0.125 in.

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Typical Adhesive Performance Characteristics (continued)

Note: The following product performance data was obtained in the 3M laboratory under the conditions specified. The following data show typical results obtained with 3M™ Scotch-Weld™ Epoxy Adhesive DP100 Plus Clear when applied to properly prepared substrates, cured, and tested according to the specifications indicated. This data was generated using the 3M™ EPX™ Applicator System equipped with an EPX static mixer, according to manufacturer's directions. Thorough hand mixing should afford comparable results.

Overlap Shear Strength (OLS) vs. Temperature¹²

(Bonds cured 24 hours @ room temperature (RT) + 2 hours @ 160°F [71°C])

Bonds tested at:	
-67°F (-55°C)	3000 psi
70°F (21°C)	3500 psi
120°F (49°C)	750 psi
150°F (66°C)	400 psi
180°F (82°C)	200 psi

180° Peel Strength vs. Temperature¹³

(Bonds cured 24 hours @ room temperature (RT) + 2 hours @ 160°F [71°C])

-67°F (-55°C)	2 piw
70°F (21°C)	13 piw
120°F (49°C)	15 piw
150°F (66°C)	2 piw
180°F (82°C)	1 piw

Solvent Resistance¹⁴

	One Hour/One Month
Acetone	A/A
Isopropyl Alcohol	A/A
Freon TF	A/A
Freon TMC	A/A
1,1,1-Trichloroethane	A/A
RMA Flux	A/A
Key: A - Unaffected, B - Slight Attack, C - Moderate/Severe Attack	

Exotherm¹⁵

	Max. Temp/Time to Reach
2 gram mass	128°F/6 min.
20 gram mass	260°F/3 min.

¹² Overlap shear (OLS) strengths were measured on 1 in. wide 1/2 in. overlap specimens. These bonds were made individually using 1 in. x 4 in. pieces of substrate. The thickness of the bond line was 0.005-0.008 in. All strengths were measured at 70°F (21°C) except where noted. (Test per ASTM D 1002-72.)

The separation rate of the testing jaws was 0.1 in. per minute for metals, 2 in. per minute for plastics and 20 in. per minute for rubbers. The thickness of the substrates were: steel, 0.060 in.; other metals, 0.05-0.064 in.; rubber, 0.125 in.; plastics, 0.125 in.

¹³ T-peel strengths were measured on 1 in. wide bonds at 73°F (23°C). The testing jaw separation rate was 20 inches per minute. The substrates were 0.020 in. thick. (Tests per ASTM D 1876-61T.)

¹⁴ Solvent resistance was determined using cured (24 hrs. RT + 2 hrs. 160°F [71°C]) samples (1/2 in. x 4 in. x 1/8 in. thickness) immersed in the test solvent for 1 hour and 1 month. After the allotted period of time, the sample was removed and visually examined for surface attack as compared to the control.

Key: A - Unaffected - no change to color or surface texture.
B - Slight attack - noticeable swelling of surface.
C - Moderate/severe attack - extreme swelling of surface.

¹⁵ Exotherm determined using the stated mass mixed for 1 minute and then by electronic thermocouple measuring the peak temperature and time to that temperature.

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3M™ EPX™ Pneumatic Applicator Delivery Rates

400 ml Applicator – Maximum Pressure 73 psi

Adhesive*	6mm Nozzle gms/minute	10mm Nozzle gms/minute
3M™ Scotch-Weld™ Epoxy Adhesive DP100 Plus Clear	54	206.5

200 ml Applicator – Maximum Pressure 58 psi

Scotch-Weld epoxy adhesive DP100 Plus Clear	45.7	179
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50 ml Applicator – Maximum Pressure 50 psi

Adhesive*	1/4 in. Nozzle gms/minute
Scotch-Weld epoxy adhesive DP100 Plus Clear	60

*Tests were run at a temperature of 70°F ± 2°F (21°C ± 1°C) and at maximum applicator pressure.

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Handling/Curing Information

Directions For Use

1. For high strength structural bonds, paint, oxide films, oils, dust, mold release agents and all other surface contaminants must be completely removed. However, the amount of surface preparation depends on the required bond strength and the environmental aging resistance desired by user. For specific surface preparations on common substrates, see the section on surface preparation.
2. Use gloves to minimize skin contact. **Do not** use solvents for cleaning hands.
3. Mixing

For Duo-Pak Cartridges

3M™ Scotch-Weld™ Epoxy Adhesive DP100 Plus Clear is supplied in a dual syringe plastic duo-pak cartridge as part of the 3M™ EPX™ Applicator System. To use, simply insert the duo-pak cartridge into the EPX applicator and start the plunger into the cylinders using light pressure on the trigger. Next, remove the duo-pak cartridge cap and expel a small amount of adhesive to ensure both sides of the duo-pak cartridge are flowing evenly and freely. If automatic mixing of Part A and Part B is desired, attach the EPX applicator mixing nozzle to the duo-pak cartridge and begin dispensing the adhesive. For hand mixing, expel the desired amount of adhesive and mix thoroughly. Mix approximately 15 seconds after uniform color is obtained.

For Bulk Containers

Mix thoroughly by weight or volume in the proportions specified in the typical uncured properties section. Mix approximately 15 seconds after uniform color is obtained.

4. For maximum bond strength, apply adhesive evenly to both surfaces to be joined.
5. Application to the substrates should be made within 3 minutes. Larger quantities and/or higher temperatures will reduce this working time.
6. Join the adhesive coated surfaces and allow to cure at 60°F (16°C) or above until completely firm. Heat up to 200°F (93°C), in order to speed curing. These products will cure in 48 hours @ 75°F (24°C).
7. Keep parts from moving during cure. Contact pressure necessary. Maximum shear strength is obtained with a 3-5 mil bond line.
8. Excess uncured adhesive can be cleaned up with methyl ethyl ketone (MEK).*

Adhesive Coverage: A 0.005 in. thick bond line will yield a coverage of 320 sq. ft./gallon.

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

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Surface Preparation

For high strength structural bonds, paint, oxide films, oils, dust, mold release agents and all other surface contaminants must be completely removed. However, the amount of surface preparation directly depends on the required bond strength and the environmental aging resistance desired by user.

The following cleaning methods are suggested for common surfaces:

Steel:

1. Wipe free of dust with oil-free solvent such as acetone, isopropyl or alcohol solvents.*
2. Sandblast or abrade using clean fine grit abrasives.
3. Wipe again with solvent to remove loose particles.
4. If a primer is used, it should be applied within 4 hours after surface preparation.

Aluminum:

1. Alkaline Degrease: Oakite 164 solution (9-11 oz./gallon water) at 190°F ± 10°F (88°C ± 5°C) for 10-20 minutes. Rinse immediately in large quantities of cold running water.
2. Acid Etch: Place panels in the following solution for 10 minutes at 150°F ± 5°F (66°C ± 2°C).

Sodium Dichromate	4.1 - 4.9 oz./gallon
Sulfuric Acid, 66°Be	38.5 - 41.5 oz./gallon
2024-T3 aluminum (dissolved)	0.2 oz./gallon minimum
Tap water as needed to balance	

3. Rinse: Rinse panels in clear running tap water.
4. Dry: Air dry 15 minutes; force dry 10 minutes at 190°F ± 10°F (88°C ± 5°C).
5. If primer is to be used, it should be applied within 4 hours after surface preparation.

Note: Read and follow component supplier's environmental health and safety information prior to preparing this etch solution.

Plastics/Rubber:

1. Wipe with isopropyl alcohol.*
2. Abrade using fine grit abrasives.
3. Wipe with isopropyl alcohol.*

Glass:

1. Solvent wipe surface using acetone or MEK.*
2. Apply a thin coating (0.0001 in. or less) or primer such as 3M™ Scotch-Weld™ Metal Primer EC3901 to the glass surfaces to be bonded and allow the primer to dry before bonding.

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

Application Equipment Suggestions

For small or intermittent applications, the 3M™ EPX™ Applicator is a convenient method of application.

For larger applications, these products may be applied by use of flow equipment.

Two-part meter/mixing/dispensing equipment is available for intermittent or production line use. These systems may be desirable because of their variable shot size and flow rate characteristics and are adaptable to many applications.

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Storage	Store products at 60-80°F (16-27°C) for maximum shelf life.
Shelf Life	These products have a shelf life of 2 years in their unopened original bulk containers and 15 months in duo-pak containers.
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.
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ISO 9001:2000

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Industrial Adhesives and Tapes Division

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