3M

Scotch-Weld™

Epoxy Adhesives

DP-105 Clear

Technical Data **December, 2009**

Product Description

3M™ Scotch-Weld™ Epoxy Adhesive DP-105 Clear is available in larger containers like 3M™ Scotch-Weld™ Epoxy Adhesive 105 B/A Clear.

Scotch-Weld DP-105 Clear is a fast setting, very flexible 1:1 mix ratio epoxy adhesive/sealant. Its flexibility when cured makes it ideal for applications involving dissimilar surfaces where thermal coefficient of expansion may be a problem. It is also unique in that it retains its clear, colorless properties even when cured in larger masses where many clear epoxy systems will often turn amber from the reaction exotherm.

Features

- 4 minute worklife
- Flexible
- Clear
- High 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.

Product		Scotch-Weld DP-105 Clear
Base Resins		Epoxy/Mercaptan
Color	Base (B) Accelerator (A)	Clear Clear
Net Weight (Lbs./Gallon)	Base (B) Accelerator (A)	9.1 - 9.5 9.4 - 9.8
Viscosity[1], Approximate @ 80°F (27°C)	Base (B) Accelerator (A)	1,000 - 5,000 cps 8,000 - 16,000 cps
Mix Ratio (B:A)	By Volume By Weight	1:1 1:0.97
Worklife[2] @ 73°F (23°C)	2 gram 20 gram	5 minutes 4 minutes

Footnotes:

1. Viscosity determined using 3M test method C-1d. Procedure involves Brookfield RVF, #7 spindle, 20 rpm and 80°F (27°C). Measurement taken after 1 minute rotation.
2. Worklife determined using 3M 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 EPX 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.

	Scotch-Weld DP-105 Clear
Physical	
Color	Clear
Hardness Shore D (ASTM D 2240)	39
Worklife[2]	3-4 minutes
Tackfree Time[3]	10 minutes
Time to Handling Strength[4]	20 min. @ 23°C (73°F)
Cure Time[5]	48 hrs. @ 23°C (73°F)
Elongation[6]	120%
Tensile Strength[6]	600 psi

Thermal	
Weight Loss by Thermal Gravimetric Analysis (TGA)[7]	1% @ 117°C (243°F) 5% @ 289°C (552°F)
Thermal Coefficient of Expansion (TCE) by TMA[8]	
(∞ x 10^{-6} units/unit/°C)	
Below Tg	—
Above Tg	181 (40-140°C range)
Glass Transition Temperature (Tg) by DSC[9]	
Onset	8°C (46°F)
Mid-Point	15°C (59°F)
Thermal Conductivity[10]	
(@ 110°F on .250" samples)	
BTU-ft./ft.^{2} - hr.-°F	.085
Cal./sec -cm-°C	.35 x 10^{-3}
Watt/m-°C	.147
Thermal Shock Resistance[11]	
Potted Washer Olyphant Test (3M/AdhD Test Method C-3174 +100°C [air] to -50°C [liquid])	Pass 5 cycles without cracking

Electrical	
Dielectric Constant @ 1 KH_z @ 23°C (73°F) [ASTM D 150]	9.2
Dissipation Factor @ 1 KH_z @ 23°C (73°F) [ASTM D 150]	0.22
Dielectric Strength (ASTM D 149) Sample Thickness Approx. 30 mil	465 volts/mil
Volume Resistivity (ASTM D 257)	1.5 x 10^{10} ohm-cm

Footnotes:

2. Worklife determined using 3M 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 EPX mixing nozzle.
3. Tack-free determined per 3M 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 3M test method C-3179. Time to handling strength taken to be that required to achieve a 50 psi 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 3M test method C-3094/ASTM D 882. Samples were 2" dumbbells with .0125" neck and .030" 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 (4°F) rise per minute per ASTM 1131-86.
8. TCE determined using Dupont TMA Analyzer using a heating rate of 50°F (10°C) per minute. Second heat values given.
9. Glass Transition Temperature (Tg) determined using Perkin Elmer DSC Analyzer with a heating rate of 68°F (20°C) per minute. Second heat values given.
10. Thermal conductivity determined using ASTM C177 and C-matic Instrument using 2 inch diameter samples.
11. Thermal shock resistance run per 3M test method C-3174. Involves potting a metal washer into a 2" x 0.5" thick section and cycling this test specimen to colder and colder temperatures.

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Typical Adhesive Performance Characteristics

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

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

	Scotch-Weld DP-105 Clear
Overlap Shear (OLS) to[12] (Bonds aged 24 hrs @ RT + 2 hrs @ 160°F (71°C)	
Etched Aluminum	2000 psi
Sanded Aluminum (60 grit)	1500 psi
Cold Rolled Steel	1300 psi
Wood, Fir	300 psi
Glass, Borosilicate	200 psi
Glass, +3M 3901 Primer	250 psi
Polycarbonate	400 psi
Acrylic	250 psi
Fiberglass	1400 psi
ABS	300 psi
PVC	520 psi
Polypropylene	80 psi

Rate of Strength Buildup (OLS on Etched Aluminum)[12] Bonds tested after:	
1 hr @ RT	250 psi
6 hrs @ RT	500 psi
24 hrs @ RT	1000 psi
7 days @ RT	2000 psi
1 mo @ RT	2000 psi

Environmental Aging (OLS on Etched Aluminum)[12] Bonds tested after:	
24 hrs RT + 2 hrs @ 160°F (71°C)	2000 psi
24 hrs RT + 2 hrs @ 240°F (116°C)	2200 psi
1 wk RT + 1 wk @ 90°F/90% RH	1800 psi
1 wk RT + 1 wk 248°F (120°C)	3000 psi
1 wk RT + 1 wk H_2O Immersion	2000 psi

Footnotes:

12. Overlap shear (OLS) strengths were measured on 1" wide 1/2" overlap specimens. These bonds were made individually using 1" x 4" pieces of substrate. The thickness of the bond line was 0.005-0.008". 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" per minute for metals, 2" per minute for plastics and 20" per minute for rubbers. The thickness of the substrates were: steel, 0.060"; other metals, 0.05-0.064"; rubber, 0.125"; plastics, 0.125".

Typical Adhesive Performance Characteristics *(continued)*

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

	Scotch-Weld DP-105 Clear
Overlap Shear Strength vs Temperature[12] (Bonds cured 24 hr @ RT + 2 hrs @ 160°F [71°C]) Bonds tested at:	
-67°F (-53°C)	3500 psi
70°F (21°C)	2000 psi
120°F (49°C)	400 psi
150°F (66°C)	250 psi
180°F (82°C)	150 psi

180° Peel Strength vs Temperature[13] (Bonds cured 24 hr @ RT + 2 hrs @ 160°F [71°C]) Bonds tested at:	
-67°F (-53°C)	3.0 piw
70°F (21°C)	35.0 piw
120°F (49°C)	5.0 piw
150°F (66°C)	2 .0 piw
180°F (82°C)	1.0 piw

Solvent Resistance[14]	One Hour/One Month
Acetone	A/A
Isopropyl Alcohol	A/A
Freon TF	A/A
Freon TMC	A/B
1,1,1 Trichloroethane	A/A
RMA Flux	A/A
Key: A - Unaffected, B - Slight Attack, C - Moderate/Severe Attack	

Exotherm[15]	Max. Temp/Time to Reach
2 gram mass	98°F (37°C)/5 min.
20 gram mass	230°F (110°C)/3 min.

Footnotes:

12. Overlap shear (OLS) strengths were measured on 1" wide 1/2" overlap specimens. These bonds were made individually using 1" x 4" pieces of substrate. The thickness of the bond line was 0.005-0.008". 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" per minute for metals, 2" per minute for plastics and 20" per minute for rubbers. The thickness of the substrates were: steel, 0.060"; other metals, 0.05-0.064"; rubber, 0.125"; plastics, 0.125".

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

14. Solvent resistance was determined using cured (24 hrs RT + 2hrs 160°F [71°C]) samples (1/2" x 4" x 1/8" 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.

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 directly depends on the required bond strength and the environmental aging resistance desired by user. For specific surface preparations on common substrates, see the following section on Surface Preparation.
2. Uses gloves to minimize skin contact. **Do not** use solvents for cleaning hands.
3. Mixing

   For Duo-Pak Cartridges

   3M™ Scotch-Weld™ Epoxy Adhesive DP-105 Clear is supplied in a dual syringe plastic Duo-Pak cartridge as part of the 3M™ Scotch-Weld™ 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 be sure 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 mixing nozzle to the Duo-Pak cartridge and begin dispensing the adhesives. 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), will speed curing. These products will cure in 48 hours @ 75°F (24°C).
7. Keep parts from moving during cure. Contact pressure is necessary. Maximum shear strength is obtained with a 3-5 mil bond line.
8. Excess uncured adhesive can be cleaned up with ketone type solvents.*

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

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

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 the 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. Vapor Degrease: Perchlorethylene condensing vapors for 5-10 minutes.
2. 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.
3. 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	

4. Rinse: Rinse panels in clean running tap water.
5. Dry: Air dry 15 minutes; force dry 10 minutes at 150°F ± 10°F (66°C ± 5°C).
6. If primer is to be used, it should be applied within 4 hours after surface preparation.

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) of primer such as 3M™ Scotch-Weld™ Primer EC-3901 to the glass surfaces to be bonded and allow the primer to dry before bonding.

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

Surface Preparation ***(continued)***

- For small or intermittent applications the 3M™ Scotch-Weld™ 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.

Storage and Shelf Life

Store 3M™ Scotch-Weld™ Epoxy Adhesive DP-105 Clear at 60-80°F (15-27°C) for maximum shelf life. These epoxy adhesive products have a shelf life of 2 years in their unopened containers and 15 months in Duo-Pak containers.

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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.

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.

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ISO 9001:2000

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