

3M

Scotch-Weld™

Acrylic Adhesives

DP805 • DP820

Technical Data

December, 2009

Product Description

3M™ Scotch-Weld™ Acrylic Adhesives DP805 and DP820 are two-part, 1:1 mix ratio, toughened acrylic structural adhesives. They exhibit excellent shear and peel strengths along with good impact and durability and bond well to many metals, ceramics, wood and most plastics.

Features

- Excellent shear and peel strengths
- 5 minute worklife (Scotch-Weld acrylic adhesive DP805)
- 20 minute worklife (Scotch-Weld acrylic adhesive DP820)
- Minimal surface preparation
- Easy mixing
- Non-sag
- 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 Acrylic Adhesive DP805	Scotch-Weld Acrylic Adhesive DP820
Color	Base (B) Accelerator (A)	Off-White Yellow	Off-White Yellow
Net Weight (Lbs./Gallon)	Base (B) Accelerator (A)	8.4 8.1	8.6 8.1
Viscosity ¹ @ 73°F (23°C)	Base (B) Accelerator (A)	75,000 cps 150,000 cps	70,000 cps 45,000 cps
Base Resin		Acrylic	Acrylic
Mix Ratio (B:A)	By Volume By Weight	1:1 1:1	1:1 1:1
Worklife ² @ 73°F (23°C)	Nozzle mixed	3-4 minutes	15-20 minutes
Applied Open Time ³		3 minutes	15 minutes
Time to Handling Strength ⁴		7-10 minutes	30-40 minutes

1. Brookfield RVF #7 spindle at 20 rpm.

2. Approximate time during which material can remain in a mixer nozzle and still be expelled without undue force on the applicator.

3. Approximate time after application of adhesive that bonds can be made without adversely affecting wetting out of adhesive and ultimate performance levels.

4. Time to achieve approx. 50 psi Overlap Shear Strength (OLS) when cured at (73°F) 23°C.

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Typical Cured Properties

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Physical

Product	3M™ Scotch-Weld™ Acrylic Adhesive DP805	3M™ Scotch-Weld™ Acrylic Adhesive DP820
Color	Pale Yellow	Pale Yellow
Shore D Hardness ⁵	79	75
Full Cure Time ⁶	8-24 hrs. @ 73°F (23°C)	24-48 hrs. @ 73°F (23°C)
Elongation ⁷	30%	50-75%
Tensile Strength ⁷	3200 psi	—

Thermal

Product	Scotch-Weld Acrylic Adhesive DP805	Scotch-Weld Acrylic Adhesive DP820
Glass Transition Temperature ⁸ (Tg)	140°F (60°C)	136°F (58°C)
Coefficient of Thermal Expansion ⁹ (units/units/°C)	105 x 10 ⁻⁶ 60-212°F (20-100°C)	180 x 10 ⁻⁶ 68-158°F (20-70°C)
Weight Loss at Temperature ¹⁰ by Thermal Gravimetric Analysis (TGA)	1% @ 275°F (135°C) 5% @ 451°F (233°C)	1% @ 266°F (130°C) 5% @ 446°F (230°C)

Electrical

Product	Scotch-Weld Acrylic Adhesive DP805	Scotch-Weld Acrylic Adhesive DP820
Dielectric Constant ¹¹	3.6 @ 500 Hz 3.6 @ 1 KHz 3.5 @ 10 KHz 3.4 @ 100 KHz	3.1 @ 500 Hz 3.0 @ 1 KHz 2.8 @ 10 KHz 2.8 @ 100 KHz
Dissipation Factor ¹¹	0.046 @ 500 Hz 0.037 @ 1 KHz 0.023 @ 10 KHz 0.018 @ 100 KHz	0.083 @ 500 Hz 0.065 @ 1 KHz 0.032 @ 10 KHz 0.022 @ 100 KHz
Volume Resistivity ¹²	1.1 x 10 ¹⁴ ohm-cm	2.2 x 10 ¹² ohm-cm
Dielectric Strength ¹³	—	3500 volts/mil
Surface Resistivity ¹²	2.1 x 10 ¹⁵ ohms	1.6 x 10 ¹⁴ ohms

5. ASTM D-2240.

6. Time to develop 80% of maximum overlap shear values.

7. Tensile and Elongation. Used procedure in 3M Test Method C-3094/ASTM D-882. Samples were 2 in. dumbbells with 0.125 in. neck and .030 in. sample thickness. Separation rate was 2 inches per minute.

8. Determined using DSC and heating rate of 68°F (20°C) per minute.

9. Determined using Thermal Mechanical Analysis (TMA) and heating rate of 41°F (5°C) per minute. First heat values given.

10. By TGA in air at 50°F (10°C)/min. TGA-7.

11. ASTM D-150 at 73°F (23°C).

12. ASTM D-257 at 73°F (23°C).

13. ASTM D-149 at 73°F (23°C). Sample thickness 14 mils.

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Typical Adhesive Performance Characteristics

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

Overlap Shear (OLS)¹⁴ to Various Substrates (psi)

Product	3M™ Scotch-Weld™ Acrylic Adhesive DP805	3M™ Scotch-Weld™ Acrylic Adhesive DP820
Aluminum - etched	3500	3200
Aluminum - (etched/oily)	3500	2900
Aluminum - (120 grit sandpaper)	3200	3100
Aluminum - (solvent cleaned only)	900	300
Cold Rolled Steel (CRS)	2800	2500
CRS (oily)	2700	2400
Copper	900	—
Galvanized Steel	1300	1200
FR-4 Glass Epoxy	2500	2000
Fiberglass Reinforced Plastic	600	700
ABS	1000	1000
PVC	1750	1750
Polycarbonate	950	1150
Acrylic	1200	1250
Fir Wood	800	1200

Overlap Shear¹⁴ (psi) CRS/CRS Tested After 7 Days of Immersion in the Following

Product	Scotch-Weld Acrylic Adhesive DP805	Scotch-Weld Acrylic Adhesive DP820
Control (no immersion)	2800	2500
Toluene	2650	NR*
Machine Oil	2850	1950
IPA (isopropyl alcohol)	2650	1350
Gasoline	2750	1500
1,1,1-Trichloroethane	2550	NR*
10% HCl	800	NR*
MEK (methyl ethyl ketone)	<10	NR*
Acetone	<10	NR*

*Not Recommended (NR)

Overlap Shear¹⁴ (FR-4/FR-4) Tested After Environmental Exposure (psi)

Product	Scotch-Weld Acrylic Adhesive DP805	Scotch-Weld Acrylic Adhesive DP820
Control (RT Aging)	2500	2000
248°F (120°C)/2 wks	2700	3300
194°F (90°C)/90% RH/2 wks	2600	1600
Tap Water 1 wk/RT	2200	1500

RT = Room Temperature RH = Relative Humidity

14. Overlap Shear (ASTM D-1002-64) (3M TM C-236) 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 73°F (23°C) except when noted. 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 0.035 in.; other metals: 0.05-0.064 in.; rubbers, 0.125 in.; plastics, 0.125 in.

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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.

Overlap Shear¹⁴ (CRS/CRS) Tested After Environmental Exposure (psi)

Product	3M™ Scotch-Weld™ Acrylic Adhesive DP805	3M™ Scotch-Weld™ Acrylic Adhesive DP820
Control (RT Aging)	2800	2500
248°F (120°C)/2 wks	500	300
194°F (90°C)/90% RH/2 wks	2200	850
Tap Water 1 wk/RT	2500	850

RT = Room Temperature RH = Relative Humidity

Overlap Shear¹⁴ (Etched Alum./Etched Alum.) Tested at Various Temperatures (psi)

Product	Scotch-Weld Acrylic Adhesive DP805	Scotch-Weld Acrylic Adhesive DP820
-67°F (-55°C)	2500	3100
73°F (23°C)	3500	3150
180°F (83°C)	2200	1900
200°F (93°C)	—	1450

Overlap Shear¹⁴ of Heat/Temp. Aged Oil Surfaces (psi)

Product	Scotch-Weld Acrylic Adhesive DP805	Scotch-Weld Acrylic Adhesive DP820
Etched Alum (Oily) 120°F (49°C)/100% RH/4 wks	3500	1650
Etched Alum 200°F (93°C)/100% RH/2 wks	3300	1000
CRS (Oily) 120°F (49°C)/100% RH/2 wks	2600	1150

14. Overlap Shear (ASTM D-1002-64) (3M TM C-236) 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 73°F (23°C) except when noted. 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 0.035 in.; other metals: 0.05-0.064 in.; rubbers, 0.125 in.; plastics, 0.125 in.

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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.

180° T-Peel Adhesion^{15, 16} (piw)

Substrate	Test Temperature	Peel Adhesion	
		3M™ Scotch-Weld™ Acrylic Adhesive DP805	3M™ Scotch-Weld™ Acrylic Adhesive DP820
Etched Al/Etched Al	-67°F (-55°C)	20	19
Etched Al/Etched Al	73°F (23°C)	35	22
Etched Al/Etched Al	100°F (38°C)	35	22
Etched Al/Etched Al	130°F (54°C)	36	22
Etched Al/Etched Al	150°F (65°C)	35	22
Etched Al/Etched Al	180°F (83°C)	34	22
Neoprene/CRS	73°F (23°C)	16 ¹⁷	11
Nitrile/CRS	73°F (23°C)	4	22
Red SBR/CRS	73°F (23°C)	17 ¹⁷	—
Black SBR/CRS	73°F (23°C)	3	9

Rate of Strength Build-up OLS¹⁴ (psi)

Etched Al/Etched Al Time Bonding to Testing	OLS Bond Strength	
	Scotch-Weld Acrylic Adhesive DP805	Scotch-Weld Acrylic Adhesive DP820
7 minutes	125	—
15 minutes	1000	—
30 minutes	2000	40
1 hour	2600	900
2 hours	2800	1700
4 hours	3200	2750
1 day	3500	3400
2 days	3500	3450
7 days	3500	3450

14. Overlap Shear (ASTM D-1002-64) (3M TM C-236) 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 73°F (23°C) except when noted. 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 0.035 in.; other metals: 0.05-0.064 in.; rubbers, 0.125 in.; plastics, 0.125 in.

15. Metal/metal bonds tested per 3M TM C-439 @ 20 in./min. at 73°F (23°C) substrate 0.020 in. thick. Metal/rubber bonds pulled at 10 in./min.

16. Rubber/metal bonds. Rubber sanded with 120 grit sandpaper then MEK wiped.

17. Rubber delamination/tear.

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Note: The data in this technical data sheet were generated using the 3M™ EPX™ Applicator System equipped with an EPX static mixing nozzle, according to manufacturer's directions. Thorough hand mixing should offer comparable results.

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. The amount of surface preparation depends on the required bond strength, environmental aging resistance desired by user. For suggested surface preparations on common substrates, see the section on surface preparation.
2. Mixing

For Duo-Pak Cartridges

3M™ Scotch-Weld™ Acrylic Adhesives DP805 and DP820 are 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 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 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 on the product label or in the typical uncured properties section. Mix approximately 15 seconds after uniform color is obtained.

3. For maximum bond strength, apply adhesive evenly to both surfaces to be joined.
4. Application to the substrates should be made within 2 minutes for Scotch-Weld acrylic adhesive DP805 or 15 minutes for Scotch-Weld acrylic adhesive DP820. Larger quantities and/or higher temperatures will reduce this working time.
5. Join the adhesive coated surfaces and allow to cure at 60°F (16°C) or above until completely firm. Heat up to 120°F-150°F (49°C-66°C) will speed up curing. Scotch-Weld acrylic adhesive DP805 will fully cure in 8-24 hours @ 73°F (23°C) and Scotch-Weld acrylic adhesive DP820 will fully cure in 24-48 hours @ 73°F (23°C).
6. Keep parts from moving during cure. Contact pressure necessary. Maximum shear strength is obtained with a 3-5 mil bond line.
7. Excess uncured adhesive can be cleaned up with ketone type solvents.*
8. Once Scotch-Weld acrylic adhesive DP805 has been applied to a surface, it is best to join the two mating surfaces together as soon as possible. The reason for this is that after approximately one minute Scotch-Weld acrylic adhesive DP805 may begin to form a very thin "skin" over the exposed surface. If left exposed long enough (2-3 minutes), a thick enough "skin" may form which will inhibit the proper wetting needed to achieve maximum performance. In instances where an extended exposed open time is required, it is still possible to achieve excellent bonds by coating both substrates to be joined and making the bond in such a manner as to rupture the "skin" surface. Scotch-Weld acrylic adhesive DP820 does not exhibit this skinning characteristic.

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

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

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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. The amount of surface preparation depends on the required bond strength, 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 solvents such as acetone or isopropyl 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 o 41.5 oz./gallon
2024-T3 aluminum (dissolved)	0.2 oz./gallon minimum
Tap water as needed for balance	

3. Rinse: Rinse panels in clear running tap water.
4. Dry: Air dry 15 minutes; forced air 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 (or see instruction pertaining to a specific primer).

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 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 the manufacturer's precautions and directions for use.

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Storage	Store product in cool, dry area where temperature is less than 80°F (27°C). Refrigerated storage (40°F to 55°F [4°C to 13°C]), but not frozen, is recommended to extend the shelf life of the products further.
Shelf Life	When stored in its original unopened cartridges at temperatures below 80°F (27°C), 3M™ Scotch-Weld™ Acrylic Adhesive DP805 has a shelf life of nine months from the date of shipment from 3M. Within this time period, short term exposure (less than two weeks) to temperatures greater than 80°F (27°C), but less than 120°F (49°C), are acceptable. When stored in its original unopened cartridges at temperatures below 80°F (27°C), 3M™ Scotch-Weld™ Acrylic Adhesive DP820 has a shelf life of six months from the date of shipment from 3M. Within this time period, short term exposure (less than two weeks) to temperatures greater than 80°F (27°C), but less than 120°F (49°C), are acceptable. If product handling does not meet these conditions then a visual inspection of the product during dispensing is recommended. Any appearance of gels in the mixing nozzle or abnormally high viscosity that makes adhesive delivery difficult indicates that the product should not be used.
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.
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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ISO 9001:2000

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Industrial Adhesives and Tapes Division

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