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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 | • Easy mixing |
| | • 5 minute worklife (Scotch-Weld acrylic adhesive DP805) 20 minute worklife (Scotch-Weld acrylic adhesive DP820) | • Non-sag |
| | • Minimal surface preparation | • 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 |
| Viscosity¹ @ 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 |
| Worklife² @ 73°F (23°C) | Nozzle mixed | 3-4 minutes | 15-20 minutes |
| Applied Open Time³ | | 3 minutes | 15 minutes |
| Time to Handling Strength⁴ | | 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

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

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).

3M™ Scotch-Weld™ Acrylic Adhesives DP805 • DP820

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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