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Scotch-Weld Acrylic Adhesive DP-818

Preliminary Technical Data Sheet

Dec.1996

Product Description 3M Scotch-Weld DP-818 Acrylic Adhesives is two part, 1:1 mix ratio, toughened acrylic structural adhesive. It exhibit excellent shear and peel strength along with good impact and durability. DP-818 adhesive bond well to many metals, ceramics, wood and most plastics.

| | | |
|-----------------|-------------------------------------|-----------------|
| Features | * Excellent shear and peel strength | * Easy mixing |
| | * 20 minute worklife | * 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 | | DP-818 |
| Color | Part A Part B | light green light red |
| Density (gram/ml) | Part A Part B | 0.97 1.02 |
| Viscosity ¹ 23 deg.C | Part A Part B | 10,000cps 8,000cps |
| Base Resin | | Acrylic resin |
| Mix Ratio (A:B) | By volume By weight | 1:1 1:1 |
| Worklife ² 23 deg.C | Nozzle mixed | 15-20 minutes |
| Applied Open Time ³ | | 15 minutes |
| Time to Handling Strength ⁴ | | 30-35 minutes |

For footnotes, see Test Procedures section on Page 7.

3 Scotch-Weld Acrylic Adhesives DP-818

Typical Cured Properties

Physical

| | |
|-------------------------------|-------------------|
| Product | DP-818 |
| Color | Cream white |
| Shore D Hardness ⁵ | 74 |
| Full Cure Time ⁶ | 48 hrs. @23 deg.C |
| Elongation ⁷ | approx. 50% |
| Tensile Strength ⁷ | - |

Thermal

| | |
|--|---------------------------------------|
| Product | DP-818 |
| Glass Transition Temp.(Tg) ⁸ | 59 deg. C |
| Coefficient of thermal Expansion (unit/unit/deg.C) ⁹ | 180x10 ⁻⁶ (20-70 deg.C) |
| Weight Loss at Temp. ¹⁰ By Thermal Gravimetric Analysis (TGA) | 1% @ 130 deg.C 5% @ 230 deg.C |

Electrical

| | |
|-----------------------------------|--|
| Product | DP-818 |
| Dielectric Constant ¹¹ | 3.1 @500Hz 3.0 @1000Hz 2.8 @10KHz 2.8 @100KHz |
| Dissipation Factor ¹² | 0.083 @500Hz 0.065 @1KHz 0.032 @10KHz 0.022 @100KHz |
| Volume Resistivity ¹² | 2.2 x 10 ¹² ohm-cm |
| Dielectric Strength ¹³ | 3500 volts/mil |
| Surface Resistivity ¹² | 1.6x10 ¹⁴ ohms |

For footnotes, see Test Procedures section on Page 7.

3 Scotch-Weld Acrylic Adhesive DP-818

Typical Adhesive Performance Characteristics Overlap Shear (OLS)¹⁴ to Various Substrate (psi)

| Product | DP-818 |
|-------------------------------|--------|
| Aluminum-etched | 3200 |
| Aluminum-(etched/oily) | 2900 |
| Aluminum-(sandpaper) | 3100 |
| Aluminum-(solvent cleaned) | 2800 |
| Cold Rolled Steel (CRS) | 2700 |
| CRS(oily) | 2650 |
| Copper | - |
| Galvanized Steel | 1100 |
| FR-4 Glass Epoxy | 1000 |
| Fiberglass reinforced plastic | 1000 |
| ABS | 1100 |
| PVC | 700 |
| Polycarbonate | 1100 |
| Acrylic | 1200 |
| Fir Wood | 1200 |

Overlap Shear¹⁴ CRS/CRS Tested After 7 Days Immersion in the Following

| Product | DP-818 |
|---------------------------|--------|
| Control (no immersion) | 2500 |
| Toluene | NR |
| Machine Oil | 1950 |
| IPA (isopropyl alcohol) | 1350 |
| Gasoline | 1500 |
| 1,1,1-Trichloroethane | NR* |
| 10% HCL | NR* |
| MEK (methyl ethyl ketone) | NR* |
| Acetone | NR* |

* NR--Not Recommended

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

| Product | DP-818 |
|------------------------|--------|
| Control (RT aging) | 2000 |
| 120 deg.C/2 weeks | 3300 |
| 90 deg.C/90%RH/2 weeks | 1600 |
| Tap Water 1 week/RT | 1500 |

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

| Product | DP-818 |
|------------------------|--------|
| Control (RT Aging) | 2500 |
| 120 deg.C/2 weeks | 300 |
| 90 deg.C/90%RH/2 weeks | 850 |
| Tap Water 1 week/RT | 850 |

For footnotes, see Test Procedures section on Page 7.

3 Scotch-Weld Acrylic adhesive DP-818

**Typical Adhesive
Performance
Characteristics**
(continued)

Overlap Shear¹⁴ (Etched Al/Etched Al) Tested at Various Temp. (psi)

| Product | DP-818 |
|-----------|--------|
| -55 deg.C | 3100 |
| 23 deg.C | 3150 |
| 83 deg.C | 1900 |
| 93 deg.C | 1450 |

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

| Product | DP-818 |
|--|--------|
| Etched Al. (Oily) 49 deg.C/100%RH/4 weeks | 1650 |
| Etched Al. 93 deg.C/100%RH/2 weeks | 1000 |
| CRS(Oily) 49 deg.C/100%RH/2 weeks | 1150 |

180 degree T-Peel Adhesion^{15,16} (piw)

| Substrate | Test Temp. deg.C | Peel adhesion, DP-818 |
|---------------------|---------------------|--------------------------|
| Etched Al/Etched Al | -55 | 19 |
| Etched Al/Etched Al | 23 | 22 |
| Etched Al/Etched Al | 38 | 22 |
| Etched Al/Etched Al | 54 | 22 |
| Etched Al/Etched Al | 65 | 22 |
| Etched Al/Etched Al | 83 | 22 |
| Neoprene/CRS | 23 | 11 ¹⁷ |
| Nitrile/CRS | 23 | 22 |
| Red SBR/CRS | 23 | - |
| Black SBR/CRS | 23 | 9 |

Rate of Strength Build-up OLS¹⁴ (psi)

| Etched Al/Etched Al Time bonding to testing | OLS Bond Strength DP-818 |
|--|-----------------------------|
| 7 minutes | - |
| 15 minutes | - |
| 30 minutes | 40 |
| 1 hour | 900 |
| 2 hours | 1700 |
| 4 hours | 2750 |
| 1 day | 3400 |
| 2 days | 3450 |
| 7 dars | 3450 |

For footnotes, see test Procedures section on Page 7.

3 Scotch-Weld Acrylic Adhesive DP-818

Note: The data in this technical data sheet were generated using the 3M Scotch-Weld EPX Applicator System equipped with an EPX static mixer 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 directly depends on the required bond strength, environmental aging resistance desired by user. For suggested surface preparations on common substrates, see the following section on Surface Preparation. 2: Mixing For Duo-Pak Cartridges Scotch-Weld DP-818 Acrylic Adhesive are supplied in a dual syringe plastic Duo-Pak cartridge as part of the 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 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 15 minutes for DP-818 adhesive. Larger quantities and/or higher temperatures will reduce this working time. 5: Join the adhesive coated surfaces and allow to cure at 16 deg.C or above until completely firm. Heat up to 93 deg.C will speed curing. Adhesive will fully cured in 24 hours. 6: Keep parts from moving during cure. Contact pressure is 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 DP-818 Acrylic Adhesive 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 two minutes DP-818 Acrylic Adhesive may begin to form a very thin " skin" over the exposed surface. If left exposed long enough (3-4 minutes), a thick enough "skin" may form which will inhibit the proper wetting needed |
|------------------------------------|---|

3 Scotch-Weld Acrylic Adhesives DP-818

Handling/Curing Information (continued)

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.

Adhesive Coverage: A 0.005 in. thick bondline will yield a coverage of 32 sq.ft./gallon (typical).

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

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 directly 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 solvent 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. If Scotch-Weld 1945 B/A two-part primer is used, apply a thin coating (0.5mils) on the metal surfaces to be bonded, air dry for 10 minutes, then cure for 30 minutes at 82 deg.C prior to bonding.

Aluminum:

- 1: Vapor Degrease: Perchloroethylene condensing vapors for 5-10 minutes.
- 2: Alkaline Degrease: Oakite 164 solution (9-11 oz./gallon water) at 88±5 deg.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 66±2 deg.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 | Balance of volume |
- 4: Rinse: Rinse panels in clear running tap water.
- 5: Dry: Air dry 15 minutes; force dry 10 minutes at 88 ± 5 deg.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.

3 Scotch-Weld Acrylic Adhesive DP-818

**Surface
Preparation**
(continued)

Glass:

- 1: Solvent wipe surface using acetone or MEK.
- 2: Apply a thin coating (0.0001 in. or less) of Scotch-Weld EC-3901 Primer 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 for handling such materials.

Test Procedures:

- 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 23 deg.C.
- 5: ASTM D-2240.
- 6: Time to develop 80% of maximum overlap shear values.
- 7: Tensile and Elongation. Used procedure in 3M ITSD TM (3M Industrial Tape and Specialties Division, Test Method) C-3094/ASTM D0882. Samples were 2 in. dumbbells with 0.125 in. neck and 0.030 in. sample thickness. Separation rate was 2 in./minute.
- 8: Determined using DSC and heating rate of 20 deg.C per minute.
- 9: Determined using Thermal Mechanical Analysis (TMA) and heating rate of 5 deg.C per minute. First heat value given.
- 10: By TGA in air at 10 deg.C/min. Perkin Elmer TGA-7.
- 11: ASTM D-150 at 23 deg.C
- 12: ASTM D-257 at 23 deg.C
- 13: ASTM D-149 at 23 deg.C. Sample thickness 14 mils.
- 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 11 in. X 4 in. pieces of substrate. The thickness of the bond line was 0.005 - 0.008 in. All strengths were measured at 23 deg.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.; rubber 0.125 in.; plastics 0.125 in.
- 15: Metal/metal bonds tested per 3M ITSD TM C-439 @ 20 in./min. at 23 deg.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.

3 Scotch-Weld Acrylic Adhesive DP-818

**Storage
and Shelf Life**

Storage: Store product in cool, dry area where temperature will not exceed 16 deg.C. Refrigerated storage is recommended.

Shelf Life: Scotch-Weld DP-818 acrylic adhesive in bulk containers have a shelf life of 6 months in unopened original containers and 6 months in Duo-Pak cartridges.

**Precautionary
Information**

Refer to Product Label and Material Safety Data Sheet for Health and Safety Information before using the product.

**For Additional
Information**

To request additional product information or to arrange for sales assistance, call toll free 1-800-742-5933. Address correspondence to : 3M Industrial Tape and Specialties Division, 3M Center, Building 200-8E-04, P.O. Box 33220, St.Paul, MN 55133-3220. Our fax number is 612-736-4776. In Canada, phone: 1-519-451-2500. In Puerto Rico, phone: 1-809-750-3000. In Mexico, phone: 1-915-6-26-04-00.

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ISO 9002

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For Additional Product Safety and Health Information, see Material Safety Data Sheet, or call:
3M, Adhesive Systems, Industrial Tape and Specialties Division
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Phone: 612/733-1110, Operator No. 55

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