3M

Scotch-Weld™

Epoxy Adhesive

DP420 Black • Off-White

Technical Data **March, 2004**

Product Description

3M™ Scotch-Weld™ Epoxy Adhesive DP420 is a high performance, two-part epoxy adhesive offering outstanding shear and peel adhesion, and very high levels of durability.

Features

- High shear strength
- High peel strength
- Outstanding environmental performance
- Easy mixing
- Controlled flow
- 20 minute worklife

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 Epoxy Adhesive DP420 Black	Scotch-Weld Epoxy Adhesive DP420 Off-White
Viscosity (approx.) @ 73°F (23°C)	**Base** **Accelerator**	20,000-50,000 cps 8,000-14,000 cps	20,000-50,000 cps 8,000-14,000 cps
Base Resin	**Base** **Accelerator**	epoxy amine	epoxy amine
Color	**Base** **Accelerator**	black amber	white amber
Net Weight Lbs./Gallon	**Base** **Accelerator**	9.3-9.7 8.8-9.2	9.3-9.7 8.8-9.2
Mix Ratio (B:A)	**Volume** **Weight**	2:1 2:0.97	2:1 2:0.98
Worklife, 73°F (23°C)	**20 g mixed** **10 g mixed** **5 g mixed**	15 minutes 20 minutes 30 minutes	15 minutes 20 minutes 30 minutes

Typical Cured Thermal Properties

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

Product	3M™ Scotch-Weld™ Epoxy Adhesive DP420 Black	3M™ Scotch-Weld™ Epoxy Adhesive DP420 Off-White
Physical Color	Black	Opaque, off-white
Shore D Hardness	75-80	75-80
Thermal Coefficient of Thermal Expansion (in./in./°C) Below Tg Above Tg	80×10^{-6} 194×10^{-6}	85×10^{-6} 147×10^{-6}
Thermal Conductivity (btu - ft./ft.^{2} - hr. - °F) @ 45°C	0.104	0.104
Electrical Dielectric Strength (ASTM D 149)	888 volts/mil	690 volts/mil
Volume Resistivity (ASTM D 257)	1.6×10^{15} ohm-cm	1.3×10^{14} ohm-cm

Typical Curing Characteristics

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

Rate of Strength Build-Up
Aluminum, Overlap Shear (7 mil Bondline) (ASTM D 1002-72)
Bonds Tested at 73°F (23°C)
Scotch-Weld Epoxy Adhesive DP420 Black

Time in Oven	Cure Temperature		
	73°F (23°C)	120°F[1] (49°C)	140°F[1] (60°C)
15 min.	—	—	3200
30	—	2300	—
60	—	4700/50[2]	4700/50[2]
2 hr.	300	—	—
3	800	—	—
5	3000	—	—
6	3700	—	—
24	4500/50[2]	—	—

[1]This represents the oven temperature to which the bonds were subjected for the prescribed time. The average bondline temperature during the cure time will be somewhat lower than the oven temperature.

NOTE: The data in this data sheet were generated using the 3M™ EPX™ Applicator System equipped with an EPX static mixer, according to manufacturer's directions. Thorough hand-mixing will afford comparable results.

Scotch-Weld™
Epoxy Adhesive
DP420 Black • Off-White

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.

Substrates and Testing

A. Overlap Shear (ASTM D 1002-72)

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 except for aluminum. Two panels 0.063 in. thick, 4 in. x 7 in. of 2024T-3 clad aluminum were bonded and cut into 1 in. wide samples after 24 hours. The thickness of the bondline was 0.005-0.008 in. All strengths were measured at 73°F (23°C) except where 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, 0.060 in.; other metals, 0.05-0.064 in.; rubbers, 0.125 in.; plastics, 0.125 in.

B. T-peel (ASTM D 1876-61T)

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 0.032 in. thick.

C. Bell Peel (ASTM D 3167)

Bell peel strengths were measured on 1/2 in. wide bonds at the temperatures noted. The testing jaw separation rate was 6 in. per minute. The bonds are made with 0.064 in. bonded to 0.025 in. thick adherends.

D. Cure Cycle

With the exception of Rate of Strength Build-Up Tests, all bonds, were cured 7 days at 73°F (23°C) at 50% RH before testing or subjected to further conditioning or environmental aging.

Aluminum, Overlap Shear, at Temperature (PSI)

	3M™ Scotch-Weld™ Epoxy Adhesive DP420 Black	3M™ Scotch-Weld™ Epoxy Adhesive DP420 Off-White
-67°F (-55°C)	4500	4500
73°F (23°C)	4500	4500
180°F (82°C) (15 min.)[1]	1260	450
(30 min.)[1]	2250	700
(60 min.)[1]	2980	750
(4 hr.)[1]	2690	2500
250°F (121°C) (15 min.)[1]	571	200

[1]Represents time in test chamber oven before test.

Metals, Overlap Shear, Tested @ 73°F (23°C) (PSI)

		Scotch-Weld Epoxy Adhesive DP420 Black	Scotch-Weld Epoxy Adhesive Off-White
Aluminum	Etched	4500	4500
	Oakite degrease	4000	3500
	MEK/abrade/MEK[2]	2500	3500
Cold Rolled Steel	Oakite degrease	—	4000
	MEK/abrade/MEK[2]	2200	2700
Copper-	MEK/abrade/MEK[2]	5000	4000
Brass-	MEK/abrade/MEK	—	4000
	CDA 260	2800	4100
Stainless Steel	MEK/abrade/MEK[2]	1800	4000
Galvanized Steel-	Hot dipped	2900	2000
	Electrodeposited	3000	2100

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.

Substrates and Testing *(continued)*

Aluminum, T-Peel (PIW), at Temperature

	3M™ Scotch-Weld™ Epoxy Adhesive DP420 Black	3M™ Scotch-Weld™ Epoxy Adhesive DP420 Off-White
-67°F (-55°C)	9.3	5-10
73°F (23°C)	50	50
180°F (82°C)	20	3-5

Metals, T-Peel, Tested @ 73°F (23°C) (PIW)

		Scotch-Weld Epoxy Adhesive DP420 Black	Scotch-Weld Epoxy Adhesive DP420 Off-White
Aluminum, etched	17-20 mil bondline	60	50
	5-8 mil bondline	50	40
Cold Rolled Steel	17-20 mil bondline		
	Oakite degreased	40	40
	MEK/abrade/MEK	25	25

Aluminum, Bell Peel (PIW), at Temperature

	Scotch-Weld Epoxy Adhesive DP420 Black	Scotch-Weld Epoxy Adhesive DP420 Off-White
-67°F (-55°C)	20	
73°F (23°C)	82	not tested
180°F (82°C)	18	

Other Substrates, Overlap Shear Tested @ 73°F (23°C)

	Surf. Prep. 1		Surf. Prep. 2	
Substrate	Scotch-Weld Epoxy Adhesive DP420 Black	Scotch-Weld Epoxy Adhesive DP420 Off-White	Scotch-Weld Epoxy Adhesive DP420 Black	Scotch-Weld Epoxy Adhesive DP420 Off-White
ABS	446	325	550	500
PVC	402[3]	220	360[3]	300
Polycarbonate	438	400	450	550
Polyacrylic	194	230	450	275
Polystryene	375	350	575	375
FRP	605	350	1100[3]	1300[3]
Phenolic	1400[3]	1400[3]	1300[3]	1400[3]
SBR/Steel	71	150[3]	175[3]	150[3]
Neoprene/Steel	84	45	100[3]	75[3]

[1]Isopropyl Alcohol Wipe. See Surface Preparation Section D for additional information.

[2]Isopropyl Alcohol/Abrade/Isopropyl Alcohol: See Surface Preparation Section E for additional information.

[3]Substrate failure.

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.

Substrates and Testing *(continued)*
Environmental Resistance
Aluminum (Etched)
Measured by Overlap Shear Tested @ 73°F (23°C) (PSI)[1] (ASTM D 1002-72)

Environment	Condition	3M™ Scotch-Weld™ Epoxy Adhesive DP420 Black	3M™ Scotch-Weld™ Epoxy Adhesive DP420 Off-White
73°F (23°C)/50% RH	30 d[2]	4900	5100
Distilled Water	30 d, i[3]	4200	4700
Water Vapor	120°F (49°C)/100% RH, 30 d 200°F (93°C)/100% RH, 14 d	4000 4033	4700 3000
Antifreeze/H_2O (50/50)	180°F (82°C), 30 d, i	3000	4200
Isopropyl Alcohol	73°F (23°C), 30 d, i	4500	5300
Methyl Ethyl Ketone	73°F (23°C), 30 d, i	3500	4600
Salt Spray (5%)	95°F (35°C), 30 d	—	5100
Skydrol LD-4	150°F (66°C), 30 d, i	4000	5400

[1]Data reported are actual values from the lots tested and may be higher than values published elsewhere in this data sheet.
[2]d = days
[3]i = immersion

3M™ EPX™ Pneumatic Applicator Delivery Rates

200 ml Applicator – Maximum Pressure 58 psi

Adhesive*	6mm Nozzle gms/minute	10mm Nozzle gms/minute
3M™ Scotch-Weld™ Epoxy Adhesive DP420 Black	29.6	113.0
3M™ Scotch-Weld™ Epoxy Adhesive DP420 Off-White	31.1	132.0

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

Handling/Application Information

Directions for Use

3M™ Scotch-Weld™ Epoxy Adhesive DP420 is supplied in dual syringe plastic duo-pak cartridges as part of the 3M™ EPX™ Applicator System. The duo-pak cartridges are supplied in 37 ml, 200 ml and 400 ml configurations. To use the EPX cartridge system simply insert the duo-pak cartridge into the EPX applicator. 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 simultaneous mixing of Part A and Part B is desired, attach the EPX mixing nozzle to the duo-pak cartridge and begin dispensing the adhesive.

When mixing Part A and Part B manually the components must be mixed in the ratio indicated in the typical uncured properties section of this data sheet. Complete mixing of the two components is required to obtain optimum properties.

Two-part mixing/proportioning/dispensing equipment is available for intermittent or production line use. These systems are ideal for line uses because of their variable shot size and flow rate characteristics and are adaptable to most applications.

Apply adhesive to clean, dry surfaces, joint parts and secure until adhesive sets (see rate of strength build up).

Surface Preparation

The following surface preparations were used for substrates described in this Technical Data Sheet.

A. **Aluminum Etch**
Optimized FPL Etch - 3M (test method C-2803)

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 (3M test method C-2802).
2. Optimized FPL Etch Solution (1 liter):

Material	**Amount**
Distilled Water	700 ml plus balance of liter (see below)
Sodium Dichromate	28 to 67.3 grams
Sulfuric Acid	287.9 to 310.0 grams
Aluminum Chips	1.5 grams/liter of mixed solution

To prepare 1 liter of this solution, dissolve sodium dichromate in 700 ml of distilled water. Add sulfuric acid and mix well. Add additional distilled water to fill to 1 liter. Heat mixed solution to 66 to 71°C (150 to 160°F). Dissolve 1.5 grams of 2024 bare aluminum chips per liter of mixed solution. Gentle agitation will help aluminum dissolve in about 24 hours.

To FPL etch panels, place them in the above solution at 150 to 160°F (66 to 71°C) for 12 to 15 minutes.

Note: Review and follow precautionary information provided by chemical suppliers prior to preparation of this etch solution.

3. Rinse immediately in large quantities of clear running tap water.

Surface Preparation
(continued)

4. Dry – air dry approximately 15 minutes followed by force dry at 140°F (60°C) maximum for 10 minutes (minimum).
5. Both surface structure and chemistry play a significant role in determining the strength and permanence of bonded structures. It is therefore advisable to bond or prime freshly primed clean surfaces as soon as possible after surface preparation in order to avoid contamination and/or mechanical damage. Please contact your 3M sales representative for primer recommendations.

B. Oakite Degrease

Oakite 164 solutions (9-11 oz./gallon of water) at 190°F ± 10°F (88°C ± 5°C) for 2 minutes. Rinse immediately in large quantities of cold running water.

C. MEK/Abrade/MEK

Wipe surface with a methyl ethyl ketone (MEK) soaked swab, abrade and wipe with a MEK soaked swab.* Allow solvent to evaporate before applying adhesive.

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

D. Isopropyl Alcohol Wipe Only Surface Preparation

Wipe surface with an isopropyl alcohol soaked swab.* Allow solvent to evaporate before applying adhesive.

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

E. Isopropyl Alcohol/Abrade/Isopropyl Alcohol Surface Preparation

Wipe surface with an isopropyl alcohol soaked swab, abrade using clean fine grit abrasives, and wipe with an isopropyl alcohol soaked swab.* Then allow solvent to evaporate before applying adhesive.

***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 products at 60-80°F (15-27°C) or refrigerate for maximum shelf life.

Shelf Life

These products have a shelf life of 15 months in original 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.

For Additional Information

To request additional product information or to arrange for sales assistance, call toll free 1-800-362-3550 or visit www.3M.com/adhesives. Address correspondence to: 3M Industrial Adhesives and Tapes Division, Building 21-1W-10, 900 Bush Avenue, St. Paul, MN 55144-1000. Our fax number is 651-778-4244. In Canada, phone: 1-800-364-3577. In Puerto Rico, phone: 1-787-750-3000. In Mexico, phone: 52-70-04-00.

Product Use

All statements, technical information and recommendations contained in this document are based upon tests or experience that 3M believes are reliable. However, many factors beyond 3M's control can affect the use and performance of a 3M product in a particular application, including the conditions under which the product is used and the time and environmental conditions in which the product is expected to perform. Since these factors are uniquely within the user's knowledge and control, it is essential that the user evaluate the 3M product to determine whether it is fit for a particular purpose and suitable for the user's method of application.

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ISO 9001

This Industrial Adhesives and Tapes Division product was manufactured under a 3M quality system registered to ISO 9001 standards.

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