Scotch-Weld™
Epoxy Adhesives
DP-460 Off-White • DP-420 Off-White

Technical Data **September, 1997**

(Supersedes December, 1994)

Product Description

Scotch-Weld™ DP-460 and Scotch-Weld™ DP-420 Epoxy Adhesives are high performance, two-part epoxy adhesives 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
- 60 minute worklife (DP-460 Adhesive) or
- 20 minute worklife (DP-420 Adhesive)

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-460 Adhesive	DP-420 Adhesive
Viscosity (approx..) @ 73°F (23°C)	Base Accelerator	80,000 cps 10,000 cps	80,000 cps 10,000 cps
Base Resin	Base Accelerator	epoxy amine	epoxy amine
Color	Base Accelerator	white amber	white amber
Net Weight Lbs./Gallon	Base Accelerator	9.4 9.0	9.4 9.2
Mix Ratio (B:A)	Volume Weight	2:1 2:0.96	2:1 2:0.98
Worklife, 73°F (23°C)	20 g mixed 10 g mixed 5 g mixed	60 minutes 75 minutes 90 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	DP-460 Adhesive	DP-420 Adhesive
Physical Color	Opaque, off-white	Opaque, off-white
Shore D Hardness	75-80	75-80
Thermal Coefficient of Thermal Expansion (in./in./°C) Below Tg	59×10^{-6}	85×10^{-6}
Above Tg	159×10^{-6}	147×10^{-6}
Thermal Conductivity (btu - ft./ft.^{2} - hr. - °F) @ 45°C	0.104	0.104
Electrical Dielectric Strength (ASTM D 149)	1100 volts/mil	690 volts/mil
Volume Resistivity (ASTM D 257)	2.4×10^{14} ohm-cm	1.3×10^{14} ohm-cm

Handling/Application Information

Directions for Use

Scotch-Weld™ DP-460 and DP-420 Epoxy Adhesives are 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 37 ml cartridge 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 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.

With the 200 ml and 400 ml cartridges the nozzle must be attached before dispensing any material to prevent unmixed adhesive from getting into the applicator cartridge holder. A small quantity of material should be discarded until uniform color, consistency of product and even flow is evident.

When mixing Part A and Part B manually (Scotch-Weld 460 B/A Epoxy Adhesive or Scotch-Weld 420 B/A Epoxy Adhesive), the components must be mixed in the ratio indicated in the Typical Uncured Properties Section of this Technical Data Sheet (page 1). 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.

Surface Preparation

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

A. **Aluminum Etch**
Optimized FPL Etch - 3M (AdhD Method C-2803)

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 (3M AdhD method C-2802).
3. Acid Etch – Immerse panels in the following solution for 10 minutes at 150°F ± 5°F (66°C ± 3°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./gal. minimum
Tap Water	Balance

4. Rinse immediately in large quantities of clear running tap water.
5. Dry – air dry approximately 15 minutes followed by force dry at 150°F ± 5°F (66°C ± 3°C) for 10 minutes.
6. Current thinking suggests 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.

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 with Scotch-Brite Scouring Pad, and wipe with a MEK soaked swab.* Allow solvent to evaporate before applying adhesive.

D. Isopropyl Alcohol Wipe

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

E. Isopropyl Alcohol/Abrade/Isopropyl Alcohol

Wipe surface with an isopropyl alcohol soaked swab, abrade with Scotch-Brite Scouring Pad, and wipe with an isopropyl alcohol soaked swab.* Then allow solvent to evaporate before applying adhesive.

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

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 2024 T-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. 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)

	DP-460 Adhesive	DP-420 Adhesive
-67°F (-55°C)	4500	4500
73°F (23°C)	4500	4500
180°F (82°C) (15 min.)[1]	700	450
(30 min.)[1]	1000	700
(60 min.)[1]	1400	750
(4 hr.)[1]	2500	2500
250°F (121°C) (15 min.)[1]	220	200

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

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

		DP-460 Adhesive	DP-420 Adhesive
Aluminum	Etched	4500	4500
	Oakite degrease	3200	3500
	MEK/abrade/MEK	3500	3500
Cold Rolled Steel	Oakite degrease	3500	4000
	MEK/abrade/MEK	2800	2700
Copper-	MEK/abrade/MEK	4000	4000
Brass-MEK/abrade/MEK			
	CDA 260	4000	4000
	Cartridge	4200	4100
Stainless Steel	MEK/abrade/MEK	4000	4000
Galvanized Steel-	Oakite degrease		
	Hot dipped	2000	2000
	Electrodeposited	2100	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

Aluminum - etched (17-20 mil bondline)

	DP-460 Adhesive	DP-420 Adhesive
-67°F (-55°C)	5-10	5-10
73°F (23°C)	60	50
180°F (82°C)	3-5	3-5

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

		DP-460 Adhesive	DP-420 Adhesive
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

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

	Surf. Prep. 1		Surf. Prep. 2	
Substrate	**DP-460 Adhesive**	**DP-420 Adhesive**	**DP-460 Adhesive**	**DP-420 Adhesive**
ABS	300	325	575	500
PVC	500	220	350	300
Polycarbonate	400	400	500	550
Polyacrylic	220	230	330	275
Polystryene	450	350	475[3]	375
FRP	800	350	1000[3]	1300[3]
Phenolic	1400[3]	1400[3]	1400[3]	1400[3]
SBR/Steel	150[3]	150[3]	140[3]	150[3]
Neoprene/Steel	100	45	120[3]	75[3]

[1]Isopropyl Alcohol Wipe. See Surface Preparation Section (Part D) of this Technical Data Sheet for additional information.

[2]Isopropyl Alcohol/Abrade/Isopropyl Alcohol: See Surface Preparation Section (Part E) of this Technical Data Sheet 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	DP-460 Adhesive	DP-420 Adhesive
73°F (23°C)/50% RH	30 d[2]	5200	5100
Distilled Water	30 d, i[3]	5100	4700
Water Vapor	120°F (49°C)/100% RH, 30 d 200°F (93°C)/100% RH, 14 d	4500 3100	4700 3000
Antifreeze/H_2O (50/50)	180°F (82°C), 30 d, i	5000	4200
Isopropyl Alcohol	73°F (23°C), 30 d, i	5700	5300
Methyl Ethyl Ketone	73°F (23°C), 30 d, i	4200	4600
Salt Spray (5%)	95°F (35°C), 30 d	5100	5100
Skydrol LD-4	150°F (66°C), 30 d, i	3700	5400

[1]Data reported are actual values from the lots tested and may be higher than values published elsewhere in this Technical Data Sheet.

[2]d = days

[3]i = immersion

Environmental Resistance

Galvanized Steels[1]

Measured by Overlap Shear Tested @ 73°F (23°C) (PSI)[2] (ASTM D 1002-72)

Environment	Condition	Hot Dipped		Electrodeposited	
		DP-460 Adhesive	DP-420 Adhesive	DP-460 Adhesive	DP-420 Adhesive
73°F (23°C)/50% RH	30 d[3]	2200	2100	2300	2100
Distilled Water	30 d, i[4]	2300	1900	2300	2300
Water Vapor	120°F (49°C)/100% RH, 30 d 200°F (93°C)/100% RH, 14 d	1900 1500	1200 300	2000 1000	1800 500
Antifreeze/H_2O (50/50)	180°F (82°C), 30 d, i	2000	1100	1950	900
Isopropyl Alcohol	73°F (23°C), 30 d, i	2000	2200	2200	2200
Methyl Ethyl Ketone	73°F (23°C), 30 d, i	2000	2100	2200	2200
Trichloroethane	73°F (23°C), 30 d, i	2300	2000	2300	2200
Salt Spray (5%)	95°F (35°C), 30d	1900	1600	1500	1500

[1]Hot dipped or electrodeposited. Galvanized steels may afford a wide spectrum of performance due to the diversity of surfaces available. The user should test to determine specific performance.

[2]Data reported are actual values from the lots tested and may be higher than values published elsewhere in this Technical Data Sheet.

[3]d = days

[4]i = immersion

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)

Time in Oven	Cure Temperature		
	73°F (23°C)	120°F[1] (49°C)	140°F[1] (96°C)
30 min.	—	<50	3000/60[2]
60	—	1300	4500/60[2]
90	—	4300/60[2]	—
2 hr.	—	4400/60[2]	4800
3	—	4800/60[2]	—
5	400	—	—
6	1000	—	—
7	3500	—	—
24	4000/60[2]		

DP-420 Adhesive

Time in Oven	Cure Temperature		
	73°F (23°C)	120°F[1] (49°C)	140°F[1] (96°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.

[2]The value in the denominator is the expected minimum 73°F (23°C) T-peel strength (piw) measured after the indicated cure cycle.

NOTE: The data in this Technical Data Sheet were generated using the Scotch-Weld EPX Applicator System equipped with an EPX static mixer, according to manufacturer's directions. Thorough hand-mixing will afford comparable results.

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Epoxy Adhesives
DP-460 Off-White • DP-420 Off-White

Storage and Shelf Life

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 12 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 Information

To request additional product information or to arrange for sales assistance, call toll free 1-800-362-3550. Address correspondence to: 3M Adhesives Division, 3M Center, Building 220-7E-05, St. Paul, MN 55144-1000. Our fax number is 612-733-9175. In Canada, phone: 1-800-364-3577. In Puerto Rico, phone: 1-809-750-3000. In Mexico, phone: 5-728-2180.

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If the 3M product is proved to be defective, THE EXCLUSIVE REMEDY, AT 3M'S OPTION, SHALL BE TO REFUND THE PURCHASE PRICE OF OR TO REPAIR OR REPLACE THE DEFECTIVE 3M PRODUCT. 3M shall not otherwise be liable for loss or damages, whether direct, indirect, special, incidental, or consequential, regardless of the legal theory asserted, including negligence, warranty, or strict liability.

ISO 9002

This Adhesives Division product was manufactured under a 3M quality system registered to ISO 9002 standards.

For Additional Product Safety and Health Information, See Material Safety Data Sheet, or call:

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