

3M™ Scotch-Weld Epoxy Adhesives EC-460

Off-White

Technical Data Sheet

Description

Product Description 3M™ Scotch-Weld™ Epoxy Adhesives EC-460 Off-White are high performance, two-part epoxy adhesives offering outstanding shear and peel adhesion, and very high levels of durability.

- High shear strength
- High peel strength
- Outstanding environmental performance
- Easy mixing
- Controlled flow
- 60 minute work life

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

Typical Uncured Physical Properties (Not for specification purposes.)

Product		Scotch-Weld Epoxy Adhesive EC-460 Off-White
Viscosity (approx.) @ 73°F (23°C)	Base Accelerator	20,000 - 50,000 cps 8,000 - 16,000 cps
Base Resin	Base Accelerator	Epoxy Amine
Color	Base Accelerator	White Amber
Net Weight Lbs./Gallon	Base Accelerator	9.3-9.7 8.8-9.2
Density (g/cm ³)	Base Accelerator	1.14 1.08
Mix Ratio (B:A)	Volume Weight	2:1 2:0.96
Worklife, 73°F (23°C)	20 g mixed 10 g mixed 5 g mixed	60 minutes 75 minutes 90 minutes

Typical Cured Thermal Properties (Not for specification purposes.)

Product		3M™ Scotch-Weld™ Epoxy Adhesive EC-460 Off-White
Physical		
Color		Opaque, off-white
Shore D Hardness		75–80
DMA – Loss Modulus (Tg Onset)		57.74
Thermal		
Coefficient of Thermal Expansion (in./in./°C)	Below Tg	59×10^{-6}
	Above Tg	159×10^{-6}
Thermal Conductivity (btu - ft./ft ² - hr. - °F) @ 45°C		0.104
Electrical		
Dielectric Strength (ASTM D 149)		1100 volts/mil
Volume Resistivity (ASTM D 257)		2.4×10^{14} ohm-cm

Typical Curing Characteristics (Not for specification purposes.)

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

¹This 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.

²The 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 3M™ EPX™ Applicator System equipped with an EPX static mixer, according to manufacturer's directions. Thorough hand-mixing will afford comparable results.

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
 EC-460 Off-White

Typical Adhesive Performance Characteristics

(Not for specification purposes.)

Aluminum, Overlap Shear,
at Temperature (PSI)

	3M™ Scotch-Weld™ Epoxy Adhesive EC-460 Off-White
-67°F (-55°C)	4600
73°F (23°C)	5200
180°F (82°C) (15 min.) ¹	2400
(30 min.) ¹	2400
(60 min.) ¹	2700
(4 hr.) ¹	2700
250°F (121°C) (15 min.) ¹	560

¹Represents time in test chamber oven before test.

Substrates and Testing

1. 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. × 4 in. pieces of substrate except for aluminum. Two panels 0.063 in. thick, 4 in. × 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.
2. 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.
3. 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.
4. 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.

Typical Adhesive Performance Characteristics, Cont.

(Not for specification purposes.)

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

Substrate		3M™ Scotch-Weld™ Epoxy Adhesive EC-460 Off-White
Aluminum	Etched	4500
	Oakite degrease	3200
	MEK/abrade/MEK	3500
Cold Rolled Steel	Oakite degrease	3500
	MEK/abrade/MEK	2800
Copper	MEK/abrade/MEK	4000
Brass	MEK/abrade/MEK	—
	CDA 260	4000
	Cartridge	4200
Stainless Steel	MEK/abrade/MEK	4000
Galvanized Steel	Oakite degrease	—
	Hot dipped	2000
	Electrodeposited	2100

Aluminum, T-Peel (PIW), at Temperature
Aluminum - etched (17-20 mil bondline)

Temperature	3M™ Scotch-Weld™ Epoxy Adhesive EC-460 Off-White
-67°F (-55°C)	5-10
73°F (23°C)	64
180°F (82°C)	

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

Substrate	3M™ Scotch-Weld™ Epoxy Adhesive EC-460 Off-White
Aluminum, Etched 17-20 mil bondline 5-8 mil bondline	60 50
Cold Rolled Steel (17-20 mil bondline) Oakite degreased MEK/abrade/MEK	40 25

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

	Surface Prep. ¹ EC-460 Off-White
ABS	650
PVC	1000
Polycarbonate	600
Acrylic	250
Polystyrene	450
FRP	800
Phenolic	1300
SBR/Steel	150 ²
Neoprene/Steel	100

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

² Substrate failure.

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 EC-460 Off-White
73°F (23°C)/50% RH	30 d ²	5500
Distilled Water	30 d, i ³	5300
Water Vapor	120°F (49°C)/100% RH, 30 d 200°F (93°C)/100% RH, 14 d	4500 4500
Antifreeze/H ₂ O (50/50)	180°F (82°C), 30 d, i	5100
Isopropyl Alcohol	73°F (23°C), 30 d, i	5700
Methyl Ethyl Ketone	73°F (23°C), 30 d, i	4200
Salt Spray (5%)	95°F (35°C), 30 d	5250
Skydrol® LD-4	150°F (66°C), 30 d, i	3700
Jet A	73°F (23°C), 7 d, i 73°F (23°C), 30 d, i	5600 5400
MEK	73°F (23°C), 30 d, i	4500
LD-4	150°F (66°C), 30 d, i	5650
Jet A (Nylon Substrate)	73°F (23°C), 7 d, i	370

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 Steels¹

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

Environment	Condition	3M™ Scotch-Weld™ Epoxy Adhesive EC-460 Off-White	
		Hot Dipped	Electrodeposited
73°F (23°C)/50% RH	30 d ³	2200	2300
Distilled Water	30 d, i ⁴	2300	2300
Water Vapor	120°F (49°C)/100% RH, 30 d 200°F (93°C)/100% RH, 14 d	1900 1500	2000 1000
Antifreeze/H ₂ O (50/50)	180°F (82°C), 30 d, i	2000	1950
Isopropyl Alcohol	73°F (23°C), 30 d, i	2000	2200
Methyl Ethyl Ketone	73°F (23°C), 30 d, i	2000	2200
Trichloroethane	73°F (23°C), 30 d, i	2300	2300
Salt Spray (5%)	95°F (35°C), 30 d	1900	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

Directions for Use

3M™ Scotch-Weld™ Epoxy Adhesives 460 Off-White is supplied in side by side cartridges. To use the cartridge simply insert the cartridge into the applicator and start the plunger into the cylinders using light pressure on the trigger. Next remove the cap and expel a small amount of adhesive to be sure both sides of the cartridge are flowing evenly and freely. If simultaneous mixing of part A and B is desired, attach the mixing nozzle to the 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. Complete mixing of the two components is required to obtain optimum properties.

Two-part mixing/proportioning/dispensing equipment can be used 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.

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

Aluminum Surface Preparation

A thoroughly cleaned, dry, grease-free surface is essential for maximum performance. Cleaning methods which will produce a break free water film on metal surfaces are generally satisfactory. Optimized FPL performed per ASTM D2651-01 and phosphoric acid anodization performed per ASTM D3933-98. Composite, Thermoplastic and Metal Preparation

MEK/Abrade/MEK

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

Isopropyl Alcohol/Abrade/ Isopropyl Alcohol

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.

Shelf life and Storage

3M™ Scotch-Weld™ Epoxy Adhesive EC-460 Off-White has a shelf life of 15 months from the date of shipment when stored at 60-80°F (15-27°C) in the original containers.

Precautionary Information

Refer to Product Label and 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, and visit www.3m.com/3M/en_US/company-us/SDS-search/

For Additional information

In the U.S., call toll free 1-800-235-2376, or fax 1-800-435-3082 or 651-737-2171. For U.S. Military, call 1-866-556-5714. If you are outside of the U.S., please contact your nearest 3M office or one of the following branches:

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Issue date: 4/2023

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