



Scotch-Weld™

Epoxy Adhesives

3501 B/A Gray and DP 3501

Technical Data

December, 2010

Product Description

3M™ Scotch-Weld™ Epoxy Adhesive 3501 B/A Gray and DP 3501 are rapid room temperature curing, two-part epoxy adhesives for use in bonding many metals, wood, and a variety of plastics. Equal parts by volume are easily mixed to produce strong, impact-resistant bonds.

Features

- Two-part room temperature curing structural adhesive with high shear strength.
- Fast cure.
- Controlled flow/thixotropic.
- Good environmental resistance.
- Excellent for bonding metal, wood, most plastics and masonry products.

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.

Color	Base Accelerator	White Black
Base Resin	Base Accelerator	Epoxy Amine
Viscosity Press Flow @ 75°F (24°C) Seconds to deliver 20 g at 60 psi through 0.104" orifice	Base Accelerator	15 - 40 35 - 60
Viscosity (Centipoise) Brookfield RVF, #7 spindle, 2 RPM at 75°F (24°C)	Base Accelerator	> 1,000,000 > 1,000,000
Net Weight (lbs./gallon)	Base Accelerator	12.6 ± .2 11.9 ± .2
Mix Ratio (B:A) (By Weight)	Volume Weight	1 : 1 1.1 : 1
Worklife at 75°F (24°C)		6-10 minutes in 20.5 g mass

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Typical Cured Properties

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Physical

Color	Gray
Shore D Hardness	75-80

Thermal

Thermal Coefficient of Expansion (in/in/°C)	60 x 10 ⁻⁶ (-50 to 10°C range) 234 x 10 ⁻⁶ (50 to 110°C range)
Thermal Conductivity btu - ft./ft.² - hr. - °F	0.193

Electrical

Dielectric Strength	700 volts/mil
Volume Resistivity	1.2 x 10 ¹³ ohm - cm

Handling/Curing Information

Directions for Use

3M™ Scotch-Weld™ Epoxy Adhesive DP 3501 is supplied in dual syringe plastic duo-pak cartridges as part of the 3M™ EPX™ Applicator System. The duo-pak cartridges are supplied in 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, join parts and secure until adhesive sets (see rate of strength build up).

These products may be applied by spatula, trowel, or flow equipment.

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Surface Preparation

For high strength structural bonds, paint, oxide films, oils, dust, mold release agents and all other surface contaminants must be removed. The amount of surface preparation depends on the user's required bond strength and environmental aging resistance.

The following cleaning methods are suggested for these common surfaces:

Steel:

1. Wipe free of dust with oil-free solvent such as Methyl Ethyl Ketone (MEK).*
2. Sandblast or abrade using clean fine grit abrasives.
3. Wipe again with solvent to remove loose particles.

Aluminum:

1. Vapor Degrease – Perchloroethylene* 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.
3. 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	38.5-41.5 oz./gallon
2024-T3 aluminum (dissolved)	0.2 oz./gallon minimum
Tap Water	Balance of Volume

Note: Read and follow component supplier's environmental, health and safety recommendations prior to preparation of this etch solution.

4. Rinse – Rinse panels in clear running tap water.
5. Dry – Air dry 15 minutes; force dry 10 minutes at 150°F ± 5°F (66°C ± 2°C).
6. If primer is to be used, it should be applied within 4 hours after surface preparation.
7. Read manufacturer's hazard communication and follow manufacturer's recommended guidelines for safe handling of the above chemical products.

Plastics:

1. Solvent wipe with Isopropyl Alcohol.*
2. Abrade using clean fine grit abrasives.
3. Solvent wipe with Isopropyl Alcohol.*

Rubbers:

1. Solvent wipe with Methyl Ethyl Ketone (MEK).*
2. Abrade using clean fine grit abrasives.
3. Solvent wipe with MEK.*

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

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Typical Performance Characteristics

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

A. Aluminum Overlap Shear

Overlap shear strength was measured on FPL etched 1" wide by 1/2" overlap specimens. The bonds were made from 2 panels of 4" x 7" x 0.063", 2024 T-3 clad aluminum bonded together and cut into 1" wide specimens. The separation rate of the testing jaws was 0.1"/minute. Tests similar to ASTM D-1002.

<u>Test Temp</u>	<u>Overlap Shear (PSI)</u>
-67°F (-55°C)	1500
75°F (24°C)	2400
180°F (82°C)	300

B. Steel Overlap Shear

Overlap shear strength was measured on 1" wide by 1/2" overlap bonds of 0.035" cold rolled steel. The steel was prepared by MEK solvent wiping, abrading and MEK wiping. The separation rate of the testing jaws was 0.1"/minute. Tests similar to ASTM D-1002.

<u>Test Temp</u>	<u>Overlap Shear (PSI)</u>
-67°F (-55°C)	1000
75°F (24°C)	2000
180°F (82°C)	150

C. Aluminum T-Peel

T-Peel bonds were measured on 1" wide specimens cut from two FPL etched 8" x 8" x 0.032", 2024 T-3 clad aluminum panels bonded together. The separation rate of the testing jaws was 20"/minute. Tests similar to ASTM D-1876.

<u>Test Temp</u>	<u>T-Peel (PIW)</u>
75°F (24°C)	4

D. Steel T-Peel

T-Peel bonds were measured on two 1" wide specimens of 0.035" cold rolled steel bonded together. The steel was prepared by MEK wiping, abrading and MEK wiping. The separation rate of the testing jaws was 20"/minutes. Tests similar to ASTM D-1876.

<u>Test Temp</u>	<u>T-Peel (PIW)</u>
75°F (24°C)	10

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Environmental Resistance

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

The following data was developed in overlap shear on 2024 T-3 clad FPL etched aluminum after aging in the following environments for the specified times. Tests similar to ASTM D-1002.

Environment	Time	Test Results 75°F (24°C)
100% Relative Humidity @ 120°F (49°C)	14 days	2030 psi
Salt Spray @ 95°F (35°C)	14 days	1895 psi
Tap Water @ 75°F (24°C)	14 days	1810 psi

Rate of Strength Build-Up

The following data was developed in overlap shear on 2024 T-3 clad FPL etched aluminum curing the adhesive at 75°F (24°C) for the times specified. Test similar to ASTM D-1002.

Time	Overlap Shear Strength
20 minutes	400 psi
30 minutes	500 psi
60 minutes	750 psi
90 minutes	900 psi

Storage

Store product at 60-80°F (15-27°C) or refrigerate for maximum storage life. Higher temperatures reduce normal storage life.

Shelf Life

3M™ Scotch-Weld™ Epoxy Adhesive DP 3501 has a shelf life of 15 months from the date of shipment from 3M when stored in its original unopened container.

Bulk 3M™ Scotch-Weld™ Epoxy Adhesive DP 3501 B/A has a shelf life of 24 months from the date of shipment from 3M when stored in its original unopened container.

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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

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ISO 9001:2008

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