Scotch-Weld™
Epoxy Adhesive
DP405 Black

Technical Data **March 2014**

Product Description

3M™ Scotch-Weld™ Epoxy Adhesive DP405 Black is a two-part, 2:1 mix ratio, toughened epoxy structural adhesive which has a 5 minute work life and accelerated cure. It exhibits excellent shear and peel strengths along with good impact resistance and durability. It bonds extremely well to many metal and composite surfaces. It also has lower odor when compared to traditional fast cure epoxies and acrylic adhesives.

Features

- Excellent shear and peel strengths
- 5-minute work life
- Easy mixing
- Low odor

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		3M™ Scotch-Weld™ Epoxy Adhesive DP405 Black
Color	Base (B) Accelerator (A)	Black Clear
Net Weight (lbs./gallon)	Base (B) Accelerator (A)	Approx. 10 Approx. 9.2
Viscosity[1] @ 73°F (23°C)	Base (B) Accelerator (A)	11,000 cps 6,500 cps
Base Resin		Epoxy
Mix Ratio (B:A)	By volume By weight	2 : 1 2.1 : 1
Work Life[2] @ 73°F (23°C)	Nozzle mixed	4 minutes
Applied Open Time[3]		3 minutes
Time to Handling Strength[4]		8 - 10 minutes

[1]Brookfield RVF Viscometer, #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 approximate 50 psi Overlap Shear Strength (OLS) when cured at (73°F) 23°C.

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.

Aluminum, Overlap Shear, at Temperature (PSI) (ASTM D1002)

Temperature	3M™ Scotch-Weld™ Epoxy Adhesive DP405
-67°F (-55°C)	4500
73°F (23°C)	4500
180°F (82°C) (15 min.)[1]	630
180°F (82°C) (30 min.)[1]	750
180°F (82°C) (1 hr.)[1]	940
180°F (82°C) (4 hrs.)[1]	900
250°F (121°C) (15 min.)[1]	400

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

Metals, Overlap Shear, Tested @ 73°F (23°C) (PSI) (ASTM D1002)

Product		3M™ Scotch-Weld™ Epoxy Adhesive DP405
Aluminum	MEK/abrade/MEK[1]	2580
Cold Rolled Steel	MEK/abrade/MEK[1]	2260
Galvanized Steel	MEK/abrade/MEK[1]	2050
Stainless Steel	MEK/abrade/MEK[1]	2860
Copper	MEK/abrade/MEK[1]	2300-
Brass	MEK/abrade/MEK[1]	2830

[1]MEK wipe/Abrade/MEK wipe: See Surface Preparation Section E for additional information.

Aluminum, Floating Roller Peel, at Temperature (PIW) (ASTM D3167)

Temperature	3M™ Scotch-Weld™ Epoxy Adhesive DP405
-67°F (-55°C)	18
73°F (23°C)	40
180°F (82°C)	8

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.

Other Substrates, Overlap Shear Tested @ 73°F (23°C) (ASTM D1002)

Substrate	3M™ Scotch-Weld™ Epoxy Adhesive DP405
ABS	300
PVC	370
Polycarbonate	360
Epoxy FRP	2070
Phenolic	1200

Environmental Resistance, Aluminum (Etched), Measured by Overlap Shear Tested @ 73°F (23°C) (PSI) (ASTM D1002)

Environment	Condition	3M™ Scotch-Weld™ Epoxy Adhesive DP405
Room Temperature	73°F(23°C)/50%RH, 30 days	4790
Water Vapor	150°F% 80% RH, 30 days	4420
Water Soak	73°F, 30 days	3820
80°C (176°F)	30 days	5400
Salt Spray	38°C/5% NaCl, 14 days	3900
IPA	73°F (23°C), 30 days immersion	4830
Methyl Ethyl Ketone	73°F (23°C), 30 days immersion	4610
Gasoline	73°F (23°C), 30 days immersion	4540
Diesel Fuel	73°F (23°C), 30 days immersion	5030
50% Antifreeze	73°F (23°C), 30 days immersion	4840
Motor Oil	73°F (23°C), 30 days immersion	4990
Thermal cycle	(-30°C/23°C/100%RH/70°C), 30 days	5340

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 (5 mil bondline) (ASTM D1002)
Bonds Tested at 73°F 23°C)

Time in Oven	Cure Temperature		
	73°F (23°C)	120°F[1] (49°C)	140°F[1] (60°C)
15 minutes	43	970	4380
30 minutes	110	3090	5900
1 hour	240	–	–
2 hours	630	–	–
3 hours	1630	–	–
5 hours	2220	–	–
6 hours	4410	–	–
24 hours	4790	–	–

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

Substrates and Testing

A. Overlap Shear (ASTM D1002)
Overlap Shear (ASTM D-1002-64, 3M Test Method C-236) strength was measured on 1" wide x 1/2" overlap specimen. These bonds were made individually using 1" x 4" pieces of substrates except for Aluminum. Two panels 0.063 in. thick, 4 in. x 7y in of 2024T-3 clad aluminum were bonded and cut into 1 in. wide samples after 24 hours. The thickness of the adhesive bond line was approximately 0.005". All strengths were measured at 73°F (23°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, 0.060 in.; other metals, 0.05-0.064 in.; rubbers, 0.125in.; plastics, 0.125 in. and samples were allowed to cure at 75°F (24°C) and approximately 50% RH for 1 week before tested. The separation rate of the testing jaws was 0.1 inch per minute for metals and 2 inches per minute for plastics.

B. Floating Roller Peel (Bell Peel) (ASTM D3167)
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 were made with 0.064 in. bonded to 0.025 in. thick adherends.

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.

Handling and Application Information

Directions for Use

3M™ Scotch-Weld™ Epoxy Adhesive DP405 Black 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 12 months in original duo-pak containers at room temperature.
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.
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ISO 9001:2008

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