



# Scotch-Weld™ Epoxy Adhesive

## DP405 LH • DP405 Black

Technical Data

July, 2009

### Product Description

3M™ Scotch-Weld™ Epoxy Adhesive DP405 LH 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 and durability. It bonds extremely well to many surfaces. It also has lower odor when compared to traditional fast cure epoxies and acrylic adhesives. Scotch-Weld DP405 LH is formulated for low halogen\* content. Scotch-Weld DP405 Black has the same properties as Scotch-Weld DP405 LH but is not formulated for low halogen content.

\*This product can be considered "low halogen". Low halogen is defined by the Electrotechnical Commission (IEC) 61249-2-21 standard as having less than 900 ppm bromine, less than 900 ppm chlorine, and less than 1500 ppm total bromine and chlorine.

### Features

- Excellent shear and peel strengths
- 5-minute work life
- Minimal surface preparation
- Easy mixing
- Low odor
- 2:1 mix ratio

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

<sup>1</sup>Brookfield RVF Viscometer, #7 spindle at 20 rpm.

<sup>2</sup>Approximate time during which material can remain in a mixer nozzle and still be expelled without undue force on the applicator.

<sup>3</sup>Approximate time after application of adhesive that bonds can be made without adversely affecting wetting out of adhesive and ultimate performance levels.

<sup>4</sup>Time to achieve approximate 50 psi Overlap Shear Strength (OLS) when cured at (73°F) 23°C.

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## 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)

Temperature	3M™ Scotch-Weld™ Epoxy Adhesive DP405 LH
-67°F (-55°C)	3500
73°F (23°C)	5300
180°F (82°C) (15 min.) <sup>1</sup>	850
(4 hr.) <sup>1</sup>	1890

<sup>1</sup>Represents time in test chamber oven before test.

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

Product	Scotch-Weld Epoxy Adhesive DP405 LH
Aluminum Etched MEK/abrade/MEK <sup>1</sup>	5530 2200
Cold Rolled Steel MEK/abrade/MEK <sup>1</sup>	2200
Galvanized Steel Hot dipped	2140

<sup>1</sup>MEK wipe/Abraide/MEK wipe: See Surface Preparation Section E for additional information.

### Aluminum, Bell Peel, at Temperature (PIW)

Temperature	3M™ Scotch-Weld™ Epoxy Adhesive DP405 LH
-67°F (-55°C)	15
73°F (23°C)	21
180°F (82°C)	11

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

Substrate	3M™ Scotch-Weld™ Epoxy Adhesive DP405 LH
ABS	350
HDPE	28
Polycarbonate	280
Polyacrylic	88

**3M™ Scotch-Weld™**  
**Epoxy Adhesive**  
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**Typical Adhesive  
 Performance  
 Characteristics**  
*(continued)*

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

Environment	Condition	3M™ Scotch-Weld™ Epoxy Adhesive DP405 LH
73°F (23°C)/50% RH	14 days	5530
Water Vapor	150°F% 80% RH, 14 days	5140
Methyl Ethyl Ketone	73°F (23°C), 30 days immersion	4650

**Total Halogen Performance (tested via Ion Chromatography)**

Product	Total Chlorine (ppm)	Total Bromine (ppm)
Scotch-Weld DP405 LH	662 nominal	< 20 nominal

**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 D1002-05)  
 Bonds Tested at 73°F (23°C)  
 3M™ Scotch-Weld™ Epoxy Adhesive DP405 LH**

Time in Oven	Cure Temperature		
	73°F (23°C)	120°F <sup>1</sup> (49°C)	140°F <sup>1</sup> (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	–	–

<sup>1</sup>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.

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**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. T-Peel (ASTM D1876)**

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**

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.

**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.

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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.

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