



# Technical Data Sheet

## 3M™ Scotch-Weld™ Epoxy Adhesive DP405 Black



Additional Info



Regulatory  
Info/SDS

### Product Description

3M™ Scotch-Weld™ Epoxy Adhesive DP405 Black is a two-part, 2:1 mix ratio, toughened epoxy structural adhesive which has a 4-minute open time and accelerated cure. It exhibits excellent shear and peel strengths along with good impact resistance.

### Product Features

- Excellent shear and peel strengths
- 4-minute open time

### Technical Information Note

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

**Note:** The following data is taken from tests conducted on limited production runs. 3M will continue to test samples from additional product runs and will issue a new data page if the test results change.

### Typical Uncured Physical Properties

Attribute Name	Temperature	Value
Accelerator Density		1.10 g/cm <sup>3</sup> (9.2 lb/gal)
Base Density		1.16 g/cm <sup>3</sup> (9.7 lb/gal)
Accelerator Viscosity	23 °C (73 °F)	69,000 cP (69,000 mPa.s) <sup>1</sup>
Base Viscosity	23 °C (73 °F)	9,000 cP (9,000 mPa.s) <sup>1</sup>
Mix Ratio by Volume (B:A)		2:1
Mix Ratio by Weight (B:A)		2.1:1
Accelerator Resin		Amine
Base Resin		Epoxy
Accelerator Color		Clear
Base Color		Black

<sup>1</sup> Viscosity measured using cone-and-plate viscometer; reported viscosity at 4 sec<sup>-1</sup> shear rate.

### Typical Mixed Physical Properties

Attribute Name	Temperature	Value
Open Time		4 min <sup>1</sup>
Time to Handling Strength	23 °C (73 °F)	15 min

<sup>1</sup> Max time allowed after applying adhesive to a substrate before bond must be closed and fixed. Cure times approximate and depend on adhesive temperature. Hotmelts: The approx. bonding range of a 3.2 mm (1/8 in) bead of molten adhesive on a non-metallic surface.

## Typical Physical Properties

Attribute Name	Value
Cured Color	Black

## Typical Cured Characteristics

Temperature: 23 °C (73 °F)

Attribute Name	Test Method	Value
Shore D Hardness	ASTM D2240	84

## Typical Performance Characteristics

### Overlap Shear Strength

Temperature: 23 °C (73 °F)

Test Method: ASTM D1002, ISO 4587

Dwell Time	Substrate	Surface Prep	Value
7 d	ABS	IPA Wipe	0.5 MPa (70 lb/in <sup>2</sup> ) <sup>1</sup>
7 d	Acrylic (PMMA)	IPA Wipe	0.3 MPa (50 lb/in <sup>2</sup> ) <sup>1</sup>
7 d	Aluminum	Sandblasted	21.5 MPa (3120 lb/in <sup>2</sup> ) <sup>1</sup>
24 h	Aluminum	Etched	25.1 MPa (3640 lb/in <sup>2</sup> ) <sup>1</sup>
7 d	CRS	Acetone/Abrade/Acetone	17.8 MPa (2580 lb/in <sup>2</sup> ) <sup>1</sup>
7 d	FRP (Epoxy)	Acetone/Abrade/Acetone	20.6 MPa (2990 lb/in <sup>2</sup> ) <sup>1</sup>
7 d	FRP (Polyester)	Acetone/Abrade/Acetone	6.3 MPa (910 lb/in <sup>2</sup> ) <sup>1</sup>
7 d	Polycarbonate (PC)	IPA Wipe	6.1 MPa (880 lb/in <sup>2</sup> ) <sup>1</sup>
7 d	Polyvinyl chloride (PVC)	IPA Wipe/Abrade/IPA Wipe	1 MPa (140 lb/in <sup>2</sup> ) <sup>1</sup>

<sup>1</sup> 25 mm (1") wide, 12.7 mm (1/2") overlap samples, 25 mm (1") x 102 mm (4") substrates, bondline thickness: 0.13-0.20 mm (5-8 mil)  
 Separation rate 2.5 mm/min (0.1 in/min) metal, 51 mm/min (2 in/min) plastic, 510 mm/min (20 in/min) rubber.  
 Substrate thickness: steel 1.5 mm (60 mil), other metal 1.3-1.6 mm (50-64 mil), rubber and plastic 3.2 mm (125 mil)  
 Cohesive Failure (CF), Adhesive Failure (AF), Mixed Failure (MF), Substrate Failure (SF)

### Overlap Shear Strength

Substrate: Aluminum

Surface Prep: Sandblasted

Temperature: 23 °C (73 °F)

Dwell Time: 7 d

Test Method: ASTM D1002, ISO 4587

Test Condition	Value
-40 °F	17 MPa (2470 lb/in <sup>2</sup> ) (79%) <sup>1</sup>
49 °C (120 °F)	4.8 MPa (690 lb/in <sup>2</sup> ) (22%) <sup>1</sup>
82 °C (180 °F)	3.2 MPa (470 lb/in <sup>2</sup> ) (15%) <sup>1</sup>
200 °C (392°F)	0.8 MPa (110 lb/in <sup>2</sup> ) (4%) <sup>1</sup>

<sup>1</sup> Overlap shear (OLS) strengths were measured on 25 mm wide x 13 mm overlap (1 x 0.5 in) specimens on 25 x 102 x 1.5 mm (1 x 4 x 0.06 in) substrates.  
 Jaw separation 2.5 mm/min (0.1 in/min). 0.25 mm (10 mil) bondline.

Substrate: Aluminum  
 Surface Prep: Etched  
 Temperature: 23 °C (73 °F)  
 Test Condition: 23 °C

Attribute Name	Test Method	Value
Bell Peel	ASTM D3167	7.4 N/mm (42 lb/in) <sup>1</sup>

<sup>1</sup> Floating roller peel; adhesives allowed to cure for 24 hours @RT; 25 mm (1 in) wide samples;  
 Samples pulled at 15 mm/min (6 in/min)  
 Cohesive (CF), Adhesive (AF) and Substrate (SF) Failure

Test Method: ASTM D638, ISO 527

Attribute Name	Temperature	Test Condition	Value
Elongation	23 °C (73 °F)	10 mm/min	2.7 % <sup>1</sup>
Modulus			2,330 MPa
Tensile Strength			43.2 MPa

<sup>1</sup> Type IV dogbone

Substrate: Aluminum  
 Surface Prep: MEK,Sandblast,MEK  
 Test Condition: Pendulum Impact

Attribute Name	Test Method	Value
Impact Shear Strength	ASTM D950	9 J <sup>1</sup>

<sup>1</sup> 21.7J Hammer

## Typical Environmental Performance

### Overlap Shear Strength

Substrate: Aluminum  
 Surface Prep: MEK,Sandblast,MEK  
 Temperature: 23 °C (73 °F)  
 Dwell Time: 7 d  
 Test Method: ASTM D1002, ISO 4587

Environmental Condition	Value
200°C / 30 minutes	27.8 MPa (4040 lb/in <sup>2</sup> ) (129% ) <sup>1</sup>
85 °C + 85 %RH: 500 hrs	21.3 MPa (3090 lb/in <sup>2</sup> ) (99% ) <sup>1</sup>
Diesel Fuel: 500 hrs	18.9 MPa (2750 lb/in <sup>2</sup> ) (88% ) <sup>1</sup>
Gasoline: 500 hrs	19.2 MPa (2780 lb/in <sup>2</sup> ) (89% ) <sup>1</sup>
Salt water (5% wt in water): 500 hrs	18.4 MPa (2670 lb/in <sup>2</sup> ) (86% ) <sup>1</sup>
Water: 500 hrs	20.0 MPa (2900 lb/in <sup>2</sup> ) (93% ) <sup>1</sup>

<sup>1</sup> 25 mm (1") wide, 12.7 mm (1/2") overlap samples, 25 mm (1") x 102 mm (4") substrates, bondline thickness: 0.13-0.20 mm (5-8 mil)  
 Separation rate 2.5 mm/min (0.1 in/min) metal, 51 mm/min (2 in/min) plastic, 510 mm/min (20 in/min) rubber  
 Substrate thickness: steel 1.5 mm (60 mil), other metal 1.3-1.6 mm (50-64 mil), rubber and plastic 3.2 mm (125 mil)  
 Cohesive Failure (CF), Adhesive Failure (AF), Mixed Failure (MF), Substrate Failure (SF)

Substrate: PVC  
 Surface Prep: 50/50 IPA  
 Temperature: 23 °C (73 °F)  
 Dwell Time: 7 d  
 Environmental Condition: 49 °C + 80 %RH

Attribute Name	Test Method	Value
Overlap Shear Strength	ASTM D1002, ISO 4587	2.8 MPa (410 lb/in <sup>2</sup> ) (293% ) <sup>1</sup>

<sup>1</sup> 25 mm (1") wide, 12.7 mm (1/2") overlap samples, 25 mm (1") x 102 mm (4") substrates, bondline thickness: 0.13-0.20 mm (5-8 mil)

Separation rate 2.5 mm/min (0.1 in/min) metal, 51 mm/min (2 in/min) plastic, 510 mm/min (20 in/min) rubber  
 Substrate thickness: steel 1.5 mm (60 mil), other metal 1.3-1.6 mm (50-64 mil), rubber and plastic 3.2 mm (125 mil)  
 Cohesive Failure (CF), Adhesive Failure (AF), Mixed Failure (MF), Substrate Failure (SF)

Substrate: Cold Rolled Steel  
 Surface Prep: Acetone/Abrade/Acetone  
 Temperature: 23 °C (73 °F)  
 Dwell Time: 7 d  
 Environmental Condition: 200°C / 30 minutes

Attribute Name	Test Method	Value
Overlap Shear Strength	ASTM D1002, ISO 4587	16.3 MPa (2360 lb/in <sup>2</sup> ) (91% ) <sup>1</sup>

<sup>1</sup> 25 mm (1") wide, 12.7 mm (1/2") overlap samples, 25 mm (1") x 102 mm (4") substrates, bondline thickness: 0.13-0.20 mm (5-8 mil)  
 Separation rate 2.5 mm/min (0.1 in/min) metal, 51 mm/min (2 in/min) plastic, 510 mm/min (20 in/min) rubber  
 Substrate thickness: steel 1.5 mm (60 mil), other metal 1.3-1.6 mm (50-64 mil), rubber and plastic 3.2 mm (125 mil)  
 Cohesive Failure (CF), Adhesive Failure (AF), Mixed Failure (MF), Substrate Failure (SF)

## Electrical and Thermal Properties

Attribute Name	Test Method	Test Condition	Value
Glass Transition Temperature (Tg)			72 °C (161 °F) <sup>1</sup>
Thermal Conductivity	ASTM E1530	50 °C, 25 psi	0.21 W/m·K
Coefficient of Thermal Expansion		Below Tg (5 ~ 20 °C)	90.2 x 10 <sup>-6</sup> m/m/°C <sup>2</sup>
Coefficient of Thermal Expansion		Above Tg (40 ~ 140 °C)	189.0 x 10 <sup>-6</sup> m/m/°C <sup>2</sup>

<sup>1</sup> Glass Transition Temperature (Tg) determined using DSC Analyzer with a heating rate of 10 °C per minute. Second heat values given.

<sup>2</sup> CTE determined using TMA Analyzer using a heating rate of 10 °C per minute. Second heat values given.

## Handling/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 50 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

For high strength structural bonds, paint, oxide films, oils, dust, mold release agents and all other surface contaminants must be completely removed. However, the amount of surface preparation directly depends on the required bond strength and the environmental aging resistance desired by user. The following cleaning methods are suggested for common surfaces:

### Steel

1. Wipe free of dust with oil-free solvent such as acetone, isopropyl or alcohol solvents.\*
2. Sandblast or abrade using clean fine grit abrasives.
3. Wipe again with solvent to remove loose particles.
4. If a primer is used, it should be applied within 4 hours after surface preparation.

### Aluminum

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.

2. Optimized FPL Etch Solution (1 liter):

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 etch aluminum panels place them in FPL etch solution heated to 66 to 71°C (150 to 160°F). Panels should soak for 12 to 15 minutes.

3. Rinse: Rinse panels in clear running tap water.
4. Dry: Air dry 15 minutes; force dry 10 minutes at 150°F ± 10°F (66°C ± 5°C).
5. If primer is to be used, it should be applied within 4 hours after surface preparation.

### Plastics/Rubber

1. Wipe with isopropyl alcohol.\*
2. Abrade using fine grit abrasives.
3. Wipe with isopropyl alcohol.\*

### Glass

1. Solvent wipe surface using acetone or MEK.\*
2. Apply a thin coating (0.0001 in. or less) of 3M™ Scotch-Weld™ Metal Primer EC3901 to the glass surfaces to be bonded and allow the primer to dry 60 minutes before bonding.

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

## Storage and Shelf Life

Store under normal conditions of 16° to 27°C (60° to 80°F) and 40 to 60% relative humidity in the original packaging, out of direct sunlight. For best performance, use this product within 18 months from date of manufacture.

## **Automotive Disclaimer**

### **Select Automotive Applications:**

This product is an industrial product and has not been designed or tested for use in certain automotive applications, such as automotive electric powertrain battery or high voltage applications, which may require the product to be manufactured in a IATF certified facility, meet a Ppk of 1.33 for all properties, undergo an automotive production part approval process (PPAP), or fully adhere to automotive design or quality system requirements (e.g., IATF 16949 or VDA 6.3). Customer assumes all responsibility and risk if customer chooses to use this product in these applications.

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## **ISO Statement**

This product was manufactured under a 3M quality system registered to ISO 9001 standards.

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