



# Scotch-Weld™

## Epoxy Adhesives

### DP-100 Clear • DP-100 NS Translucent

#### Technical Data

December, 2009

#### Product Description

3M™ Scotch-Weld™ Epoxy Adhesives DP-100 and DP-100NS are two-part adhesives offering fast cure and machinability.

Available in larger containers like 3M™ Scotch-Weld™ Epoxy Adhesives 100 B/A or 100 NS B/A.

#### Features

- Easy mixing
- High Flow (Scotch-Weld DP-100 Clear)
- Non-Sag (Scotch-Weld DP-100 NS Translucent)
- Fast Cure
- Scotch-Weld DP-100 meets UL 94 HB

#### 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	
		DP-100 Clear	DP-100 NS Translucent
<b>Viscosity<sup>1</sup></b> <b>@ 73°F (23°C)</b>	Base Accelerator	8,000-15,000 cps 9,000-16,000 cps	90,000-150,000 cps 50,000-85,000 cps
<b>Base Resin</b>		Epoxy	Epoxy
<b>Color</b>		Clear/Lt. Amber <sup>4</sup>	Translucent <sup>4</sup>
<b>Net Weight</b> <b>(Lbs./Gallon)</b>	Base Accelerator	9.5-9.9 9.2-9.6	9.6-10.0 9.2-9.6
<b>Mix Ratio (B:A)</b>	Volume Weight	1 : 1 1 : 0.98	1 : 1 1 : 0.96
<b>Worklife<sup>2</sup></b> <b>@ 73°F (23°C)</b>	10 g mixed	5 minutes	5 minutes (Gel time <sup>3</sup> )

1. Viscosity determined using 3M test method C-1d. Procedure involves Brookfield RVF, #6 spindle, 20 rpm and 80°F (27°F). (100 Clear) and #6 spindle, 4 rpm and 80°F (27°F) (100 NS). Measurement taken after 1 minute.

2. Worklife determined using 3M test method C-548. Procedure involves periodically measuring a 10 gram mixed mass for spreading and wetting properties. This time approximates the usable worklife in an EPX applicator nozzle.

3. Gel time determined using 3M test method C-554. Procedure involves periodically checking a 10 gram mixed mass for flowing properties.

4. Color may vary from nearly white to yellow/amber. Adhesive performance is not affected by color variation.

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### Typical Cured 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	
	DP-100 Clear	DP-100 NS Translucent
<b>Physical:</b>		
<b>Color</b>	Translucent <sup>11</sup>	Translucent <sup>11</sup>
<b>Shore D Hardness (ASTM D 2240)</b>	80-85	80-85
<b>Time to Handling Strength<sup>5</sup></b>	15-20 min. @ 23°C (73°F)	15-20 min. @ 23°C (73°F)
<b>Cure Time<sup>6</sup></b>	24-48 hours @ 23°C (73°F)	24-48 hours @ 23°C (73°F)

<b>Thermal:</b>		
<b>Wt. loss by Thermal Gravimetric Analysis<sup>7</sup></b>	5% @ 307°C (585°F)	
<b>Glass Transition Temp<sup>8</sup></b>	33°C (91°F)	34°C (86°F)
<b>Coefficient of Thermal<sup>9</sup> Expansion (in./in./°C)</b>	60 x 10 <sup>-6</sup> (-40°C to +20°C) (-38°F to +68°F) 209 x 10 <sup>-6</sup> (60°C to 120°C) (+140°F to +248°F)	29 x 10 <sup>-6</sup> (-50°C to +30°C) (-56°F to +86°F) 149 x 10 <sup>-6</sup> (50°C to 110°C) (+122°F to +230°F)
<b>Thermal Conductivity<sup>10</sup> (btu-ft./sq. ft.-hr. °F)</b>	0.107 @ 46°C (115°F)	0.106 @ 45°C (113°F)

<b>Electrical:</b>		
<b>Dielectric Strength (ASTM D 149)</b>	860 volts/mil	1100 volts/mil
<b>Volume Resistivity (ASTM D 257)</b>	3.5 x 10 <sup>12</sup> ohm-cm	2.2 x 10 <sup>14</sup> ohm-cm

5. Handling strength determined per 3M test method C-3179. Time to handling strength is the time required to achieve 50 psi OLS strength to aluminum.
6. The cure time is defined as the time required for the adhesive to achieve a minimum of 80% of its ultimate OLS on aluminum.
7. Weight loss by Thermal Gravimetric Analysis reported as that temperature at which 5% weight loss occurs by TGA in air at 5°C (41°F) rise per minute per ASTM 1131-86 Test Procedures.
8. Glass transition temperature (Tg) determined using Perkin Elmer (DSC) Analyzer with a heating rate of 20°C (68°F) per minute. Second heat values given.
9. Coefficient of thermal expansion determined using DuPont (TMA) using a heating rate of 10°C (50°F) per minute. Second heat values given.
10. Thermal conductivity determined using ASTM C177 and C-matic Instrument with 2 in. diameter samples.
11. Color may vary from nearly white to yellow/amber. Adhesive performance is not affected by color variation.

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### Handling/Curing Information

1. For optimum 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. For specific surface preparations on common substrates, see the following section on Surface Preparation.
2. Use gloves to minimize skin contact with adhesive.
3. These products consist of two parts.

### Mixing and Applying

#### For Duo-Pak Cartridges - 50 ml

3M™ Scotch-Weld™ DP-100 and DP-100 NS Adhesives are supplied in a dual syringe plastic Duo-Pak cartridge as part of the 3M™ Scotch-Weld™ EPX™ Applicator system. To use, simply insert the Duo-Pak cartridge into the EPX applicator and start the plunger into the cylinders using light pressure on the trigger. 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 mixing of Part A and Part B is desired, attach the EPX mixing nozzle to the Duo-Pak cartridge and begin dispensing the adhesive. For hand mixing, expel the desired amount of adhesive and mix thoroughly. Mix approximately 15 seconds after uniform color is obtained.

#### For Duo-Pak Cartridges - 200/400 ml

**Directions for Use:** While holding cartridge in an upright position, remove insert from Duo-Pak cartridge by unscrewing plastic nut. Detach metal removal disc from insert to free plastic nut for nozzle attachment. Clear orifices if necessary. Attach mixing nozzle and secure with plastic nut. Place cartridge into EPX Applicator. Dispense a small quantity of adhesive to assure both components are dispensing equally. Apply adhesive to clean surfaces, join parts, secure until set up (20 minutes @ 75°F [24°C]). Leave nozzle attached to store. Replace nozzle after storage.

#### For Bulk Containers

Mix thoroughly by weight or volume in the proportions specified in the Typical Uncured Properties section. Mix approximately 15 seconds after uniform color is obtained.

4. For maximum bond strength apply adhesive evenly to both surfaces to be joined.
5. Application to the substrates should be made within 5 minutes. Larger quantities and/or higher temperatures will reduce this working time.
6. Join the adhesive coated surfaces and allow to cure at 60°F (16°C) or above until completely firm. Heat, up to 200°F (93°C), will speed curing. These products will fully cure in 24-48 hours @ 75°F (24°C).
7. Keep parts from moving during cure. Contact pressure is necessary. Maximum shear strength is obtained with a 3-5 mil bond line.
8. Excess uncured adhesive can be cleaned up with ketone type solvents.\*

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

**Adhesive Coverage:** A 0.005 in. thick bondline will typically yield a coverage of 320 sq. ft./gallon.

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### Surface Preparation

For optimum 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 the user.

The following cleaning methods are suggested for common surfaces:

#### Steel:

1. Wipe free of dust with oil-free solvent such as acetone or isopropyl alcohol.\*
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. Vapor Degrease: Perchloroethylene condensing vapors for 5-10 minutes.
2. Alkaline Degrease: Oakite 164 solution (9-11 oz./gallon water) at  $190^{\circ}\text{F} \pm 10^{\circ}\text{F}$  ( $88^{\circ}\text{C} \pm 5^{\circ}\text{C}$ ) 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  $150^{\circ}\text{F} \pm 5^{\circ}\text{F}$  ( $66^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ).

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 as needed to balance	
4. Rinse: Rinse panels in clear running tap water.
5. Dry: Air dry 15 minutes and force dry 10 minutes at  $150^{\circ}\text{F} \pm 10^{\circ}\text{F}$  ( $66^{\circ}\text{C} \pm 5^{\circ}\text{C}$ ).
6. 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.\*

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

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### Application Equipment Suggestions

For small or intermittent applications the 3M™ Scotch-Weld™ EPX™ applicator is a convenient method of application.

For larger applications these adhesives may be applied by use of flow equipment.

Two-part meter/mixing/dispensing equipment is available for intermittent or production line use. These systems may be desirable because of their variable shot size and flow rate characteristics and are adaptable to many applications.

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### Typical Adhesive Performance Characteristics

**Note:** The following product performance data was obtained in the 3M laboratory under the conditions specified. The following data shows typical results obtained with 3M™ Scotch-Weld™ Epoxy Adhesives DP-100 and DP-100 NS when applied to properly prepared substrates, cured for 7 days at 73°F (23°C) under 2 psi cure pressure, and tested according to the test methods indicated.

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

#### A. Overlap Shear

Overlap shear (OLS) strengths were measured on 1 in. wide 1/2 in. overlap specimens. These bonds were made individually using 1 in. x 4 in. pieces of substrate except for aluminum. Two panels 0.063 in. thick, 4 in. x 7 in. of 2024 T-3 clad aluminum were bonded and cut into 1 in. wide samples after 24 hours. The thickness of the bond line was 0.005 - 0.008 in. All strengths were measured at 73°F (23°C) except where noted. (Tests per ASTM D 1002-72.)

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.

#### B. T-peel

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. (Tests per ASTM D 1876-61T.)

#### C. Cure Cycle

With the exception of Rate of Strength Build-Up Tests, all bonds were cured 7 days at 73°F (23°C)/50% RH before testing or subjected to further conditioning or environmental aging.

#### Etched Aluminum, Overlap Shear, at temperature (psi)

Test Temp. °F (°C)	3M™ Scotch-Weld™ Epoxy Adhesive	
	DP-100 Clear	DP-100 NS Translucent
-67°F (-53°C)	900	900
73°F (23°C)	1500	1500
180°F (82°C) (15 min.) <sup>1</sup>	300	300

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

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

		3M™ Scotch-Weld™ Epoxy Adhesive	
		DP-100 Clear	DP-100 NS Translucent
Aluminum-	Etched	1500	1500
	MEK/abrade/MEK	950	570
Cold Rolled Steel-	MEK/abrade/MEK	1000	890
Copper-	MEK/abrade/MEK	950	1140
Brass-	MEK/abrade/MEK	700	500
Stainless Steel-	MEK/abrade/MEK	750	840
Galvanized Steel-	MEK/abrade/MEK	900	1080

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### 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.

#### Aluminum, T-peel (piw), tested @ 73°F (23°C) (psi)

		3M™ Scotch-Weld™ Epoxy Adhesive	
		DP-100 Clear	DP-100 NS Translucent
Aluminum etched	17-20 mil bondline	2	2
	5-8 mil bondline	2	2
Cold Rolled Steel	17-20 mil bondline MEK/abrade/MEK	2	2

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

All cleaned by alcohol wipe, abrade, alcohol wipe.

	3M™ Scotch-Weld™ Epoxy Adhesive	
	DP-100 Clear	DP-100 NS Translucent
ABS	490	180
PVC	330	240
Polycarbonate	250	120
Polyacrylic	100	150
FRP	950	680
SBR/Steel	125	230
Neoprene/Steel	140	60
Nitrile/Steel	140	90

**Note:** The data shown here was generated using the 3M™ Scotch-Weld™ 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) (psi)

Bonds Tested at 73°F (23°C)

Time	3M™ Scotch-Weld™ Epoxy Adhesive	
	DP-100 Clear	DP-100 NS Translucent
10 minutes	0	200
20 minutes	400	220

#### Compression Strength (ASTM D 695-68T)

3M™ Scotch-Weld™ DP-100 Clear Adhesive	8400 psi @ 73°F (23°C)
3M™ Scotch-Weld™ DP-100 NS Translucent Adhesive	8400 psi @ 73°F (23°C)

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### 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.

#### Environmental Resistance

##### Aluminum (Etched)

Measured by Overlap Shear tested 73°F (23°C) psi<sup>1</sup>

Environment	Condition	3M™ Scotch-Weld™ Epoxy Adhesive	
		DP-100 Clear	DP-100 NS Translucent
73°F (23°C)/50% RH	30 days	1500	1500
Water Vapor	160°F/100 RH, 3 days	1500	1500

#### Solvent Resistance:<sup>10</sup>

(Visual check after immersion in specified solvent at 73°F [23°C]).

	3M™ Scotch-Weld™ Epoxy Adhesive			
	DP-100 Clear		DP-100 NS Translucent	
	1 Hour	1 Month	1 Hour	1 Month
Acetone	A	A	A	A
Isopropyl Alcohol	A	B	A	B
Freon TF	A	A	A	A
Freon TMC	A	A	A	A
1, 1, 1-Trichlorethane	A	B	A	B
RMA Flux	A	A	A	A

Key: A - Unaffected; B - Slight Attack; C - Moderate/Severe Attack

1. Viscosity determined using 3M test method C-1d. Procedure involves Brookfield RVF, #6 spindle, 20 rpm and 80°F (27°F). (100 Clear) and #6 spindle, 4 rpm and 80°F (27°F) (100 NS). Measurement taken after 1 minute.

10. Solvent resistance was determined using cured (24 hrs RT + 2 hrs 160°F [71°C]) samples (1/2 in. x 4 in. x 1/8 in. thickness) immersed in the test solvent for 1 hour and 1 month. After the allowed period of time, the sample was removed and visually examined for surface attack as compared to the control.

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**Storage and Shelf Life**      **Storage:** Store products at 60-80°F (16-27°C) for maximum storage life. Rotate on “first in-first out” basis.

**Shelf Life:** When stored as recommended in original unopened container, this product has a shelf life of 15 months.

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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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