

# 3M Scotch-Weld™ Epoxy Adhesives

DP-190 B/A Translucent • DP-190 B/A Gray

Technical Data

January, 1997

## Product Description

Available in larger containers as Scotch-Weld Epoxy Adhesives 190 B/A Translucent and Gray Adhesive.

DP-190 B/A Translucent Epoxy Adhesive is a 1:1 mix ratio, faster curing version of the 2216 B/A Translucent Epoxy Adhesive.

DP-190 B/A Gray Epoxy Adhesive is a 1:1 by volume mix ratio of Scotch-Weld Epoxy Adhesive 2216 B/A Gray. It exhibits good peel, shear and environmental aging properties.

## Features

- 90 minute worklife
- Flexible
- Translucent or gray color
- High shear and peel strength
- 1:1 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.**

		DP-190 B/A Translucent Adhesive	DP-190 B/A Gray Adhesive
<b>Base Resins</b>		Epoxy/Amine	Epoxy/Amine
<b>Viscosity<sup>1</sup>, Approximate @ 80°F</b>	Base (B) Accelerator (A)	6,000 cps 14,000 cps	100,000 cps 60,000 cps
<b>Net Weight (Lbs./gal.)</b>	Base (B) Accelerator (A)	9.5 8.4	11.4 10.8
<b>Color (Lbs./gal.)</b>	Base (B) Accelerator (A)	Clear Amber	White Gray
<b>Mix Ratio (B:A)</b>	By Volume By Weight	1:1 1.15:1	1:1 1.06:1
<b>Worklife<sup>2</sup> @ 73°F (23°C)</b>	2 gram 20 gram	80 min. 60 min.	— 90 min.

For footnotes see Pages 6 and 7.

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### Typical Cured Properties

#### Physical

	DP-190 B/A Translucent Adhesive	DP-190 B/A Gray Adhesive
<b>Color</b>	Translucent	Gray
<b>Hardness (ASTM D 2240) Shore D</b>	35	60
<b>Worklife<sup>2</sup></b>	80 minutes	90 minutes
<b>Tack-free Time<sup>3</sup></b>	~ 4 hrs	~ 6 hrs
<b>Time to Handling Strength<sup>4</sup></b>	6 hrs	8-12 hrs
<b>Full Cure Time<sup>5</sup></b>	14 days	7 days
<b>Elongation<sup>6</sup></b>	120%	30%
<b>Tensile Strength<sup>6</sup></b>	2750 psi	3500 psi

#### Thermal

	DP-190 B/A Translucent Adhesive	DP-190 B/A Gray Adhesive
<b>Weight Loss by Thermal Gravimetric Analysis (TGA)<sup>7</sup></b>	1% @ 390°F (199°C) 5% @ 594°F (312°C)	1% @ 477°F (247°C) 5% @ 639°F (337°C)
<b>Thermal Coefficient of Expansion (TCE) by TMA<sup>8</sup> (<math>\infty \times 10^{-6}</math> units/unit/°C)</b>		
<b>Below Tg</b>	86 (41-68°F [5-20°C] range)	62 (41-68°F [5-25°C] range)
<b>Above Tg</b>	166 (167-284°F [75-140°C] range)	177 (167-284°F [65-140°C] range)
<b>Glass Transition Temperature (Tg) by DCS<sup>9</sup></b>		
<b>Onset</b>	50°F (10°C)	45°F (7°C)
<b>Mid-Point</b>	80°F (27°C)	68°F (20°C)
<b>Thermal Conductivity<sup>10</sup> (@ 110°F on .250 in. samples)</b>		
<b>BTU - ft./ft.<sup>2</sup> - hr. - °F)</b>	.079	.220
<b>Cal./sec. - cm - °C)</b>	.39 x 10 <sup>-3</sup>	90.9 x 10 <sup>-2</sup>
<b>Watt/m - °C)</b>	.136	.381
<b>Thermal Shock Resistance<sup>11</sup></b>		
<b>Potted Washer Olyphant Test (3M ITSD Test Method C-3174 +100°C [air] to -50°C [liquid])</b>	Pass 5 cycles without cracking	Pass 5 cycles without cracking

#### Electrical

	DP-190 B/A Translucent Adhesive	DP-190 B/A Gray Adhesive
<b>Dielectric Constant @ 1 KHz @ 73°F (23°C) (ASTM D 150)</b>	6.2	6.5
<b>Dissipation Factor @ 1 KHz @ 73°F (23°C) (ASTM D 150)</b>	0.16	0.09
<b>Dielectric Strength (ASTM D 149) Sample Thickness Approx. 30 mil.</b>	875 volts/mil	830 volts/mil
<b>Volume Resistivity (ASTM D 257)</b>	7.5 x 10 <sup>10</sup> ohm-cm	5.0 x 10 <sup>12</sup> ohm-cm

For footnotes see Pages 6 and 7.

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## Epoxy Adhesives

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### Handling/Curing Information

### Directions For Use

1. For high strength structural bonds, paints, oxide films, oils, dust, mold release agents and all other surface contaminants must be completely removed. However, the amount of surface preparation necessary directly depends on the required bond strength and the environmental aging resistance desired by the user. For suggested surface preparations on common substrates, see the following section on Surface Preparation.

2. Mixing

#### **For Duo Pak Cartridges**

Scotch-Weld™ DP-190 B/A Translucent and DP-190 B/A Gray Epoxy Adhesives are supplied in a dual syringe plastic Duo-Pak cartridge as part of the 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 automatic 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 Bulk Containers**

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

3. For maximum bond strength, apply adhesive evenly to both surfaces to be joined.
4. Application to the substrates should be made within 75 minutes. Larger quantities and/or higher temperatures will reduce this working time.
5. 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 cure in 7 to 14 days @ 75°F (24°C).
6. Keep parts from moving during cure. Contact pressure is necessary. Maximum shear strength is obtained with a 3-5 mil bond line.
7. Excess uncured adhesive can be cleaned up with ketone type solvents.\*

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

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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 completely removed. However, the amount of surface preparation necessary 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, 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. If Scotch-Weld 1945 B/A two-part primer is used, apply a thin coating (0.5 mils) on the metal surfaces to be bonded, air dry for 10 minutes, then cure for 30 minutes at 180°F (82°C) prior to bonding.

#### 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 (87°C) ± 10°F 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 (65°C) ± 5°F.\*

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
4. Rinse: Rinse panels in clear running tap water.
5. Dry: Air dry 15 minutes; force dry 10 minutes at 150°F (65°C) ± 10°F.
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.\*

#### Glass:

1. Solvent wipe surface using acetone or MEK.\*
2. Apply a thin coating (0.0001 in. or less) of Scotch-Weld EC-3901 Primer or equivalent to the glass surfaces to be bonded and allow the primer to dry before bonding.

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

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### Application Equipment Suggestions

For smaller or intermittent applications, the 3M EPX Applicator is a convenient method of application.

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

Two part meter/mixing/proportioning/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

The following product performance data were obtained in the 3M laboratory under the conditions specified. The following data show typical results obtained with the Scotch-Weld adhesives when applied to properly prepared substrates, cured, and tested according to the specifications indicated. The data were generated using the Scotch-Weld EPX™ Applicator System equipped with an EPX static mixer, according to manufacturer's directions. Thorough hand mixing should afford comparable results.

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

### Overlap Shear Strength (OLS) to<sup>12</sup>

(Bonds cured 24 hrs @ RT + 2 hrs 160°F [71°C])

	DP-190 B/A Translucent Adhesive	DP-190 B/A Gray Adhesive
Etched Aluminum	1800 psi	2500 psi
Sanded Aluminum (60 grit)	850 psi	1500 psi
Cold Rolled Steel	850 psi	1400 psi
Wood, Fir	650 psi	1100 psi
Glass, Borosilicate	260 psi	300 psi
Glass, +3M 3901 Primer	300 psi	300 psi
Polycarbonate	400 psi	800 psi
Acrylic	350 psi	500 psi
Fiberglass	1000 psi	1600 psi
ABS	400 psi	700 psi
PVC	650 psi	800 psi
Polypropylene	90 psi	50 psi

### Rate of Strength Buildup

(OLS on Etched Aluminum)<sup>12</sup> Bonds tested after:

	DP-190 B/A Translucent Adhesive	DP-190 B/A Gray Adhesive
1 hr @ RT	10 psi	10 psi
6 hrs @ RT	200 psi	200 psi
24 hrs @ RT	800 psi	1000 psi
7 days @ RT	1200 psi	2000 psi
1 mo @ RT	1800 psi	2200 psi
3 mos @ RT	1800 psi	2500 psi

### Environmental Aging

(OLS on Etched Aluminum)<sup>12</sup> Bonds tested after:

	DP-190 B/A Translucent Adhesive	DP-190 B/A Gray Adhesive
24 hrs RT + 2 hrs @ 160°F (71°C)	1700 psi	2500 psi
24 hrs RT + 2 hrs @ 240°F (115°C)	3200 psi	3000 psi
1 wk RT + wk @ 90°F/90% RH	1400 psi	2400 psi
1 wk RT + 1 wk 248°F (120°C)	3500 psi	3500 psi
1 wk RT + 1 wk H <sub>2</sub> O Immersion	1700 psi	2500 psi

For footnotes see Pages 6 and 7.

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### Typical Adhesive Performance Characteristics (continued)

#### Overlap Shear Strength vs Temperature<sup>12</sup>

(Bonds cured 24 hr @ RT + 2 hrs @ 160°F [71°C]) Bonds tested at:

	DP-190 B/A Translucent Adhesive	DP-190 B/A Gray Adhesive
-67°F (-55°C)	3500 psi	1500 psi
70°F (21°C)	1700 psi	2500 psi
120°F (49°C)	290 psi	1000 psi
150°F (66°C)	200 psi	600 psi
180°F (82°C)	160 psi	400 psi

#### 180°F Peel Strength vs Temperature<sup>12</sup>

(Bonds cured 24 hr @ RT + 4 hrs @ 160°F [71°C]) Bonds tested at:

	DP-190 Translucent B/A Adhesive	DP-190 Gray B/A Adhesive
-67°F (-55°C)	3 piw	3 piw
70°F (21°C)	30 piw	20 piw
120°F (49°C)	3 piw	10 piw
150°F (66°C)	2 piw	4 piw
180°F (82°C)	1 piw	2 piw

#### Solvent Resistance<sup>14</sup>

One Hour/One Month

One Hour/One Month

	DP-190 B/A Translucent Adhesive	DP-190 B/A Gray Adhesive
Acetone	A/A	A/A
Isopropyl Alcohol	A/A	A/A
Freon TF	A/A	A/A
Freon TMC	A/B	A/A
1,1,1-Trichlorethane	A/A	A/A
RMA Flux	A/A	A/A
Key: A - Unaffected, B - Slight Attack, C - Moderate/Severe Attack		

For footnotes see Pages 6 and 7.

### Test Procedures Footnotes

1. Viscosity determined using 3M ITSD TM (Industrial Tape and Specialties Division Test Method) C-1D. Procedure involves Brookfield RVF, #7 spindle, 20 rpm and 80°F (26°C). Measurement taken after 1 minute rotation.
2. Worklife determined using 3M ITSD TM C-3180. Procedure involves periodically measuring a 2 gram mixed mass for self-leveling and wetting properties. This time will also approximate the usable worklife in an EPX mixing nozzle.
3. Tack-free time determined per 3M ITSD TM C-3173. Involves dispensing 0.5 gram amount of adhesive onto substrate and testing periodically for no adhesive transfer to metal spatula.
4. Handling strength determined per 3M ITSD TM C-3179. Time to handling strength taken to be that required to achieve a 50 psi OLS strength using aluminum substrates.

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### Test Procedures Footnotes (continued)

5. The cure time is defined as that time required for the adhesive to achieve a minimum of 80% of the ultimate strength as measured by aluminum-aluminum OLS.
6. Tensile and Elongation. Used procedure in 3M ITSD C-3094/ATSM D 882. Samples were 2 in. dumbbells with .0125 in. neck and .030 in. sample thickness. Separation rate was 2 inches per minute. Samples cured 2 hrs RT plus 2 hrs/ 160°F (71°C).
7. Weight loss by TGA reported as that temperature at which 5% weight loss occurs by TGA in air at 5°C rise per minute per ASTM 1131-86.
8. TCE determined using Dupont TMA Analyzer using a heating rate of 50°F (10°C) per minute. Second heat values given.
9. Glass Transition Temperature (T<sub>g</sub>) determined using Perkin Elmer DSC Analyzer with a heating rate of 68°F (20°C) per minute. Second heat values given.
10. Thermal conductivity determined using ASTM C177 and C-matic Instrument using 2 in. diameter samples.
11. Thermal shock resistance run per 3M ITSD TM C-3174. Involves potting a metal washer into a 2 in. x 0.5 in. thick section and cycling this test specimen to colder and colder temperatures.
12. 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. The thickness of the bond line was 0.005-0.008 in. All strengths were measured at 70°F (21°C) except were noted. (Test 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.; rubber, 0.125 in.; plastics, 0.125 in.
13. T-peel strengths were measured on 1 in. wide bonds at 73°F (22°C). The testing jaw separation rate was 20 inches per minute. The substrates were 0.020 in. thick. (Tests per ASTM D 1876-61T.)
14. 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 allotted period of time the sample was removed and visually examined for surface attack as compared to the control.

Key: A - Unaffected - no change to color or surface texture.  
B - Slight attack - noticeable swelling of surface.  
C - Moderate/severe attack - extreme swelling of surface.

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### Storage and Shelf Life

Store products at 60-80°F (15-27°C) for maximum shelf life. These products have a shelf life of 2 years in their unopened original bulk containers and 15 months in Duo-Pak containers from date of shipment.

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### Precautionary Information

Refer to Product Label and Material Safety Data Sheet for Health and Safety Information before using this product. For additional health and safety information, call 612-733-1110 operator number 55.

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### For Additional Information

To request additional product information or to arrange for sales assistance, call toll free 1-800-362-3550. Address correspondence to: 3M Industrial Tape and Specialties Division, 3M Center, Building 220-7E-01, St. Paul, MN 55144-1000. Our fax number is 612-733-9175. In Canada, phone: 1-800-364-3577. In Puerto Rico, phone: 1-809-750-3000. In Mexico, phone: 5-728-2180.

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### Important Notice

3M MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. User is responsible for determining whether the 3M product is fit for a particular purpose and suitable for user's method of application. Please remember that many factors can affect the use and performance of a 3M ITSD product in a particular application. The materials to be bonded with the product, the surface preparation of those materials, the product selected for use, the conditions in which the product is used, and the time and environmental conditions in which the product is expected to perform are among the many factors that can affect the use and performance of a 3M ITSD product. Given the variety of factors that can affect the use and performance of a 3M ITSD product, some of which are uniquely within the user's knowledge and control, it is essential that the user evaluate the 3M ITSD product to determine whether it is fit for a particular purpose and suitable for the user's method of application.

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### Limitation of Remedies and Liability

If the 3M product is proved to be defective, THE EXCLUSIVE REMEDY, AT 3M'S OPTION, SHALL BE TO REFUND THE PURCHASE PRICE OF OR TO REPAIR OR REPLACE THE DEFECTIVE 3M PRODUCT. 3M shall not otherwise be liable for loss or damages, whether direct, indirect, special, incidental, or consequential, regardless of the legal theory asserted, including negligence, warranty, or strict liability.

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**ISO 9002**

This Industrial Tape and Specialties Division product was manufactured under a 3M quality system registered to ISO 9002 standards.

**3M**

Adhesive Systems  
Industrial Tape and Specialties Division

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