

# 3M

## Scotch-Weld™

### Epoxy Adhesives

#### DP190 Translucent and Gray

Technical Data

April, 2010

#### Product Description

3M™ Scotch-Weld™ Epoxy Adhesive DP190 Translucent is a 1:1 mix ratio similar to 3M™ Scotch-Weld™ Epoxy Adhesive 2216 B/A Translucent but faster curing.

3M™ Scotch-Weld™ Epoxy Adhesive DP190 Gray is a 1:1 by volume mix ratio of 3M™ Scotch-Weld™ Epoxy Adhesive 2216 B/A Gray and exhibits good peel, shear and environmental aging properties.

Available in bulk containers as 3M™ Scotch-Weld™ Epoxy Adhesive 2216 B/A.

#### 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.

|                                                      |                             | Scotch-Weld<br>Epoxy Adhesive<br>DP190 Translucent | Scotch-Weld<br>Epoxy Adhesive<br>DP190 Gray |
|------------------------------------------------------|-----------------------------|----------------------------------------------------|---------------------------------------------|
| <b>Base Resins</b>                                   |                             | Epoxy/Amine                                        | Epoxy/Amine                                 |
| <b>Viscosity<sup>1</sup>, Approximate<br/>@ 75°F</b> | Base (B)<br>Accelerator (A) | 2,000-8,000 cps<br>7,000-15,000 cps                | 75,000-150,000 cps<br>40,000-80,000 cps     |
| <b>Net Weight<br/>(Lbs./gal.)</b>                    | Base (B)<br>Accelerator (A) | 9.3-9.7<br>8.2-8.6                                 | 11.0-11.4<br>10.6-11.0                      |
| <b>Color<br/>(Lbs./gal.)</b>                         | Base (B)<br>Accelerator (A) | Clear<br>Amber                                     | White<br>Gray                               |
| <b>Mix Ratio (B:A)</b>                               | By Volume<br>By Weight      | 1:1<br>1.15:1                                      | 1:1<br>1.06:1                               |
| <b>Worklife<sup>2</sup><br/>@ 73°F (23°C)</b>        | 2 gram<br>20 gram           | 80 min.<br>60 min.                                 | —<br>90 min.                                |

#### Footnotes:

1. Viscosity determined using 3M 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 test method 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 3M™ EPX™ Applicator mixing nozzle.

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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.**

#### Physical

##### Footnotes:

3. Tack-free time determined per 3M test method 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 test method C-3179. Time to handling strength taken to be that required to achieve a 50 psi OLS strength using aluminum substrates.
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 test method 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 TMA Analyzer using a heating rate of 50°F (10°C) per minute. Second heat values given.
9. Glass Transition Temperature (Tg) determined using 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 test method 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.

|                                              | 3M™ Scotch-Weld™<br>Epoxy Adhesive<br>DP190 Translucent | 3M™ Scotch-Weld™<br>Epoxy Adhesive<br>DP190 Gray |
|----------------------------------------------|---------------------------------------------------------|--------------------------------------------------|
| <b>Color</b>                                 | Translucent                                             | Gray                                             |
| <b>Hardness (ASTM D 2240)<br/>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

|                                                                                                                                                               | Scotch-Weld<br>Epoxy Adhesive<br>DP190 Translucent | Scotch-Weld<br>Epoxy Adhesive<br>DP190 Gray |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|---------------------------------------------|
| <b>Weight Loss by Thermal Gravimetric Analysis (TGA)<sup>7</sup></b>                                                                                          | 1% @ 390°F (199°C)<br>5% @ 594°F (312°C)           | 1% @ 477°F (247°C)<br>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<br>[5-20°C] range)                     | 62 (41-68°F<br>[5-25°C] range)              |
| <b>Above Tg</b>                                                                                                                                               | 166 (167-284°F<br>[75-140°C] range)                | 177 (167-284°F<br>[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><br/>(@ 110°F on .250 in. samples)<br/>BTU - ft./ft.<sup>2</sup> - hr. - °F)<br/>Cal./sec. - cm - °C)<br/>Watt/m - °C</b> | .079<br>.39 x 10 <sup>-3</sup><br>.136             | .220<br>90.9 x 10 <sup>-2</sup><br>.381     |
| <b>Thermal Shock Resistance<sup>11</sup><br/>Potted Washer Olyphant Test<br/>(3M ITSD Test Method C-3174<br/>+100°C [air] to -50°C [liquid])</b>              | Pass 5 cycles<br>without cracking                  | Pass 5 cycles<br>without cracking           |

#### Electrical

|                                                                              | Scotch-Weld<br>Epoxy Adhesive<br>DP190 Translucent | Scotch-Weld<br>Epoxy Adhesive<br>DP190 Gray |
|------------------------------------------------------------------------------|----------------------------------------------------|---------------------------------------------|
| <b>Dielectric Constant @ 1 KHz @ 73°F (23°C)<br/>(ASTM D 150)</b>            | 6.2                                                | 6.5                                         |
| <b>Dissipation Factor @ 1 KHz @ 73°F (23°C)<br/>(ASTM D 150)</b>             | 0.16                                               | 0.09                                        |
| <b>Dielectric Strength<br/>(ASTM D 149) Sample Thickness Approx. 30 mil.</b> | 875 volts/mil                                      | 830 volts/mil                               |
| <b>Volume Resistivity<br/>(ASTM D 257)</b>                                   | 7.5 x 10 <sup>10</sup> ohm-cm                      | 5.0 x 10 <sup>12</sup> ohm-cm               |

# 3M™ Scotch-Weld™

## Epoxy Adhesives

### DP190 Translucent and Gray

#### 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 3M™ Scotch-Weld™ Adhesives when applied to properly prepared substrates, cured, and tested according to the specifications indicated. The data were generated using the 3M™ EPX™ Applicator System equipped with an EPX applicator 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])

|                                      | 3M™ Scotch-Weld™<br>Epoxy Adhesive<br>DP190 Translucent | 3M™ Scotch-Weld™<br>Epoxy Adhesive<br>DP190 Gray |
|--------------------------------------|---------------------------------------------------------|--------------------------------------------------|
| 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™ Scotch-Weld™ Primer 3901 | 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:

|             | Scotch-Weld<br>Epoxy Adhesive<br>DP190 Translucent | Scotch-Weld<br>Epoxy Adhesive<br>DP190 Gray |
|-------------|----------------------------------------------------|---------------------------------------------|
| 1 hr @ RT   | 10 psi                                             | 10 psi                                      |
| 6 hrs @ RT  | 200 psi                                            | 50 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                                    |

#### Footnotes:

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 where 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.

# 3M™ Scotch-Weld™

## Epoxy Adhesives

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#### Typical Adhesive Performance Characteristics (continued)

##### Footnotes:

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 where 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. 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.

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

#### Environmental Aging

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

|                                           | 3M™ Scotch-Weld™ Epoxy Adhesive DP190 Translucent | 3M™ Scotch-Weld™ Epoxy Adhesive DP190 Gray |
|-------------------------------------------|---------------------------------------------------|--------------------------------------------|
| 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                                   |

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

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

|               | Scotch-Weld Epoxy Adhesive DP190 Translucent | Scotch-Weld Epoxy Adhesive DP190 Gray |
|---------------|----------------------------------------------|---------------------------------------|
| -67°F (-55°C) | 3500 psi                                     | 1500 psi                              |
| 70°F (21°C)   | 1200 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:

|               | Scotch-Weld Epoxy Adhesive DP190 Translucent | Scotch-Weld Epoxy Adhesive DP190 Gray |
|---------------|----------------------------------------------|---------------------------------------|
| -67°F (-55°C) | 3 piw                                        | 3 piw                                 |
| 70°F (21°C)   | 20 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>13</sup>

One Hour/One Month

One Hour/One Month

|                      | Scotch-Weld Epoxy Adhesive DP190 Translucent | Scotch-Weld Epoxy Adhesive DP190 Gray |
|----------------------|----------------------------------------------|---------------------------------------|
| 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

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#### 3M™ EPX™ Pneumatic Applicator Delivery Rates

#### 200 ml Applicator – Maximum Pressure 58 psi

| Adhesive*                                  | 6mm Nozzle<br>gms/minute | 10mm Nozzle<br>gms/minute |
|--------------------------------------------|--------------------------|---------------------------|
| 3M™ Scotch-Weld™ Epoxy Adhesive DP190 Gray | 11.9                     | 46.0                      |

#### 50 ml Applicator – Maximum Pressure 50 psi

| Adhesive*                                         | 1/4 in. Nozzle<br>gms/minute       |
|---------------------------------------------------|------------------------------------|
| 3M™ Scotch-Weld™ Epoxy Adhesive DP190 Translucent | 112                                |
| Scotch-Weld epoxy adhesive DP190 Gray             | 16.9                               |
| Scotch-Weld epoxy adhesive DP190 Gray             | 21.5 (nozzle cut back 2 divisions) |
| Scotch-Weld epoxy adhesive DP190 100°F (38°C)     | 41.1                               |

\*Tests were run at a temperature of 70°F ± 2°F (21°C ± 1°C) and at maximum applicator pressure.

#### Handling/Curing Information

#### Directions For Use

- 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 section on surface preparation.
- Mixing

##### For Duo Pak Cartridges

3M™ Scotch-Weld™ Epoxy Adhesives DP190 Translucent and DP190 Gray are supplied in a dual syringe plastic duo-pak cartridge as part of the 3M™ 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 applicator 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. Mix approximately 15 seconds after uniform color is obtained.

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

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

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

# 3M™ Scotch-Weld™

## Epoxy Adhesives

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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.

##### Aluminum:

1. 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.\*
2. 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 as needed to balance |                        |

3. Rinse: Rinse panels in clear running tap water.
4. Dry: Air dry 15 minutes; force dry 10 minutes at 150°F (65°C) ± 10°F.
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 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, including pilot lights, and follow manufacturer's precautions and directions for use.

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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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### DP190 Translucent and Gray

|                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Storage</b>                                  | Store products at 60-80°F (15-27°C) for maximum shelf life.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Shelf Life</b>                               | These products have a shelf life of two years in their unopened original bulk containers and 15 months in duo-pak containers from date of shipment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Precautionary Information</b>                | 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 1-800-364-3577 or (651) 737-6501.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
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ISO 9001:2000

This Industrial Adhesives and Tapes Division product was manufactured under a 3M quality system registered to ISO 9001:2000 standards.



#### Industrial Adhesives and Tapes Division

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