

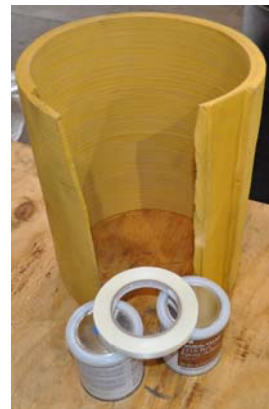


Application Procedure for SPLASHTRON Sleeves.

Rev. 1

SPLASHTRON split wraparound sleeves are made of vulcanized elastomer, sized to fit specific pipe O.D.'s, normally in thickness of 1/4", 3/8", and 1/2". They are installed in the field, over welded joints, where long, continuous SPLASHTRON coverage is required. Their sleeves are adhered to the pipe with Splash Cote 2216.

Splash Cote 2216 is a two-part compound that, when mixed, forms a gray, highly flexible epoxy adhesive, with high shear and peel strengths. Part A is gray in color, and Part B is white.



Directions for use

Surface Preparation:

Splash Cote should be applied to clean, dry surfaces only; clean inside of SPLASHTRON Split Sleeve with solvent (i.e.) MEK or acetone. Metal should be sandblasted to SSPC-SP5 white metal, if possible, if sandblasting does not permit then use a power tool. For best results with power tool use a MBX Bristle Blaster this tool can be supplied by Mark Tool. Then clean the blasted surface with solvent (i.e.) MEK or acetone. Existing splashtron edges should be wrapped with shrink-rap & then duck-tape.



If pipe is FBE coated or has paint system applied to the pipe. The area needs to be abraded to 1.5 to 3.5 mil profile by using a power tool, MBX Bristle Blaster, or sandblasted.



Mixing

Mix part A and part B, using proper mixing ratio, either by weight or volume. Thoroughly blend the two components until a uniform gray color results.

| | <u>By Volume</u> | <u>By Weight</u> |
|----------------|------------------|------------------|
| Part A (Gray) | 3 parts | 7 parts |
| Part B (White) | 2 parts | 5 parts |

Splash cote should be mixed in a container with straight sides. Mix only as much as you expect to use in an hour and a half. Work life at 73.5 degrees F. is approximately 90 minutes, but higher temperature shortens this time.



Application:

For small quantities, a spatula or knife is suggested. Up to 1/8" thick of mixed material should be spread evenly on the prepared metal surface prior to laying on the SPLASHTRON sleeve. Apply adhesive at 60 degrees F or above.

An alternate method, which is preferable, is to apply 1/16" thick to the inside of the SPLASHTRON sleeve, and 1/16" thick to the metal surface. Allow to sit 5 to 10 minutes, or until tacky, then apply the sleeve to the pipe.



Hardening:

Only contact pressure is required for excellent adhesion. Parts must be kept aligned during cure. Mixed adhesive will harden overnight at room temperature. Faster cures are obtainable using elevated temperatures. Do not exceed 200 degrees F. or the quality of the bond may be affected.

Notes on Sleeve Application:

After the split sleeve has been applied to the bare metal, it should be secured and held firmly in place by filament tape. Apply tape first around the middle of the sleeve. Twist the sleeve a quarter turn, to help spread the adhesive uniformly, and bring it back to the original position.



Work the adhesive toward each end of the sleeve with your hands, and then apply filament tape near each end. The tape is sufficient to hold the sleeve in place while the epoxy is curing, providing the sleeve is not subjected to any type of loading, twisting, or rough handling which could cause it to move on the pipe.

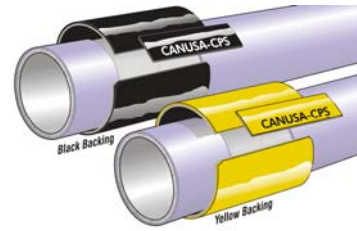


All gaps, cracks or crevices should be filled with the mixed epoxy compound. A putty knife is useful for this purpose. If the uncured epoxy is too thin, and tends to run, allow it to sit for 15 to 20 minutes after mixing and it will acquire sufficient viscosity and tackiness to make the application easier. Note: wrapping the sleeve with Shrink wrap or stretch wrap will contain all the excess epoxy.



Heat Shrink Sleeve option

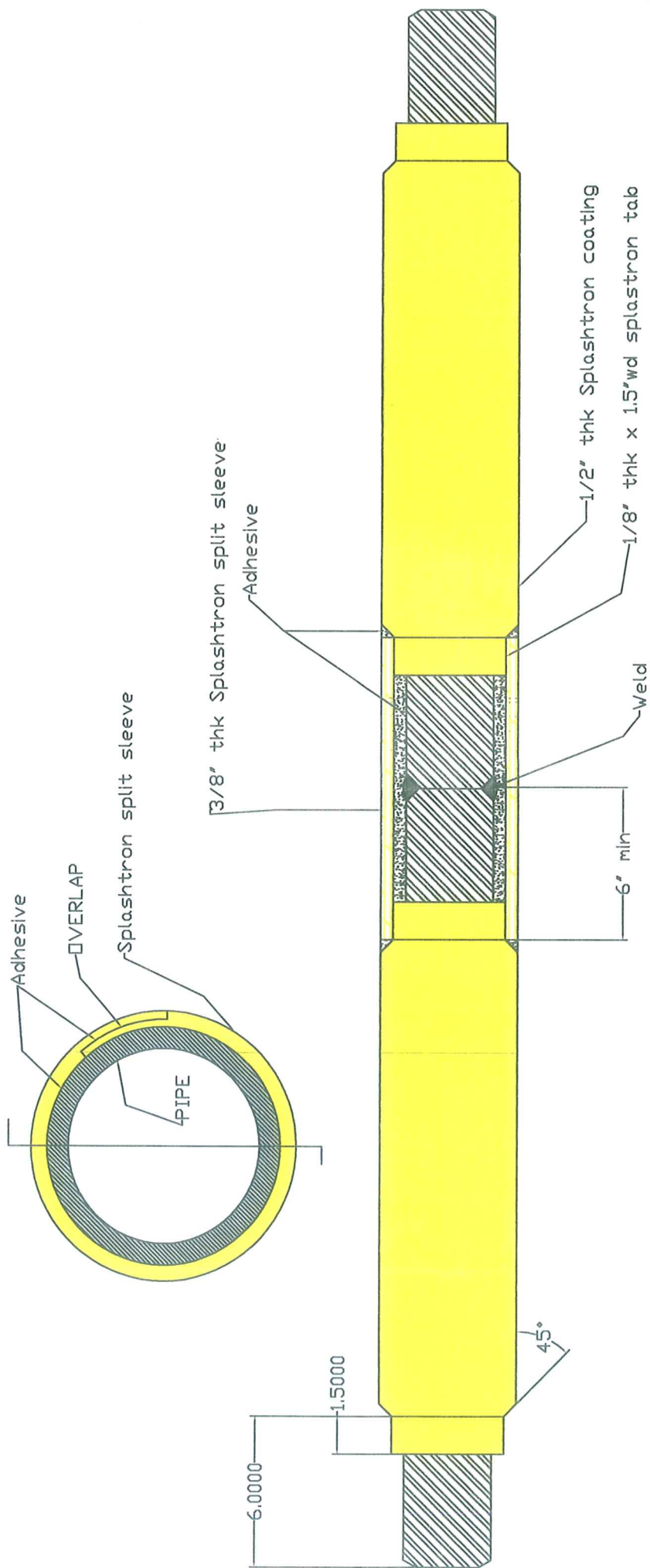
If the freshly applied sleeve is stressed or worked in any way, such as passing over rollers on a pipe lay barge, shrink sleeves should be applied over the SPLASHTRON sleeve.



The heat used to tighten the shrink sleeve, normally by torch, also accelerates the cure of the epoxy. The shrink sleeve bonds to the SPLASHTRON sleeve, helping prevent movement until it is securely bonded to the pipe.

It is recommended that shrink sleeves be used over all freshly applied SPLASHTRON sleeves to insure strong, continuous, holiday-free coating.

For instructions on how to apply shrink sleeves properly, see the literature available from your shrink sleeve supplier.





Scotch-Weld™

Epoxy Adhesive

2216 B/A Gray • 2216 B/A Tan NS • 2216 B/A Translucent

Technical Data

March, 2002

Product Description 3M™ Scotch-Weld™ Epoxy Adhesive 2216 B/A Gray, Tan NS and Translucent are flexible, two-part, room temperature curing epoxies with high peel and shear strengths.

- Advantages**
- Excellent for bonding many metals, woods, plastics, rubbers, and masonry products.
 - Base and Accelerator are contrasting colors.
 - Good retention of strength after environmental aging.
 - Resistant to extreme shock, vibration, and flexing.
 - Excellent for cryogenic bonding applications.
 - 2216 B/A Gray Adhesive meets MIL-A-82720 and DOD-A-82720.
 - 2216 B/A Tan NS Adhesive is non-sag for greater bondline control.
 - 2216 B/A Translucent can be injected.

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 | 2216 B/A Gray | | 2216 B/A Tan NS | | 2216 B/A Translucent | |
|--|------------------|-----------------|------------------|-------------------|----------------------|----------------|
| | Base | Accelerator | Base | Accelerator | Base | Accelerator |
| Color: | White | Gray | White | Tan | Translucent | Amber |
| Base: | Modified Epoxy | Modified Amine | Modified Epoxy | Modified Amine | Modified Epoxy | Modified Amine |
| Net Wt.: (lb/gal) | 11.1-11.6 | 10.5-11.0 | 11.1-11.6 | 10.5-11.0 | 9.4-9.8 | 8.0-8.5 |
| Viscosity: (cps) (Approx.) Brookfield RVF #7 sp. @ 20 rpm | 75,000 - 150,000 | 40,000 - 80,000 | 75,000 - 150,000 | 550,000 - 900,000 | 11,000 - 15,000 | 5,000 - 9,000 |
| Mix Ratio: (by weight) | 5 parts | 7 parts | 5 parts | 7 parts | 1 part | 1 part |
| Mix Ratio: (by volume) | 2 parts | 3 parts | 2 parts | 3 parts | 1 part | 1 part |
| Work Life: 100 g Mass @ 75°F (24°C) | 90 minutes | 90 minutes | 120 minutes | 120 minutes | 120 minutes | 120 minutes |

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Epoxy Adhesives

2216 B/A Gray • 2216 B/A Tan NS • 2216 B/A Translucent

Typical Cured Physical Properties

| Product | 2216 Gray | 2216 Tan NS | 2216 Translucent |
|---------------------------------|-----------|-------------|------------------|
| Color | Gray | Tan | Translucent |
| Shore D Hardness ASTM D 2240 | 50-65 | 65-70 | 35-50 |
| Time to Handling Strength | 8-12 hrs. | 8-12 hrs. | 12-16 hrs. |

Typical Cured Electrical Properties

| Product | 2216 Gray | 2216 Translucent |
|------------------------------------|--|---|
| Arc Resistance | 130 seconds | |
| Dielectric Strength | 408 volts/mil | 630 volts/mil |
| Dielectric Constant @ 73°F (23°C) | 5.51—Measured @ 1.00 KHz | 6.3 @ 1 KHz |
| Dielectric Constant @ 140°F (60°C) | 14.17—Measured @ 1.00 KHz | — |
| Dissipation Factor 73°F (23°C) | 0.112 Measured @ 1.00 KHz | 0.119 @ 1 KHz |
| Dissipation Factor 140°F (60°C) | 0.422—Measured @ 1.00 KHz | — |
| Surface Resistivity @ 73°F (23°C) | 5.5 x 10 ¹⁶ ohm—@ 500 volts DC | — |
| Volume Resistivity @ 73°F (23°C) | 1.9 x 10 ¹² ohm-cm—@ 500 volts DC | 3.0 x 10 ¹² ohm-cm @ 500 volts DC |

Typical Cured Thermal Properties

| Product | 2216 Gray | 2216 Translucent |
|-------------------------------------|---|--|
| Thermal Conductivity | 0.228 Btu-ft/ft ² h °F | 0.114 Btu-ft/ft ² h °F |
| Coefficient of Thermal Expansion | 102 x 10 ⁻⁶ in/in/°C between 0-40°C 134 x 10 ⁻⁶ in/in/°C between 40-80°C | 81 x 10 ⁻⁶ in/in/°C between -50-0°C 207 x 10 ⁻⁶ in/in/°C between 60-150°C |

Typical Cured Outgassing Properties

Outgassing Data
NASA 1124 Revision 4

| | % TML | % CVCM | % Wtr |
|-----------|-------|--------|-------|
| 2216 Gray | .77 | .04 | .23 |

2216 Gray was cured in air for 7 days @ 77°F (25°C).

Handling/Curing Information

Directions for Use

1. 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. For suggested surface preparations of common substrates, see the following section on Surface Preparation.
2. These products consist of two parts. Mix thoroughly by weight or volume in the proportions specified on the Product Label and in the Uncured Properties Section. Mix approximately 15 seconds after a uniform color is obtained.

Scotch-Weld™

Epoxy Adhesives

2216 B/A Gray • 2216 B/A Tan NS • 2216 B/A Translucent

Handling/Curing Information (continued)

3. For maximum bond strength, apply product evenly to both surfaces to be joined.
4. Application to the substrates should be made within 90 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 firm. Heat, up to 200°F (93°C), will speed curing.
6. The following times and temperatures will result in a full cure:

| Product | 2216 Gray | 2216 Tan NS | 2216 Translucent |
|------------------|-------------|-------------|------------------|
| Cure Temperature | Time | Time | Time |
| 75°F (24°C) | 7 days | 7 days | 30 days |
| 150°F (66°C) | 120 minutes | 120 minutes | 240 minutes |
| 200°F (93°C) | 30 minutes | 30 minutes | 60 minutes |

7. Keep parts from moving until handling strength is reached. Contact pressure is necessary. Maximum shear strength is obtained with a 3-5 mil bond line. Maximum peel strength is obtained with a 17-25 mil bond line.
8. Excess uncured adhesive can be cleaned up with ketone type solvents.*

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

Application and Equipment Suggestions

These products may be applied by spatula, trowel or flow equipment.

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

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 or Aluminum (Mechanical Abrasion)

1. Wipe free of dust with oil-free solvent such as acetone or alcohol solvents.*
2. Sandblast or abrade using clean fine grit abrasives (180 grit or finer).
3. Wipe again with solvents to remove loose particles.
4. If a primer is used, it should be applied within 4 hours after surface preparation. If 3M™ Scotch-Weld™ Structural Adhesive Primer EC-1945 B/A is used, apply a thin coating (0.0005") 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.

***Note:** When using solvents, extinguish all ignition sources and follow the manufacturer's precautions and directions for use. Use solvents in accordance with local regulations.

Surface Preparation (continued)

Aluminum (Chemical Etch)

Aluminum alloys may be chemically cleaned and etched as per ASTM D 2651. This procedure states to:

1. Alkaline Degrease – Oakite 164 solution (9-11 oz/gal of 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):**

| Material | Amount |
|-------------------|--|
| 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 (minimum) at 140°F (60°C) maximum.
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 (180 grit or finer).
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™ Structural Adhesive Primer EC-3901 to the glass surfaces to be bonded and allow the primer to dry a minimum of 30 minutes @ 75°F (24°C) before bonding.

***Note:** When using solvents, extinguish all ignition sources and follow the manufacturer's precautions and directions for use. Use solvents in accordance with local regulations.

Scotch-Weld™

Epoxy Adhesives

2216 B/A Gray • 2216 B/A Tan NS • 2216 B/A Translucent

Typical Adhesive Performance Characteristics

A. Typical Shear Properties on Etched Aluminum

ASTM D 1002

Cure: 2 hours @ 150 ± 5°F (66°C ± 2°C), 2 psi pressure

| | Overlap Shear (psi) | | |
|------------------|---------------------------|-----------------------------|-----------------------------|
| Test Temperature | 2216 B/A Gray Adhesive | 2216 B/A Tan NS Adhesive | 2216 B/A Trans. Adhesive |
| -423°F (-253°C) | 2440 | — | — |
| -320°F (-196°C) | 2740 | — | — |
| -100°F (-73°C) | 3000 | — | — |
| -67°F (-53°C) | 3000 | 2000 | 3000 |
| 75°F (24°C) | 3200 | 2500 | 1700 |
| 180°F (82°C) | 400 | 400 | 140 |

| Test Temperature | Shear Modulus (Torsion Pendulum Method) |
|------------------|--|
| -148°F (-100°C) | 398,000 psi (2745 MPa) |
| -76°F (-60°C) | 318,855 psi (2199 MPa) |
| -40°F (-40°C) | 282,315 psi (1947 MPa) |
| 32°F (0°C) | 218,805 psi (1500 MPa) |
| 75°F (24°C) | 49,580 psi (342 MPa) |

B. Typical T-Peel Strength

ASTM D 1876

| | T-Peel Strength (piw) @ 75°F (24°C) | | |
|------------------|-------------------------------------|-----------------------------|-----------------------------|
| Test Temperature | 2216 B/A Gray Adhesive | 2216 B/A Tan NS Adhesive | 2216 B/A Trans. Adhesive |
| 75°F (24°C) | 25 | 25 | 25 |

**Typical Adhesive
Performance
Characteristics**
(continued)

C. Overlap Shear Strength After Environmental Aging-Etched Aluminum

| | | Overlap Shear (psi) 75°F (24°C) | | |
|--|-------------------------------|----------------------------------|--------------------------------|--------------------------------|
| Environment | Time | 2216 B/A Gray Adhesive | 2216 B/A Tan NS Adhesive | 2216 B/A Trans. Adhesive |
| 100% Relative Humidity @ 120°F (49°C) | 14 days 30 days 90 days | 2950 psi 1985 psi 1505 psi | 3400 psi 2650 psi | 1390 psi |
| *Salt Spray @ 75°F (24°C) | 14 days 30 days 60 days | 2300 psi 500 psi 300 psi | 3900 psi 3300 psi | 1260 psi |
| Tap Water @ 75°F (24°C) | 14 days 30 days 90 days | 3120 psi 2942 psi 2075 psi | 3250 psi 2700 psi | 1950 psi |
| Air @ 160°F (71°C) | 35 days | 4650 psi | 4425 psi | |
| Air @ 300°F (149°C) | 40 days | 4930 psi | 4450 psi | 3500 psi |
| Anti-icing Fluid @ 75°F (24°C) | 7 days | 3300 psi | 3050 psi | 2500 psi |
| Hydraulic Oil @ 75°F (24°C) | 30 days | 2500 psi | 3500 psi | 2500 psi |
| JP-4 Fuel | 30 days | 2500 psi | 2750 psi | 2500 psi |
| Hydrocarbon Fluid | 7 days | 3300 psi | 3100 psi | 3000 psi |

*Substrate corrosion resulted in adhesive failure.

D. Heat Aging of 2216 B/A Gray (Cured for 7 days @ 75°F [24°C])

| Overlap Shear (psi) | Time aged @ 300°F (149°C) | | | |
|---------------------|---------------------------|---------|---------|---------|
| Test Temperature | 0 days | 12 days | 40 days | 51 days |
| -67°F (-53°C) | 2200 | 3310 | 3120 | 2860 |
| 75°F (24°C) | 3100 | 5150 | 4930 | 4740 |
| 180°F (82°C) | 500 | 1000 | 760 | 1120 |
| 350°F (177°C) | 420 | 440 | 560 | — |

Scotch-Weld™

Epoxy Adhesives

2216 B/A Gray • 2216 B/A Tan NS • 2216 B/A Translucent

Typical Adhesive Performance Characteristics (continued)

E. Overlap Shear Strength on Abraded Metals, Plastics, and Rubbers.

Overlap shear strengths were measured on 1" x 1/2" overlap specimens. These bonds were made individually using 1" by 4" pieces of substrate (Tested per ASTM D 1002).

The thickness of the substrates were: cold rolled, galvanized and stainless steel – 0.056-0.062", copper – 0.032", brass – 0.036", rubbers – 0.125", plastics – 0.125". All surfaces were prepared by solvent wiping/abrading/ solvent wiping.

The jaw separation rate used for testing was 0.1 in/min for metals, 2 in/min for plastics, and 20 in/min for rubbers.

| Substrate | Overlap Shear (psi) @ 75°F (24°C) | |
|---|-----------------------------------|--------------------------|
| | 2216 B/A Gray Adhesive | 2216 B/A Tan NS Adhesive |
| Aluminum/Aluminum | 1850 | 2350 |
| Cold Rolled Steel/Cold Rolled Steel | 1700 | 3100 |
| Stainless Steel/Stainless Steel | 1900 | |
| Galvanized Steel/Galvanized Steel | 1800 | |
| Copper/Copper | 1050 | |
| Brass/Brass | 850 | |
| Styrene Butadiene Rubber/Steel | 200* | |
| Neoprene Rubber/Steel | 220* | |
| ABS/ABS Plastic | 990* | 1140* |
| PVC/PVC, Rigid | 940* | |
| Polycarbonate/Polycarbonate | 1170* | 1730* |
| Acrylic/Acrylic | 1100* | 1110* |
| Fiber Reinforced Polyester/ Reinforced Polyester | 1660* | 1650* |
| Polyphenylene Oxide/PPO | 610 | 610 |
| PC/ABS Alloy / PC/ABS Alloy | 1290 | 1290 |

*The substrate failed during the test.

Storage and Shelf Life

Storage: Store products at 60-80°F (16-27°C) for maximum storage life.

Shelf Life: When stored at the recommended temperatures in the original, unopened containers, the 3M Standard shelf life is two years from date of shipment from 3M.

Note

2216 B/A is identical to 3M™ Scotch-Weld™ Epoxy Adhesive EC-2216 B/A in chemical composition. EC-2216 B/A has been labeled, packaged, tested, and certified for aircraft and aerospace applications. 2216 B/A may be used for aircraft and aerospace applications if proper Certificates of Test have been issued and material meets all aircraft manufacturer's specification requirements.

Scotch-Weld™

Epoxy Adhesives

2216 B/A Gray • 2216 B/A Tan NS • 2216 B/A Translucent

Precautionary Information

Refer to Product Label and Material Safety Data Sheet for Health and Safety Information before using this product.

For Additional Information

To request additional product information or to arrange for sales assistance, call toll free 1-800-362-3550 or visit www.3M.com/adhesives. Address correspondence to: 3M Engineered Adhesives Division, 3M Center, Building 220-7E-01, St. Paul, MN 55144-1000. Our fax number is 651-733-9175. In Canada, phone: 1-800-364-3577. In Puerto Rico, phone: 1-787-750-3000. In Mexico, phone: 52-70-04-00.

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ISO 9002

This Engineered Adhesives Division product was manufactured under a 3M quality system registered to ISO 9002 standards.



Engineered Adhesives Division

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