

## Advanced Materials

# Human

## MULTI-PURPOSE EPOXY ADHESIVE

**DESCRIPTION :** **Human** epoxy adhesive is a multi-purpose, viscous material that is suitable for bonding a variety of materials, including metal, ceramic, and wood. The electrically insulating adhesive is easy to apply either manually by spatula and stiff brush or mechanically with meter/mix and coating equipment. **Human** epoxy adhesive cures at temperatures from 68°F (20°C) to 356°F (180°C) with no release of volatile constituents. It qualifies to ABR 2-1079 and DAN 1284-01.

**APPLICATIONS :**

- Metal
- Ceramics
- Wood
- Vulcanized Rubber
- Foams
- Plastics

**ADVANTAGES :**

- Long open time
- High shear and peel strength
- Easy to apply
- Good resistance to static and dynamic loads
- Electrically insulating

TYPICAL PROPERTIES :	Property	Test Method	Test Values <sup>(1)</sup>	
			Resin	Hardener
	Color/appearance	Visual	Creamy, viscous/liquid	Amber Liquid
	Specific Gravity	ASTM D-792	1.17	0.92
	Viscosity (cP) @ 77°F (25°C)	ASTM D-2393	50,000	35,000

TYPICAL MIXED PROPERTIES :	Property	Test Method	Test Values <sup>(1)</sup>
	Reaction Ratio (by weight)		100R/80H
	Reaction Ratio (by volume)		100R/100H
	Pot Life, hours @ 77°F (25°C) (4.fl. oz. mass)	ASTM D-2471	2
	Mixed viscosity (cP) @ 77°F (25°C)	ASTM D-2393	45,000

<sup>†</sup>Tested @ 77°F (25°C)

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<b>RECOMMENDED CURE SCHEDULES:</b>	<b><u>Temperature</u></b>	<b><u>Handling Strength</u></b>	<b><u>Minimum Cure Time</u></b>
	68°F (20°C)	12 hours	15 hours
	77°F (25°C)	7 hours	12 hours
	104°F (40°C)	2 hours	3 hours
	158°F (70°C)	30 minutes	50 minutes
	212°F (100°C)	6 minutes	10 minutes
	302°F (150°C)	4 minutes	5 minutes

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**TYPICAL CURED  
PROPERTIES :**

**Application of Adhesive**

The resin/hardener mix is applied with a spatula to the pretreated and dry joint surfaces.

A layer of adhesive 0.002 to 0.004-inches (0.05 to 0.10-mm) thick will normally impart the greatest lap shear strength to a joint.

The joint components should be assembled and clamped as soon as the adhesive has been applied. Even contact throughout suffices to ensure proper cure.

**Standard Test Specimens**

Unless otherwise stated, the figures given below were all determined by testing standard specimens made up by lap-jointing 4-inch x 1-inch x 0.06-inch (10-cm x 2.5-cm x 1.5-mm) strips of aluminum. The joint area was 0.5 x 1 inch (12.5 mm x 2.5 cm) in each case.

<b><u>Property</u></b>	<b><u>Test Method</u></b>	<b><u>Test Values<sup>(1)</sup></u></b>
<b>Lap Shear Strength, psi (MPa)</b>	<b>ASTM D-1002</b>	
<b><i>Effects of cure time and temperature</i></b>		
<b><u>Cure Temperature</u></b>	<b><u>Time</u></b>	
77°F (25°C)	8 hours	710 (4.9)
	15 hours	1990 (13.7)
	24 hours	2130 (14.7)
	72 hours	2280 (15.7)
	5 days	2560 (17.6)
158°F (70°C)	1 hour	3130 (21.5)
	2 hours	3410 (23.5)
	3 hours	3200 (22)
212°F (100°C)	10 minutes	3700 (25.5)
	20 minutes	3980 (27.4)
	30 minutes	4120 (28.4)
302°F (150°C)	5 minutes	4270 (29.4)
	10 minutes	4410 (30.4)
	20 minutes	4410 (30.4)

# Human

## Property

Lap Shear Strength, psi (MPa)

### *Effect of Test Temperature*

(Load applied 10 minutes after specimens reach test temperature.)

## Test Method

ASTM D-1002

### Cure Cycle

5 days @ 77°F (25°C)

### Test Temp.

-76°F (-60°C)

2840 (19.5)

-4°F (-20°C)

2840 (19.5)

68°F (20°C)

2560 (17.6)

104°F (40°C)

1420 (9.8)

140°F (60°C)

570 (3.9)

20 min @ 212°F (100°C)

-76°F (-60°C)

3560 (24.5)

-46°F (-20°C)

3410 (23.5)

68°F (20°C)

3980 (27.4)

104°F (40°C)

1990 (13.7)

140°F (60°C)

1000 (6.9)

<sup>†</sup>Tested @ 77°F (25°C)

## Property

Lap Shear Strength, psi (MPa)

### *Effect of Immersion*

(Cure cycle 16 hours @ 104°F (40°C). Immersion for 90 days in media listed.)

### Media

Standard - As prepared

### Test Values<sup>(†)</sup>

2560 (17.6)

Acetone (30 days)

570 (3.9)

Acetylene

430 (2.9)

Gasoline

2410 (16.6)

Ethyl Acetate (30 days)

570 (3.9)

Acetic Acid 10%

Degraded

Methanol

Degraded

Lubricating Oil - HD30

2560 (17.6)

Kerosene

Degraded

Trichloroethylene

Degraded

Water @ 68°F (20°C)

1420 (9.8)

Water @ 194°F (90°C)

430 (2.9)

Lap Shear Strength, psi (MPa)

### *Effect of Tropical Exposure*

(104° (40°C)/92% R.H.)

### Cure Cycle

16 hrs @ 104°F (40°C)

### Exposure Time

0 days

### Test Values<sup>(†)</sup>

2560 (17.6)

10 days

2560 (17.6)

30 days

1710 (11.8)

60 days

1560 (10.7)

90 days

570 (3.9)

20 min @ 212°F (100°C)

0 days

3980 (27.4)

10 days

2560 (17.6)

30 days

1710 (11.8)

60 days

1560 (10.7)

90 days

1280 (8.8)

<sup>†</sup>Tested @ 77°F (25°C)



# Human

**Lap Shear Strength, psi (MPa)**  
**Effect of Heat Aging**  
(Cured 16 hours @ 104°F (40°C).

**Test Method**  
ASTM D-1002

<b><u>Aging Temperature</u></b>	<b><u>Exposure Time</u></b>	<b><u>Test Values<sup>(1)</sup></u></b>
68°F (20°C)	0 days	2560 (17.6)
	1 years	2560 (17.6)
	2 years	2280 (15.7)
	3 years	1710 (11.8)
	4 years	1990 (13.7)
	5 year	1990 (13.7)
140°F (60°C)	3 days	2560 (17.6)
	10 days	2420 (16.6)
	30 days	2130 (14.7)
176°F (80°C)	3 days	2130 (14.7)
	10 days	2130 (14.7)
	30 days	2130 (14.7)
	60 days	2130 (14.7)
	1 year	1280 (8.8)
	2 years	710 (4.9)
	3 years	710 (4.9)
	4 years	430 (2.9)
248°F (120°C)	5 years	280 (1.9)
	3 days	2130 (14.7)
	10 days	2280 (15.7)
	30 days	2280 (15.7)
	60 days	2130 (14.7)

**Property**  
**Lap Shear Strength (psi)**  
**Tested on Metal Substrates**  
(Cured 20 min @ 212°F (100°C)

<b><u>Metal</u></b>	<b><u>Substrate Thickness</u></b> <b><u>(in./mm)</u></b>	<b><u>Test Values<sup>(1)</sup></u></b>
Carbon Steel	0.039/1.0	3840 (26.4)
Stainless Steel	0.039/1.0	3270 (22.5)
Galvanized Steel <sup>2</sup>	0.06/1.5	1990 (13.7)
Copper	0.06/ 1.5	3270 (22.5)
Brass	0.06/ 1.5	2990 (20.6)

<sup>1</sup>Tested @ 77°F (25°C)

<sup>2</sup>Surface degreased only, not roughened.

**Property**  
**Fatigue Strength (psi)**  
Tested using a load frequency of 90 Hz and a 1 inch (25 mm) joint overlap  
(Cured 20 min @ 212°F (100°C)