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LOCTITE®

Technical Process Bulletin

LOCTITE EA 9309.3NA AERO

Epoxy Paste Adhesive

(KNOWN AS Hysol EA 9309.3NA)

INTRODUCTION

LOCTITE EA 9309.3NA AERO is a toughened two-part paste adhesive. It contains 5 mil/0.13 mm glass beads for bondline thickness control. LOCTITE EA 9309.3NA AERO bonds metal skins and honeycomb core to yield tough permanently flexible joints resistant to humidity, water and most common fluids. Its outstanding feature is high shear and peel strength to aluminum.

FEATURES

- High Shear Strength
- High Peel Strength
- Bondline Thickness Control
- Good Environmental Resistance

Uncured Adhesive Properties

	Part A	Part B
Color	Pink-red	Blue
Viscosity @ 77°F	1500-3,800 Poise	0.1-0.2 Poise
Brookfield Viscometer	HBT 7 @ 20 rpm	LVF Spdl 1 @ 60 rpm
Viscosity @ 25°C	150-300 Pa·s	0.01-0.02 Pa·s
Brookfield Viscometer	HBT Spdl 7 @ 2.1 rad/s	LVF Spdl 1 @ 6.3 rad/s
Density (g/ml)	1.15	1.0
Warranty Life @ <77°F/25°C	1 year	1 year

This material will normally be shipped at ambient conditions, which will not alter our standard warranty, provided that the material is placed into its intended storage upon receipt. Premium shipment is available upon request.

Handling

Mixing - This product requires mixing two components together just prior to application to the parts to be bonded. Complete mixing is necessary. The temperature of the separate components prior to mixing is not critical, but should be close to room temperature (77°F/25°C).

Mix Ratio	Part A	Part B
By Weight	100	22

Note: Volume measurement is not recommended for structural applications unless special precautions are taken to assure proper ratios.

Pot Life (450 gram mass) 35 minutes @ 77°F/25°C
Method - ASTM D2471 in water bath.

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Application

Mixing - Combine Part A and Part B in the correct ratio and mix thoroughly. THIS IS IMPORTANT! Heat buildup during or after mixing is normal. Do not mix quantities greater than 450 grams as dangerous heat buildup can occur causing uncontrolled decomposition of the mixed adhesive. TOXIC FUMES CAN OCCUR, RESULTING IN PERSONAL INJURY. Mixing smaller quantities will minimize the heat buildup.

Applying - Bonding surfaces should be clean, dry and properly prepared. For optimum surface preparation consult the LOCTITE Surface Preparation Guide. The bonded parts should be held in contact until the adhesive is set. Handling strength for this adhesive will occur in 12 hours @ 77°F/25°C, after which the support tooling or pressure used during cure may be removed. Since full bond strength has not yet been attained, load application should be small at this time.

Curing - This adhesive may be cured for 3 to 5 days @ 77°F/25°C or 1 hour @ 180°F/82°C to achieve normal performance.

Cleanup - It is important to remove excess adhesive from the work area and application equipment before it hardens. Denatured alcohol and many common industrial solvents are suitable for removing uncured adhesive. Consult your supplier's information pertaining to the safe and proper use of solvents.

Bond Strength Performance

Tensile Lap Shear Strength - Tensile lap shear strength tested per ASTM D1002. Adherends are 0.063 inch/1.6 mm thick aluminum as referenced and treated with FPL per ASTM D2651 or Phosphoric Acid Anodizing (PAA) per ASTM D3933. Adhesive cures are referenced.

Typical Results

	2024-T3 Clad / FPL 72 hours at 77°F/25°C under 10 psi/0.7 bar pressure		2024-T3 Bare / PAA 2 hours at 150°F/66°C under 10 psi/0.7 bar pressure	
Test Temperature, °F/°C	**psi**	**MPa**	**psi**	**MPa**
-67/-55	5470	37.7	-	-
77/25	4753	32.8	5000	34.5
180/82	934	6.4	1000	6.9
77/25 (Hot/Wet)	4757	32.8	-	-

750 hours @ 160°F/71°C & 85% R.H.

*Adhesive components were mixed and allowed to sit for 35 minutes, then applied to the bonding surface.

*Sub-ambient -67°F/-55°C test specimens saw a total soak time of 30 minutes prior to testing.

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Tensile Lap Shear Strength - Tensile lap shear strength tested per ASTM D1002 after curing for 5 days @ 77°F/25°C. Adherends are 2024-T3 Alclad 0.063 inch/1.6 mm thick aluminum treated with Phosphoric Acid Anodizing (PAA) per ASTM D3933.

		Typical Results Tested at 77°F/25°C	
Exposure	**Conditioning time**	**psi**	**MPa**
Control	None	4,800	33.1
Hydraulic Oil	7 days @ 77°F/25°C	4,600	31.7
JP-4 Fuel	7 days @ 77°F/25°C	4,700	32.3
Anti-icing Fluid	7 days @ 77°F/25°C	4,500	31.3
Hydrocarbon III	7 days @ 77°F/25°C	4,300	29.6
Skydrol 500	7 days @ 77°F/25°C	4,600	31.7
Water	30 days @ 77°F/25°C	4,700	32.4
Hot/Wet	30 days @ 120°F/49°C & 98% R.H.	5,100	35.2
Salt Spray (5% NaCl)	30 days @ 105°F/41°C	5,000	32.4
Creep Deflection @ 77°F/25°C	After 192 hrs. @ 1600 psi /11.0 MPa load	0.00056 in	0.0142 mm

Peel Strength - T-Peel strength tested per ASTM D1876 @ 77°F/25°C. Adherends are 0.020 inch/0.51 mm thick aluminum as referenced and treated with Phosphoric Acid Anodizing (PAA) per ASTM D3933. Adhesive cures are referenced.

Typical Results

	2024-T3 Clad 72 hours at 77°F/25°C under 28 in-Hg/711 mm-Hg Vacuum		2024-T3 Bare 2 hours at 180°F/82°C under 28 in-Hg/711 mm-Hg Vacuum	
Test Temperature, °F/°C	**lbf/in**	**N/25mm**	**lbf/in**	**N/25mm**
-67/-55	31	138	21	93
77/25	48	214	32	142

*Sub-ambient -67°F test specimens saw a total soak time of 30 minutes prior to testing.

Floating Roller (Bell) Peel Strength - Bell Peel strength tested per ASTM D3167. Adherends are 2024-T3 Bare 0.025 inch/0.64 mm & 0.063 inch/1.6 mm thick aluminum and treated with Phosphoric Acid Anodizing (PAA) per ASTM D3933. Adhesive cure is referenced.

Typical Results

72 hours at 77°F/25°C under 28 in-Hg/711 mm-Hg Vacuum

Test Temperature, °F/°C	**lbf/in**	**N/25mm**
77/25	94	418

Service Temperature

Service temperature is defined as that temperature at which this adhesive still retains 1000 psi/6.9 MPa using test method ASTM D1002 and is approximately 180°F/82°C.

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Bulk Resin Properties
Tensile Properties - tested using 0.125 inch/3.18 mm castings per ASTM D638.
Shore D Hardness - Durometer Model D ASTM D2240.
Tensile Properties: Cure 72 hours @ 77°F/25°C

▪ Tensile Strength @ 77°F/25°C	4,670 psi	32.2 MPa
▪ Tensile Modulus @ 77°F/25°C	334 ksi	2,303 MPa
▪ Shear Modulus @ 77°F/25°C	122 ksi	841 MPa
▪ Poisson's Ratio	0.36	
▪ Elongation at Break,%	10	
▪ Shore D Hardness @ 77°F/25°C	80	

Glass Transition Temperature (Tg) - Rheometric Scientific DMTA IV - Single Cantilever,
Heat-up rate: 5°C/min., Frequency: 1 Hz, Strain: 0.1%
Specimen Dimensions: 1 inch/25.4 mm x 0.49 inch/12.4 mm x 0.063 inch/1.6 mm
Cure: 72 hours @ 77°F/25°C

Tg dry (DMTA)	142°F	61°C
Tg wet (DMTA)	147°F	64°C

Cure: 1 hour @ 180°F/82°C

Tg dry (DMTA)	178°F	81°C
Tg wet (DMTA)	147°F	64°C

*Wet: 160°F/71°C & 85% RH until saturation. Moisture uptake was 2.5%.

Compressive Properties - tested using 0.5 inch/12.7 mm castings per ASTM D695.

Compressive Strength @ 77°F/25°C	7,500 psi	51.7 MPa
Compressive Modulus @ 77°F/25°C	245 ksi	1,688 MPa

Electrical Properties - tested per ASTM D149, D150.

	0.1 KHz	1.0 KHz	10.0 KHz
Dielectric Constant	4.33	4.29	4.17
Dissipation Factor	.018	.014	.028
Volume Resistivity (ohm-cm)		1.36×10^{14}	
Surface Resistivity (ohm)		4.94×10^{14}	
Thermal Conductivity (cal/sec-cm-°C)		4.50×10^{-4}	

Handling Precautions
Do not handle or use until the Material Safety Data Sheet has been read and understood.
For industrial use only.

DISPOSAL INFORMATION
Dispose of spent remover and paint residue per local, state and regional regulations. Refer to HENKEL TECHNOLOGIES MATERIAL SAFETY DATA SHEET for additional disposal information.

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PRECAUTIONARY INFORMATION

General:

As with most epoxy based systems, use this product with adequate ventilation. Do not get in eyes or on skin. Avoid breathing the vapors. Wash thoroughly with soap and water after handling. Empty containers retain product residue and vapors so obey all precautions when handling empty containers.

PART A

CAUTION! This material may cause eye and skin irritation or allergic dermatitis. It contains epoxy resins.

PART B

WARNING! This material causes eye and skin irritation or allergic dermatitis. It contains amines.

Before using this product refer to container label and HENKEL TECHNOLOGIES MATERIAL SAFETY DATA SHEET for additional precautionary, handling and first aid information.

Note

The data contained herein are furnished for information only and are believed to be reliable. We cannot assume responsibility for the results obtained by others over whose methods we have no control. It is the user's responsibility to determine suitability for the user's purpose of any production methods mentioned herein and to adopt such precautions as may be advisable for the protection of property and of persons against any hazards that may be involved in the handling and use thereof. In light of the foregoing, **Henkel Corporation specifically disclaims all warranties expressed or implied, including warranties of merchantability or fitness for a particular purpose, arising from sale or use of Henkel Corporation's products. Henkel Corporation specifically disclaims any liability for consequential or incidental damages of any kind, including lost profits.** The discussion herein of various processes or compositions is not to be interpreted as representation that they are free from domination of patents owned by others or as a license under any Henkel Corporation patents that may cover such processes or compositions. We recommend that each prospective user test his proposed application before repetitive use, using this data as a guide. This product may be covered by one or more United States or foreign patents or patent applications.

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