Technical Process Bulletin

LOCTITE EA 9360 AERO
Epoxy Paste Adhesive
(KNOWN AS Hysol EA 9360)

INTRODUCTION
LOCTITE EA 9360 AERO is a two-component toughened paste adhesive, which combines high peel strength at room temperature with tensile lap shear strength @ 225°F to 250°F (107°C to 121°C).

FEATURES
- Available in dual cartridge packaging
- High peel strength
- Excellent static stress durability
- >225°F (107°C) service
- Easy mixing two component system
- Room temperature cure
- Low Slump

Uncured Properties

	Part A	Part B	Mixed
Color	Off White	Blue	
Viscosity @ 77°F	3000 Poise	1700 Poise	1200 Poise
Brookfield, HBT	Spdl 7 @ 20 rpm	Spdl 6 @ 20 rpm	Spdl 5 @ 20 rpm
Viscosity @ 25°C	300 Pa·S	170 Pa·S	120 Pa·S
Brookfield, HBT	2.1 rad/sec	2.1 rad/sec	2.1 rad/sec
Density (g/ml)	1.16	1.00	1.14
Shelf Life			
@ <40°F/4°C	1 year	1 year	
@ <77°F/25°C	6 months	6 months	
@ <90°F/32°C	6 months	6 months	

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	43
By Volume	2	1

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

Pot Life (200 gram mass) 50 minutes @ 77°F (25°C)
Method - ASTM D2471 in water bath.

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 24 hours at 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 5-7 days @ 77°F (25°C) to achieve normal performance. Accelerated cures up to 200°F (93°C) (for small masses only) may be used as an alternative. For example, 1 hour @ 180°F (82°C) will give complete cure.

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 - tested per ASTM D1002. Adherends are 2024-T3 Bare aluminum treated with phosphoric acid anodize per ASTM D3933.

Test Temperature, °F/°C	Typical Results	
	psi	MPa
-67 (-55)	4000	27.6
77 (25)	5000	34.5
180 (82)	3000	20.7
225 (107)	2000	13.8
250 (121)	950	6.5

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Tensile Lap Shear Strength - tested per ASTM D1002. Adherends are 2024-T3 AlClad aluminum treated with phosphoric acid anodize per ASTM D3933.

Process Variables (Various Adhesive Cure Schedules)

Adhesive Cure Parameter	Test Temp. °F	Test Temp. °C	Typical Results psi	Typical Results MPa
Control: 7 days at 77°F (25°C)	75	24	5904	40.7
	212	100	3133	21.6
72 hrs at 77°F (25°C)	75	24	4724	32.6
1 hr at 146°F (65°C)	75	24	5917	40.8
	212	100	3412	23.5
45 minutes at 194°F (90°C)	75	24	5915	40.8
	212	100	3314	22.9

Tensile Lap Shear Strength - tested per ASTM D1002. Adherends are 2024-T3 AlClad aluminum treated with phosphoric acid anodize per ASTM D3933 and primed with BR-127.

Dry, Heat Aging, Hot/Wet, Aircraft Fluids

Specimen Conditioning	Test Temp. °F	Test Temp. °C	Typical Results psi	Typical Results MPa
Dry	-67	-55	4618	31.8
	75	24	5904	40.7
	212	100	3133	21.6
Heat Aging 168 hrs at 250°F (121°C)	-67	-55	5140	35.4
	75	24	5912	40.8
	212	100	4449	30.7
Hot/Wet	75	24	5712	39.2
1000 hrs at 158°F (70°C) & 85% RH	212	100	1845	12.7
DI Water	75	24	5705	39.3
168 hrs at 158°F (70°C)	212	100	2019	13.9
Hydraulic Fluid (MIL-H-5606)	75	24	5791	39.9
300 hrs at 158°F (70°C)	212	100	3618	25.0
Jet Fuel (JP8)	75	24	6293	43.4
1000 hrs at 104°F (40°C)	212	100	2953	20.4
De-icing Fluid (IPA)	75	24	5987	41.5
168 hrs at 75°F (24°C)	212	100	2191	15.1

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Peel Strength
Floating Roller (Bell) Peel Strength - tested per ASTM D3167. Adherends are 2024-T3 AlClad peeling skin 0.020 inch (0.51 mm) & backing skin 0.063 inch (1.6 mm) aluminum treated and with phosphoric acid anodize per ASTM D3933 and primed with BR-127.

Adhesive Cure Parameter	Typical Results Tested at 77°F (25°C) lb/in	N/25mm
72 hours cure at 77°F (25°C)	60	265
7 days at 77°F (25°C)	68	303
7 days at 77°F (25°C) + post cure 168 hours at 248°F (120°C)	35	156
1 hour cure at 149°F (65°C)	55	244
45 min. cure at 194°F (90°C)	30	135

T-Peel Strength - tested per ASTM D1876. Adherends are 2024-T3 Bare 0.020 inch (0.51 mm) thick aluminum treated with phosphoric acid anodize per ASTM D3933.

Adhesive Cure Parameter	Typical Results Tested at 77°F (25°C) lb/in	N/25mm
5 days at 77°F (25°C)	49	218
60 min. at 160°F (71°C)	30	134

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 >225°F (107°C).

Bulk Resin Properties
Tensile Properties - tested using 0.125 inch (3.18 mm) castings per ASTM D638.
Adhesive Cure 5 days at 77°F (25°C) & Tested at 77°F (25°C)

Tensile Strength	6,145 psi	42.4 MPa
Young's Modulus	487.2 ksi	3360 MPa
Elongation at Break	5%	

Thermal Conductivity - Tested per ASTM E1461

Specific Heat, J/g	1.26
Conductivity, W/mK	0.25

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Thermal Property
Glass Transition Temperature (Tg) - Storage Modulus (E')
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)

Adhesive Initial Cure Parameter	Adhesive Post Cure	°F	°C
7 days at 77°F (25°C)	None	151	66
7 days at 77°F (25°C)	1 hr. at 170°F (77°C)	203	95
30 days at 77°F (25°C)	1 hr. at 170°F (77°C)	207	97
7 days at 77°F (25°C)	1 hr. at 190°F (88°C)	216	102
7 days at 77°F (25°C)	1.5 hrs. at 200°F (93°C)	225	107

Compression Strength & Modulus at 2% Offset - Tested per ASTM D695 cylindrical samples 1.42 inch (36 mm) tall x 0.56 inch (14.2 mm) diameter. Adhesive cure 7 days at 77°F (25°C)

Specimen Conditioning	Test Temp.		Typical Results: Compression Strength		Compression Modulus	
	°F	°C	psi	MPa	ksi	MPa
Dry	-67	-55	20,377	141	391	2700
	75	24	9,878	68	368	2538
	212	100	914	6.3	49	338
Hot/Wet 1000 hrs at 158°F (70°C) & 85% RH	-67	-55	19,861	137	399	2752
	75	24	8,866	61	288	1986
	212	100	415	2.9	103	710

Shore D Hardness on different cures
Cure 1 : 1 hour @ 180ºF
Cure 2 : 10 hours @ 150ºF
Cure 3 : 7 days @ RT

Shore D Hardness (ASTM 2240, Type D Durometer)

	Cure 1*	Cure 2	Cure 3
Measurement 1	85	81	81
Measurement 2	80	83	83
Measurement 3	85	85	83
Average	**83**	**83**	**82**

***specimen shows exotherm at the curing temperature**

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.

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.

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Note

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