

304

General Purpose, High Viscosity, Two-Part, Epoxy Adhesive

Description

Lord® 304 adhesive is a general purpose, high viscosity, two-part epoxy used for applications that require gap filling or non-slumping characteristics on a vertical surface. The cured adhesive offers strong, durable, chemically and environmentally resistant bonds. Lord 304 adhesive has demonstrated excellent adhesion to prepared metals, FRP, phenolic, wood, prepared rubber, and other materials.

Features and Benefits

Contains No Solvent - 100% Solids, nonflammable and virtually odorless.

Excellent Stability - provides a two-year shelf life.

Proven Environmental Resistance - resists dilute acids, alkalis, solvents, greases, oils, moisture, sunlight, and weathering. Temperature resistant from -34°C to 121°C (-30°F to 250°F).

High Strength - provides load-bearing properties equal to or greater than the products being bonded in many cases.

Variable Cure - cures completely at room temperature or much more quickly at elevated temperatures. See graph on Page 2.

Excellent Engineering Properties - provides low shrinkage, good creep properties, and low water absorption. For these and other engineering properties, see Table 3 on Page 3.

Flexible Mix Ratio - accommodates a range of service temperatures and stress loads through modification of the resin-to-hardener mix ratio. See Table 2 on Page 2.

Table 1: Typical Properties* of Uncured Lord 304 Adhesive

	Lord 304-1	Lord 304-2	Mixed
Appearance	Gray Paste	Off-White Paste	Gray Paste
Viscosity, POISE @ 25°C (77°F)	40,000 - 400,000	20,000 - 100,000	N/A
Brookfield HBF with Helipath at 1 rpm	T-Bar Spindle E	T-Bar Spindle C	N/A
Density			
kg/m ³	1431 ± 3%	1053 ± 3%	N/A
lb/gal	11.9 ± 3%	8.7 ± 3%	N/A
Flash Point (closed cup)	85°C (185°F)	>93°C (>200°F)	>93°C (>200°F)
Total Solids Content, by Weight	100%	100%	100%
Working Time {54g mass @ 24°C (75°F)}	N/A	N/A	1 - 2 Hours
Handleable Bonds	Temperature Dependent, See Graph on Page 2		
General Purpose Mix Ratio			
by weight	1	1	N/A
by volume	1	1.3	N/A
Shelf Life from date of shipment at 25°C (77°F), unopened container	2 Years	2 Years	

*Data is typical and not to be used for specification purposes.

Surface Preparation

Remove soil, grease, oil, fingerprints, dust, mold release agents, rust, and other contaminants from substrate surfaces.

Vapor degrease or wipe the surfaces with a clean cloth soaked in an uncontaminated ketone or chlorinated solvent and allow to dry thoroughly. If a solvent cannot be used, substitute a detergent solution or, for metals only, a suitable alkaline degreasing agent following the manufacturer's instructions for use. Wear chemical resistant gloves.

Next, use an abrasive material to roughen the surfaces or remove tarnish if necessary. Abrasion should always be followed by a second degreasing which will ensure removal of loose particles.

Glass and ceramic surfaces that have been primed with Lord AP134 primer exhibit superior environmental resistance. Cured rubber should first be primed with Lord 7701 surface treatment. Prime metal surfaces with Lord 7714 primer.

Handle prepared surfaces carefully to avoid contamination. Assemble as soon as possible.

Mixing

Nonautomated

Measure the resin and hardener components to meet your service temperature needs and joint design (See Table 2). Thoroughly mix the components until uniform in color and consistency. Be careful not to whip excessive air into the adhesive as it will weaken the cured film.

Heat buildup due to an exothermic reaction between the two components will shorten the potlife of the adhesive. Mixing smaller quantities will minimize that buildup. Do not attempt to use any adhesive that has exhausted its potlife and has begun to cure.

Automated

Lord 304 adhesive can be dispensed using conventional meter/mix/dispense equipment if the particular adhesive usage justified the investment. Gear pumps are not recommended due to the high viscosity of this product.

Application

The mixed adhesive may be applied by spreading it on one or both of the surfaces to be bonded using any convenient tool such as a spatula, or notched trowel. As a general rule, a film thickness of approximately 20 one-thousandths of an inch (~0.020" or ~0.5 mm) is suggested. The addition of a small amount of solid glass beads to the mixed adhesive is a convenient way to control the thickness of the bondline.

Parts Assembly

Join the parts in such a way as to avoid entrapped air. Apply only enough pressure to ensure good wetting of the adhesive on both surfaces. Squeezing a little adhesive out at the edges is usually a sign of proper assembly. It is not necessary to clamp the assembly unless movement during adhesive set-up is likely. Excessive clamping pressure will create a poor bond.

Curing

The graph below shows suggested times versus temperatures for accelerating the cure of Lord 304 adhesive. Elevated temperature cures produce the highest bond strengths and impact resistance. Firm recommendations of cure times and temperatures are difficult because heat transmission varies considerably depending upon material composition and heating methods.

The adhesive will cure fully in 24 - 48 hours with handling strength in 8-16 hours, provided that the adhesive, substrates, and ambient temperature are 18°C (65°F) or higher.

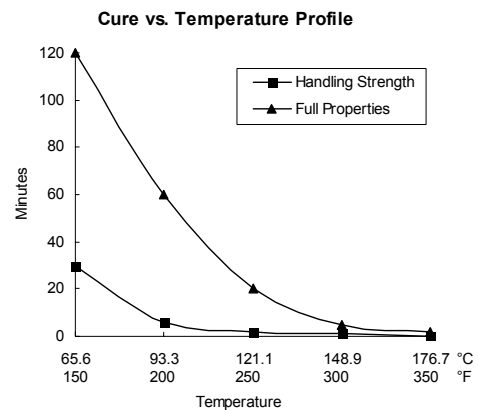


Table 2: Mix Ratios for Lord 304-1 Resin: Lord 304-2 Hardener

Service Temperature	High Temperature	General Purpose	Low Temperature
	10°C to 121°C (50°F to 250°F)	-34°C to 121°C (-30°F to 250°F)	-40°C to 38°C (-40°F to 100°F)
Mix Ratio			
by Weight	2:1	1:1	1:2
by Volume	1.5:1	1:1.3	1:2.6
Joint Design	Shear Stress	Mixed Stress	Peel Stress

Table 3: Typical Properties of Cured Lord 304 Adhesive Mixed 1:1 by Weight*

	Values	Units	Test Method
Hardness	79	Shore D	Lord TM 23B
Tensile Strength	4360	psi	ASTM D882-83A (mod)
Elongation at Break	10	%	ASTM D882-83A (mod)
Young's Modulus	146,000	psi	ASTM D882-83A (mod)
Water Absorption (24 hour immersion)	0.33	%	ASTM D570-81 (24 hour immersion)
Glass Transition Temperature (T _g)	56 (133)	°C (°F)	ASTM1640-99 (by DMA)
Coefficient of Thermal Expansion above T _g	268 x 10 ⁻⁶	mm/mm°C	Lord Internal Method (by DMA)

Table 4: Bond Performance Data

Substrates	Cold Rolled Steel to Cold Rolled Steel Lap Shear	Aluminum to Aluminum Lap Shear	SMC to SMC Lap Shear	Natural Rubber to Cold Rolled Steel 45% Peel	SBR to SBR T-Peel
Room Temperature	2790 psi A	2190 psi A	590 psi FT	50 lbs/in 65R/8C/A	113 lbs/in 34R/SB
Hot Strength at 85°C (180°F)	370 psi A	295 psi A	230 psi A	N/A	N/A
24 Hour Recovery After 7 Days in H ₂ O	3000 psi A	2900 psi A	770 psi FT	28 lbs/in A	113 lbs/in R
14 Days Salt Spray Exposure, Test Immediately	2620 psi A	1950 psi A	885 psi 92FT/A	18 lbs/in A	113 lbs/in 17R/SB
14 Days at 38°C (100°F), 100% Relative Humidity, Test Immediately	2070 psi A	1620 psi A	610 psi FT	30 lbs/in 17R/A	63 lbs/in 30R/SB/A
Test at -34°C (-30°F)	1550 psi A	920 psi A	580 psi FT	69 lbs/in 70R/10C/A	107 lbs/in 50R/C

	Substrate	Surface Treatment
Surface Preparations	Cold Rolled Steel and Aluminum Sheet Molded Compound (SMC) Styrene Butadiene Rubber (SBR) Natural Rubber	MEK Wipe, Grit Blast, MEK Wipe 320 Grit Sandpaper, Dry Rag Wipe Primed with Lord 7701 Primer Primed with Lord 7701 Primer

Bond Parameters	Bond Area	Film Thickness	Cure	Mix Ratio	
Metal Lap Shears	1.0"x0.5"	0.010"	72 hr. @ RT	1:1 by wt.	All values represent an average of 5 test samples.
SMC Lap Shears	1.0"x1.0"	0.030"	72 hr. @ RT	1:1 by wt.	
T-Peels	1.0"x3.0"	0.020"	72 hr. @ RT	1:1 by wt.	
45° Peels	1.0"x1.0"	0.020"	72 hr. @ RT	1:1 by wt.	

Failure Mode Key

Abbreviation	R	FT	A	C	SB
Definition	Rubber Failure	Fiber Tear	Adhesive Failure	Cohesive Failure	Stock Break

*All data is typical and not to be used for specification purposes. Physical properties may vary depending on mix ratio, degree of crosslink, and cure method as well as other parameters.

Table 5: Coverage Information

Square Coverage by Wet Film thickness					Linear Coverage by Bead Diameter									
Wet Film Thickness		Per Gallon		- Gals. Required Per 1000 Sq. Ft. (93 Sq. M)	Bead Diameter		Per		Per Lord-Pak 50		Per Lord-Pak 200		Per Lord-Pak CX	
mils	mm	Sq.Ft.	Sq. M		In.	mm	Ft.	M	Ft.	M	Ft.	M	Ft.	M
5	0.13	320	29.7	3.1	1/16	1.59	6100	1800	82	25	330	100	630	192
10	0.25	160	14.9	6.5	1/8	3.18	1500	457	20	6.0	82	25	160	48.7
20	0.51	80	7.4	12.5	3/16	4.76	690	210	8.5	2.5	35.5	10.8	68	20.7
30	0.76	52	4.8	20	1/4	6.35	375	114	4.5	1.3	19	5.8	38.5	11.7
31.25*	0.79	50	4.6	20	3/8	9.52	165	50	2	0.6	8.5	2.6	16	4.8
40	1.02	40	3.7	25	1/2	12.7	95	29	-	-	4.5	1.3	8.5	2.6
60	1.52	26	2.4	40	3/4	19.0	35	11	-	-	2	0.6	3.5	1.0
62.5*	1.59	25	2.3	40	7/8	22.2	30	9	-	-	-	-	2.5	0.7
125***	3.18	12	1.1	80	1	25.4	22	7	-	-	-	-	1	0.3

*1/32 in. **1/16 in. ***1/8 in. 1 mil = 0.001 inch All values are approximate; not for specification purposes.

Clean Up

Uncured Adhesive

Clean up excess adhesive on the bonded assembly, as well as mixing and application equipment, before the adhesive sets up. Use hot water and detergent, or an organic solvent; ketones have been shown to work best.

Cured Adhesive

Removing cured Lord 304 adhesive is difficult because of its resistance to chemicals, solvents, and cleaning agents. Heating to 204°C (400°F) or above will soften the adhesive, allowing the parts to be separated and the adhesive to be more easily removed. Some success may be achieved with commercial epoxy strippers.

Values stated in this bulletin represent typical values as not all tests are run on each lot of material produced. For formalized product specifications for specific product end uses, contact the Customer Service Department.

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Subsequent Processing

After the adhesive has been cured, it may be filed, sanded, machined or otherwise handled in the same way as a light metal. Paints, lacquers, enamels, and other coatings may be applied without danger of solvent attack.

Packaging

- 1/2 Pint Container (0.24 Liter)
- 1 Quart Container (0.95 Liter)
- 1 Gallon Container (3.8 Liter)
- 5 Gallon Pail (19 Liter)
- 55 Gallon Drum (208 Liter)

Storage

Ship and store Lord 304 adhesive in original container between 4°C - 27°C (40°F - 80°F).

Cautionary Information

Before using this or any Lord product, refer to the Material Safety Data Sheet (MSDS) and label for safe use and handling instructions.

For industrial/commercial use only. Must be applied by trained personnel only. Not to be used in household applications. Not for consumer use.

For additional information, contact Lord Corporation at: 814/868-3611 ext. 3277, FAX: 814/864-3452 or write: Lord Corporation, 2000 West Grandview Blvd., P.O. Box 10038, Erie, PA 16514-0038.

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