LORD

320

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

product information

Typical Applications

Lord® 320/322 is a general-purpose, high-viscosity, two-part, toughened, epoxy adhesive that was originally formulated for primerless adhesion† to automotive sheet molded compound (SMC.) The adhesive has proven its strength, durability, and environmental resistance on thousands of vehicles. Lord 320/322 has also demonstrated excellent adhesion to prepared metals, rubber, fiber reinforced plastics, polyester thermosets and thermoplastics and many other materials.

Features and Benefits

Contains No Solvents — Lord 320/322 adhesive is 100% solids, nonflammable and virtually odorless. The uncured adhesive may be cleaned up with hot water or solvents.

High Strength — Lord 320/322 is a true adhesive. In many cases it has load bearing properties equal to or greater than the materials being bonded.

Variable Cure — The adhesive will cure completely at room temperature or much more quickly at elevated temperatures.

Proven Environmental Resistance —Lord 320/322 adhesive resists moisture, sunlight, salt spray, and thermal cycling.

Toughened — Toughening provides impact resistance and extreme durability through superior inhibition of crack propagation.

Temperature and Chemical Resistance — Resistant to postbakes up to 400°F(204°C). Anti-corrosion processes including phosphatizing and ELPO or E-coat coatings do not affect the adhesive or its adhesion. Continuous immersion in solvents is not recommended.

Table 1: Typical Properties of Uncured Lord 320/322 Adhesive*

	Lord 320	Lord 322	Mixed
Appearance	Off-White Paste	Gray Paste	Gray Paste
Viscosity in cps @ 77°F (25°C):	0.3-1x10^6	0.4-2x10^6	N/A
Brookfield HBF with Helipath at 5 rpm	T-Bar Spindle D	T-Bar Spindle E	
Density			
Pounds/Gallon	12.3 ± 3%	10.3 ± 3%	N/A
Grams/Cubic Centimeter	1.48 ± 3%	1.24 ± 3%	N/A
Flash Point (closed cup)	>200°F (>93°C)	>200°F (>93°C)	>200°F (>93°C)
Total Solids Content by Weight	100%	100%	100%
Working Time {54g mass @ 75°F (24°C)}	N/A	N/A	10 - 20 Minutes
General Purpose Mix Ratio by Volume	1	1	N/A
Shelf Life from Date of Shipment at 77°F (25°C), unopened container	1 Year	1 Year	N/A

*Not to be used for specification purposes
†Mix ratio for primerless adhesion to SMC is 1:1.25 by weight.

Substrate Preparation

The surfaces to be bonded must be free of soil, grease, oil, fingerprints, dust, mold release agents, rust, and other contaminants before application of Lord® 320/322 adhesive.

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.

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.

Metals treated with Lord® 7711 primer exhibit superior environmental resistance as do glass and ceramic surfaces that have been primed with Lord 7715 primer. Cured rubber should first be primed with Lord® 7701 surface treatment.

Prepared surfaces should be handled carefully to avoid contamination and should be assembled as soon as possible.

Using Lord® 320/322 Adhesive

Proper Mixing

Nonautomated
Measure the resin and hardener components to meet the 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.

Heat buildup due to an exothermic reaction between the two components will shorten the potlife of the adhesive. Mixing smaller quantities or spreading the mixing operation over a large surface area will minimize heat buildup. Do not attempt to use any adhesive that has begun to set.

Automated
Lord 320/322 adhesive is packaged in Lord-Pak™ cartridge systems for convenient, automated mixing and application. Lord-Pak systems eliminate the waste involved in hand mixing and application without the capital investment of meter/mix/dispense equipment. If the particular adhesive usage justifies the investment of M/M/D equipment, utilization of positive displacement equipment is strongly advised.

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 stiff brush, spatula, or trowel. A paper cone may be used as a disposable method for applying the adhesive in a bead. 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.

Part Assembly

Try to 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. Maximum adhesion will occur only with parts which mate well without the need for excessive clamping pressure during cure. Excessive clamping may also squeeze too much adhesive from the bond area which could also result in a poor bond.

Curing Lord 320/322 Adhesive

Higher temperatures will provide faster cure rates; however the bondline temperature should not exceed 300°F(149°C.) 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 approximately 24 hours with handling strength in approximately 2 hours, provided that the adhesive, substrates, and ambient temperature are 65°F(18°C) or higher.

Table 2: Mix Ratios for Lord 320 Resin: Lord 322 Hardener

Service Temperature	High Temperature 50°F-200°F (10°C-93°C)	General Purpose	Low Temperature -40°F-100°F (-40°C-38°C)
Mix Ratio by Volume	1.5:1	1:1	1:1.5
Joint Design	Shear Stress	Mixed Shear	Peel Stress

Table 3: Typical Properties of Cured Lord 320/322 Adhesive Mixed 1:1 by Volume, RT Cure*

	Values	Units	Test Method
Tensile Strength at Break	4440	psi	ASTM D882-83A (mod)
Elongation at Break	3	%	ASTM D882-83A (mod)
Young's Modulus	230,000	psi	ASTM D882-83A (mod)
Water Absorption	0.22	%	ASTM D570-81
Shrinkage	0.35	%	(72 Hours RT Cure)
Glass Transition Temperature (Tg)	176(80)	°F (°C)	ASTM D882-83A (mod)
Coefficient of Thermal Expansion below Tg	2.91×10^{-4}	mm/mm°C	ASTM D882-83A (mod)
Coefficient of Thermal Expansion above Tg	3.29×10^{-4}	mm/mm°C	ASTM D882-83A (mod)

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	2225 psi A	1690 psi C	620 psi FT	63 lbs/in R	91 lbs/in 50R/C
Hot Strength at 180°F (85°C)	1590 psi C	1495 psi C	640 psi 15 SB/FT	30 lbs/in 20 R/A	11 lbs/in C
24 Hour Recovery After 7 Days in H_2O at 130°F (54°C)	2300 psi C	1540 psi A	600 psi FT	52 lbs/in R	100 lbs/in 20SB/50R/C
14 Days Salt Spray Exposure, Test Immediately	2260 psi C	12450 psi A	710 psi FT	50 lbs/in 80R/C/A	107 lbs/in 70SB/R
14 Days at 100°F (38°C), 100% Relative Humidity, Test Immediately	2270 psi C	1920 psi 50C/A	635 psi 98FT/A	58 lbs/in R	98 lbs/in 33SB/R
Test at -30°F (-34°C)	2025 psi A	1690 psi A	731 psi FT	64 lbs/in R	89 lbs/in 25R/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 Chemlok® 7701 Primed with Chemlok® 7701

Bond Parameters	Bond Area	Film Thickness	Cure	Mix Ratio	
Metal Lap Shears	1.0" x 0.5"	0.010"	72 hr.@ RT	1:1 by Volume	*All values represent an average of 5 test samples.*
SMC Lap Shears	1.0" x 1.0"	0.030"	72 hr.@ RT	1:1 by Volume	
T-Peels	1.0" x 3.0"	0.020"	72 hr.@ RT	1:1 by Volume	
45° Peels	1.0" x 1.0"	0.020"	72 hr.@ RT	1:1 by Volume	

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.	Bead Diameter		Per Gallon		Per Lord-Pak™ 50		Per Lord-Pak 200		Per Lord-Pak CX	
mils	mm	Sq.Ft.	Sq. M	(93 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 — It is important to 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® 320/322 adhesive is difficult because of its resistance to chemicals, solvents, and cleaning agents. Heating to 400°F(204°C) 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.

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 Availability

Lord 320/322 adhesive is only packaged in 1/2-pint, one-quart, one-gallon, and five-gallon containers, 55-gallon drums, Lord-Pak™ 50 ml, 200ml and CX 380 ml cartridges. It may be special ordered in minimum quantities in Lord-Pak Systems which contain 380 ml of mixed adhesive.

Storage Information

Ship and store Lord 320/322 adhesive in original container between 40°F(4°C) and 80°F(27°C).

Cautionary Information

Do not get in the eyes, on skin or clothing. May cause eye and skin irritation; may cause allergic skin reaction. In case of skin or eye contact, flood immediately with plenty of water. For eyes, call physician. Remove contaminated clothing. Wash clothing before reuse. **Keep out of reach of children.** If swallowed, do not induce vomiting. Drink several glasses of water. Call physician or poison control center. Before using Lord adhesives, refer to the specific Material Safety Data Sheet (MSDS) for additional cautionary and safe handling information. If the MSDS is not in your files, please request one from Lord Regulatory Compliance at (814)868-3611, extension 3407.

For additional information, contact Lord Corporation at: 814/868-3611, extension 3277, FAX: 814/864-3390, Telex: 291935 or write: **Lord Corporation, Chemical Products, 2000 West Grandview Blvd., P.O. Box 10038, Erie, PA 16514-0038.**

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