



320/322

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

Description

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

Features and Benefits

Contains No Solvents - provides a 100% solids adhesive, nonflammable and virtually odorless. The uncured adhesive can be cleaned up with hot water or solvents.

High Strength - provides load bearing properties equal to or greater than the materials being bonded.

Variable Cure - cures completely at room temperature or much more quickly at elevated temperatures.

Environmental Resistance - resists moisture, sunlight, salt spray, and thermal cycling.

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

Temperature and Chemical Resistance - resists postbakes up to 204°C (400°F). 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, cP	3 - 10 x 10 ⁵	4.5 - 20 x 10 ⁵	N/A
Brookfield HBF with Helipath at 5 rpm @ 25°C (77°F)	T-Bar Spindle D	T-Bar Spindle E	
Density			
kg/m ³	1.54 - 1.55	1.24 - 1.27	N/A
lb/gal	12.5 - 12.9	10.33 - 10.54	N/A
Flash Point (closed cup)	>93°C (>200°F)	>93°C (>200°F)	>93°C (>200°F)
Total Reactive Solids, by Weight	100%	100%	100%
Working Time, 54g mass @ 24°C (77°F)	N/A	N/A	20 - 40 Minutes
General Purpose Mix Ratio			
by volume	1	1	N/A
Shelf Life from date of shipment at 25°C (77°F), 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.

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

Non-automated

Measure the resin and hardener components to meet the service temperature needs and joint design (refer to 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 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 advised.

Application

Apply the mixed adhesive 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 can be used as a disposable method for applying the adhesive in a bead. As a general rule, a film thickness of approximately ~0.5 mm (~20 one-thousandths of an inch) 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.

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 squeeze too much adhesive from the bond area which could also result in a poor bond.

Curing

Higher temperatures will provide faster cure rates; however the bondline temperature should not exceed 149°C (300°F). Elevated temperature cures produce the highest bond strengths and impact resistance. Firm recommendations of cure times and temperatures depend upon material composition and heating methods.

The adhesive will cure fully in approximately 24 hours with handling strength in 2 - 4 hours, provided that the adhesive, substrates, and ambient temperatures are 18°C (65°F) or higher. Higher temperatures will provide faster cures. Full strength is obtained in 45 - 60 minutes @ 85°C (180°F).

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

Service Temperature	High Temperature 10°C-204°C (50°F-400°F)	General Purpose -40°C-204°C (-40°F-400°F)	Low Temperature -40°C-38°C (-40°F-100°F)
Mix Ratio			
by volume	1.5:1	1:1	1:1.5
by weight	1.8:1	1.2:1	1:1.2
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	30.6 (4440)	Mpa (psi)	ASTM D882-83A (mod)
Elongation at Break	3	%	ASTM D882-83A (mod)
Young's Modulus	1,586 (230,000)	Mpa (psi)	ASTM D882-83A (mod)
Water Absorption	0.22	%	ASTM D570-81 (24 hr. immersion)
Shrinkage	0.35	%	(72 Hours RT Cure)
Glass Transition Temperature (Tg)	80 (176)	°C (°F)	ASTM E1640-99 by DMA
Coefficient of Thermal Expansion below Tg	291 x 10 ⁻⁶	mm/mm°C	Lord DMA internal method
Coefficient of Thermal Expansion above Tg	329 x 10 ⁻⁶	mm/mm°C	Lord DMA internal method

Table 4: Bond Performance Data

Substrates	Cold Rolled Steel to Cold Rolled Steel Lap Shear Mpa (psi)	Aluminum to Aluminum Lap Shear Mpa (psi)	SMC to SMC Lap Shear Mpa (psi)	Natural Rubber to Cold Rolled Steel 45° Peel kg/25mm (lbs/in)	SBR to SBR T-Peel kg/25mm (lbs/in)
Room Temperature	15.3 (2225) A	11.7 (1690) C	4.3 (620) FT	28.1 (63) R	40.6 (91) 50R/C
Hot Strength at 85°C (180°F)	11.0 (1590) C	10.3 (1495) C	4.4 (640) 15 SB/FT	13.4 (30) 20 R/A	4.9 (11) C
24 Hour Recovery After 7 Days in H ₂ O at 54°C (130°F)	15.9 (2300) C	10.6 (1540) A	4.1 (600) FT	23.2 (52) R	44.7 (100) 20SB/50R/C
14 Days Salt Spray Exposure, Test Immediately	15.6 (2260) C	85.8 (12450) A	4.9 (710) FT	22.3 (50) 80R/C/A	47.8 (107) 70SB/R
14 Days at 38°C (100°F), 100% Relative Humidity, Test Immediately	15.7 (2270) C	13.2 (1920) 50C/A	4.4 (635) 98FT/A	25.9 (58) R	43.8 (98) 33SB/R
Test at -34°C (-30°F)	14.0 (2025) A	11.7 (1690) A	5.0 (731) FT	28.6 (64) R	39.7 (89) 25R/C

Substrate Preparation Methods

Substrate	Surface Treatment
Cold Rolled Steel and Aluminum Sheet Molding 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	
	cm	inches	cm	inches			
Metal Lap Shears	2.54x1.27	(1.0"x0.5")	0.025	(0.010")	72 hr. @ RT	1:1 by volume	<i>All Values</i>
SMC Lap Shears	2.54x2.54	(1.0"x1.0")	0.076	(0.030")	72 hr. @ RT	1:1 by volume	<i>represent an</i>
T-Peels	2.54x7.62	(1.0"x3.0")	0.051	(0.020")	72 hr. @ RT	1:1 by volume	<i>average of 5</i>
45° Peels	2.54x2.54	(1.0"x1.0")	0.051	(0.020")	72 hr. @ RT	1:1 by volume	<i>test samples</i>

*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.

Failure Mode Key: R= rubber failure FT= fiber tear, A= adhesive failure, C= cohesive failure, SB=stock break

Table 5: Coverage Information

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

*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

Before the adhesive sets up, remove excess adhesive on the bonded assembly, as well as mixing and application equipment. 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. Heat to 204°C (400°F) or above to soften the adhesive. This allows 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 can be filed, sanded, machined or handled in the same way as a light metal. Paints, lacquers, enamels, and other coatings can 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 Container (19 Liter)
- 55 Gallon Drum (208 Liter)
- Lord-Pak™ 50 ml, 200ml and CX 380 ml cartridges

Storage

Ship and store Lord 320/322 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 information, contact Bergdahl Associates, Inc.
2992 Sutro Street
Reno, Nevada 89512-1616
775-323-7542 fax 775-323-7595