



MASTERING THE BASICS:

Structural Adhesive Bonding 101

LORD

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I. Introduction

Structural Adhesives

A quality adhesive is the basis of a structural bond. But it's only the beginning. To get the best results, proper application is essential.

That's the goal of this user guide — to help you answer your application questions.

LORD Structural Adhesives

LORD Structural Adhesives offer advantages to designers and fabricators, and are strong enough to replace welding and mechanical fastening. The advantages of LORD Structural Adhesives include:

- ✓ Even distribution of stress
- ✓ Bonding and sealing in one step
- ✓ Reduction of noise and vibration
- ✓ Providing improved aesthetics
- ✓ Helping to prevent corrosion
- ✓ Offering excellent environmental resistance
- ✓ Joining dissimilar materials



I. Introduction

The first step, however, involves understanding the type of chemistry being used, which is important. In general, **acrylics** excel at bonding unprepared metals, composites and thermoplastics. **Urethanes** offer resiliency and flexibility, and are candidates for joining composites, thermoplastics, natural materials and prepared metals. **Epoxies** give the highest strengths when bonding prepared metals, composites, thermoplastics and natural substrates such as wood.

Structural adhesives are thermoset polymers. They will not melt or change with environmental exposure, temperature or time. Acrylics and epoxies can withstand temperatures from -40°F to 400°F. Most urethanes are good up to 250°F with a low-end slightly better than the others. Exposure to water, humidity, oil, gasoline, solvents, and other environmental factors won't weaken bond strength in properly designed joints.

The Three Adhesive Chemistries

- ✓ **Acrylic based adhesives** are primarily used to bond metals. Acrylics are very aggressive, have a rapid cure, require minimal surface preparation and can bond plastics, but should be tested for compatibility.
- ✓ **Urethane based adhesives** are a good choice for bonding plastics, composites, wood and foam. Urethanes are generally used for metal bonding applications where the metal is primed, painted or coated.
- ✓ **Epoxy based adhesives** can be used on metals, plastics, composites, concrete, wood and foam. Epoxies are generally very strong and chemically resistant. They have a slower cure but can often be accelerated with heat.

Adhesive bonding also provides cost savings due to reduced labor costs and assembly time. The bottom line is choosing the appropriate structural adhesive is vital to the success of your project.



Selecting an Adhesive

Adhesive Product Selection

When selecting an adhesive, there are several important considerations at every application phase, including substrate type, surface preparation, temperature, application/cure time and other factors. Use the chart on the next page to determine which LORD solution is best suited for your particular application.

Note: These are general recommendations. For comprehensive product selection assistance, please contact the resources below:

Web: <http://www.lord.com/products-and-solutions/adhesives>

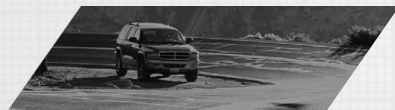
Print: LORD® Structural Adhesives Selector Guide

Email: customer.support@lord.com

Phone: 877-ASK-LORD (275-5673)

The following are some considerations that may influence your choice of adhesive. Please remember that these are guidelines. You should always test for acceptable performance with your application.

Always refer to the LORD Technical Data Sheets for specific product information on the Adhesive Properties, Surface Preparation, Mixing, Application, Curing, Test Data, Clean Up and Storage.



	BARE ALUMINIUM OR STEEL, INCLUDING STAINLESS	GALVANIZED STEEL	PREFINISHED METAL	FRP/GRP	SMC	RUBBER (1)	ENGINEERING THERMOPLASTICS (POLYCARBONATE, ACRYLIC, ABS, PVC) (5)	WOOD	URETHANE FOAM (2)	CERAMIC/STONE	THERMOPLASTIC, TPU, TPO, NYLON, POLYPROPYLENE (3)	GLASS (1)
BARE ALUMINIUM OR STEEL, INCLUDING STAINLESS	200s 400s	200s 400s 600s	200s 400s	200s 400s 600s 800s Maxlok	200s 400s 600s 800s Maxlok		200s (5) 400s (5)					200s (1) 400s (1)
	800s Maxlok	800s Maxlok	800s Maxlok	800s Maxlok	800s Maxlok		Maxlok (5)					Maxlok (1)
	300s (4,6)	300s (4,6)	300s (4,6)	300s (4,6)	300s (4,6)	300s (1,4)	300s (4)	300s (4)	300s (4)	300s (4)	300s (4)	
GALVANIZED STEEL	200s 400s 606 (2) 800s Maxlok	200s 400s 606 (2) 800s Maxlok	200s 400s 606 (2) 800s Maxlok	200s 400s 606 (2) 800s Maxlok	200s 400s 606 (2) 800s Maxlok		200s (5) 400s (5)					200s (1) 400s (1)
							Maxlok (5)					Maxlok (1)
				300s	300s	300s (1,4)		300s 7000s	7000s	300s	300s 7000s	
PREFINISHED METAL	200s 400s 600s 800s Maxlok	200s 400s 600s 800s Maxlok	200s 400s 600s 800s Maxlok	200s 400s 600s 800s Maxlok	200s 400s 600s 800s Maxlok		200s (5,6) 400s (5,6)					200s (1) 400s (1)
							Maxlok (5,6)					Maxlok (1)
				300s	300s	300s (1,6)	300s (6)	300s	300s	300s (1,6)	300s	
				7000s	7000s (6)	7000s (1,6)	7000s (6)	7000s	7000s	7000s (1,6)	7000s	7000s (1)
FRP/GRP	200s 400s 600s 800s Maxlok	200s 400s 600s 800s Maxlok	200s 400s 600s 800s Maxlok	200s 400s 600s 800s Maxlok	200s 400s 600s 800s Maxlok		200s 400s 600s	606				200s 400s
							Maxlok					Maxlok
				300s (6)	300s (6)	300s (1)	300s	300s	300s (6)	300s (1,6)	300s (1)	
				7000s (6)	7000s (6)	7000s (1)	7000s (6)	7000s	7000s (6)	7000s (1,6)	7000s (1)	7000s (1)
SMC	200s 400s 600s 800s Maxlok	200s 400s 600s 800s Maxlok	200s 400s 600s 800s Maxlok	200s 400s 600s 800s Maxlok	200s 400s 600s 800s Maxlok		200s 400s 600s			(1,6)		200s 400s
							Maxlok					Maxlok
				300s	300s (1)	300s	300s	300s	300s (6)	300s (1,6)	300s (1)	
				7000s	7000s (1)	7000s	7000s	7000s	7000s (6)	7000s (1,6)	7000s (1)	7000s (1)
RUBBER (1)						300s	300s	300s	300s	300s (1)	300s (1)	
						7000s	7000s	7000s	7000s	7000s (1)	7000s (1)	7000s (1)
ENGINEERING THERMOPLASTICS (POLYCARBONATE, ACRYLIC, ABS, PVC) (5)	200s (5) 400s (5)						200s (5) 400s (5)					400s (1)
							Maxlok (5)					Maxlok (1)
							300s	300s	300s	300s	7000s	7000s (1)
							7000s	7000s	7000s	7600s	7000s	7000s (1)
WOOD								300s	300s	300s		
								7000s	7000s	7000s	7000s	7000s (1)
URETHANE FOAM (2)									7000s	300s	300s	
										7000s	7000s	7000s (1)
CERAMIC/STONE										300s	300s	
										7000s (1)	7000s (1)	7000s (1)
THERMOPLASTIC, TPU, TPO, NYLON, POLYPROPYLENE (3)												NR
											300s	NR
											7000s (1)	NR
GLASS (1)												400s (1) Maxlok (1)
												7000s (1)

- (1) Requires a primer or adhesion promoter.
- (2) Variable results - Contact the LORD Customer Support Center for special instructions.
- (3) Flame, corona, plasma treatment or a primer is required - Contact the LORD Customer Support Center.
- (4) Epoxy used on bare metals requires a clean, solvent-wiped surface for best results.
- (5) Acrylic adhesive should not be used to attach large thermoplastic parts due to the differences in thermal expansion - Contact the LORD Customer Support Center.
- (6) May require scuffing or abrading surfaces.

NR - Not Recommended

Best to test for acceptable performance. These are only recommendations

Selecting an Adhesive

Size and Package Options

LORD Structural Adhesives are formulated to improve manufacturing processes and final products for a variety of composite, metal and plastic assemblies. For your convenience, LORD adhesives are available in convenience cartridge packaging to bulk packaging that includes gallons, pails, drums and totes for high volume applications.



For your convenience, LORD adhesives are available in convenience cartridge packaging to bulk packaging.



For higher volume production, LORD can provide Systems Engineering Expertise:

- Production process design and optimization
- Fixturing and joint design
- Meter mix dispense expertise

What follows are instructions and best practices for dispensing convenience cartridge packaging.

General Guidelines for Adhesive-Bonded Joint Design

Joint configuration should be designed so that the basic stress is primarily shear, tensile or compressive with cleavage and peel stresses minimized on the bond line. Joints should be designed so that all of the bonded area equally shares the load. Illustrations provided depict both recommended joint design alternatives and joint designs to be avoided.

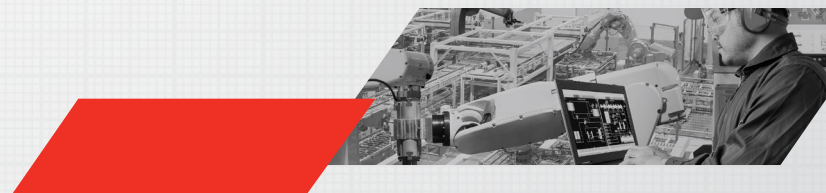
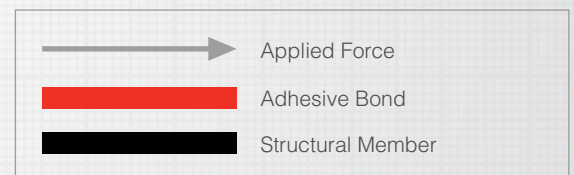
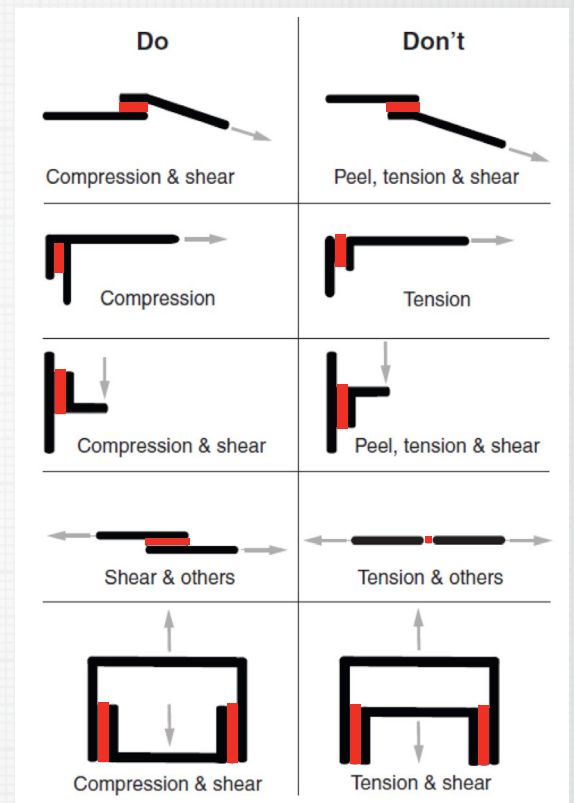
LAP JOINTS:

Lap joints are the most practical design and applicable in bonding thin materials. Lap joints are used to enhance joint strength by reducing its potential to peel stress.

BUTT JOINTS:

In tension, the straight butt joint is impractical for load bearing assemblies. To minimize this stress, the angle design applies compression. Compressive loading will not affect the joint unless buckling of the vertical component occurs.

To request the complete User Instruction, *General Guidelines for Adhesive-Bonded Joint Design*, contact customer.support@LORD.com or 877-ASK-LORD (275-5673).



IV.

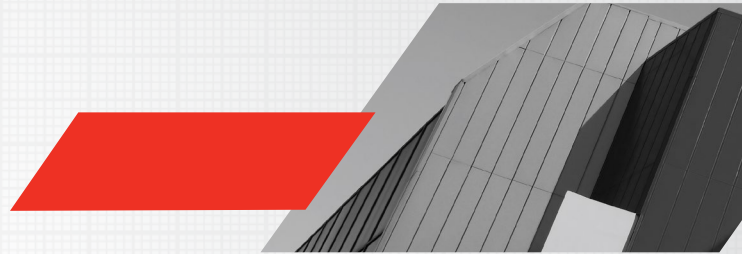
Surface Preparation

The amount of surface preparation required for good bonding will depend upon both the substrate and the adhesive that is used. In general, obvious dirt and loose particles should be removed from the bond surface with a clean, dry rag. Using compressed shop air to blow off parts is not recommended, since shop air usually contains water from condensation and oil from the compressor that can contaminate the bond surface. Avoid handling the bond area after the surface has been prepared. Dirty hands/gloves, soap, mold release, grease, etc. can contaminate the surface and potentially lead to poor adhesion.

Prior to adhesive application, remove soils, greases, oils, dust, mold release agents, rust and other contaminants from substrate surface with the use of a vapor-free solvent, such as MED, acetone or IPA.

- Plastics – Clean the surface with a dry rag or dampened solvent rag.
- Metals – Prime, paint or grit blast, followed by solvent wash for optimum bond performance.

The Technical Data Sheet (TDS) for each adhesive contains specific information related to Surface Preparation. To request the complete instructions, *Preparation of Metal Substrates for Bonding with LORD Adhesives*, contact customer.support@LORD.com or 877-ASK-LORD (275-5673).



✓ ACRYLIC ADHESIVES

LORD acrylic adhesives deliver excellent bond performance to most bare and painted metals with minimal surface preparation. Acrylic adhesives are well known for their ability to bond through cutting oils and light surface contamination, and a dry rag wipe is usually sufficient for bond surface preparation. For plastic and composite bonding, it is recommended that the surface be wiped with isopropyl alcohol using a clean rag. Acetone or methyl ethyl ketone (MEK) can be used as alternative solvents. Bonding to plastics and composites can often be enhanced through light sanding or scuffing of the surface prior to the solvent wipe.

✓ URETHANE ADHESIVES

LORD urethane adhesives bond well to painted/primed metals and many plastics/composites that have been cleaned with an isopropyl alcohol solvent wipe. For difficult to bond substrates, such as low surface energy plastics, light sanding, plasma treatment, or especially flame treatment can be very effective in enhancing the bond.

✓ EPOXY ADHESIVES

LORD epoxy adhesives can deliver good adhesion to both metals and plastics. In general, substrates should be sanded/scuffed in order to obtain good bonding performance with epoxies. The use of primers can also enhance the bonding performance of epoxies on bare metals and plastics.



V Application

Preparing Convenience Cartridges for Use:

Purge and Run Mix Tip length of adhesive

Below are best practices on preparing two-part adhesive and seam sealer cartridges for optimum bonding results. (Figures 1-6 below)

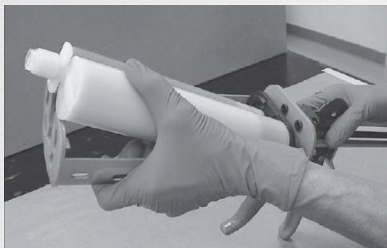


Figure 1
Insert the cartridge into the dispensing gun with the proper mix ratio set up.



Figure 2
Remove any cap and plugs.

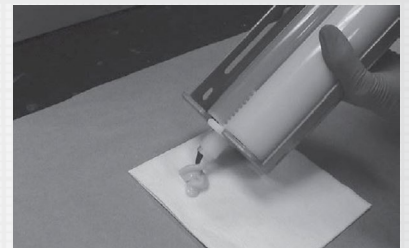


Figure 3
Level the plungers by applying pressure to the gun until both sides of the material flow through the openings in the cartridge.

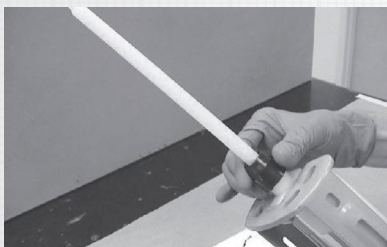


Figure 4
Attach the mix tip.

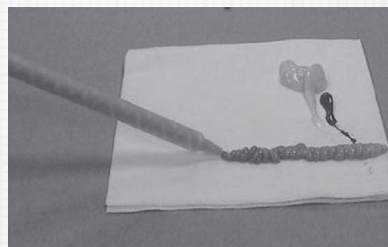


Figure 5

- Apply pressure to the gun, forcing the material through the mix tip.
- Run out a mixer's length of adhesive on scrap material to ensure a complete mix.



Figure 6
Position and dispense adhesive.



View **this playlist** to watch training videos on proper dispensing of LORD adhesives.

V Application

The static mix tip may generally be left attached to the cartridge if the entire cartridge is not used. The cured adhesive in the tip will act as a cap. However, it is possible in some cases that mixed, cured adhesive will block the nose of the cartridge, so best practice is to remove the static mix tip and replace the original plastic plug(s) — taking care to match the proper sides — for longer-term storage.



Dispensing

Structural adhesives work best at a very thin, controlled bond thickness (10 to 20 mils), and they sometimes contain glass bead “spacers” to set this bond gap. Prior to dispensing the bead, attempt to remove any scrap material from the substrate such as protruding burrs, welds, or other irregularities that would prevent the two bonding

surfaces from lying flat on top of one another. Apply adhesive in a continuous bead in the desired locations, taking care that the dispensed pattern will not cause air to be trapped in the bond line when the substrates are mated. A single adhesive bead dispensed in the center of the bond area is generally preferred.

V Application

Estimating Material and Coverage

The bead diameter should be predetermined based upon the desired final bond line width and thickness. The table below can be used as a guide for sizing the adhesive bead diameter.

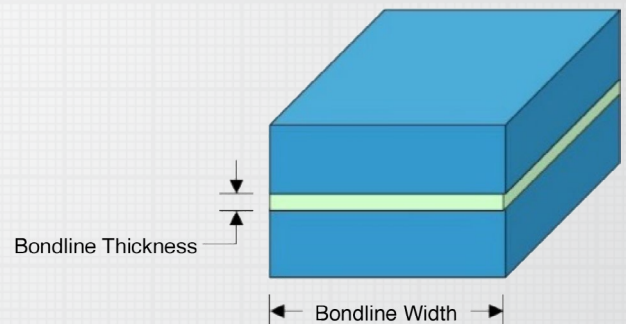
Note: These bead diameters will yield an excess of 10 percent in case of irregularities in the surface.



Bead Diameter Estimator – Inches (cm)

Required Bead Diameter: Use the table below to determine the required bead diameter from the dimensions of the adhesive joint.

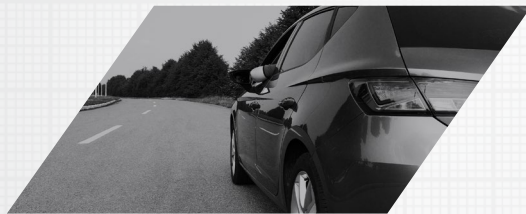
Bondline Thickness In. (mm)	Bondline Width – In. (cm)						
	0.25 (0.6)	0.50 (1.8)	1.0 (2.5)	2.0 (5.1)	4.0 (10.2)	8.0 (20.3)	
0.01 (0.25)	0.01 (0.25)	0.08 (0.20)	0.11 (0.29)	0.16 (0.41)	0.23 (0.57)	0.32 (0.81)	
0.02 (0.5)	0.02 (0.5)	0.11 (0.29)	0.16 (0.41)	0.23 (0.57)	0.32 (0.81)	0.45 (1.15)	
0.04 (1.0)	0.04 (1.0)	0.16 (0.41)	0.23 (0.57)	0.32 (0.81)	0.45 (1.15)	0.64 (1.62)	
0.08 (2.0)	0.08 (2.0)	0.23 (0.57)	0.32 (0.81)	0.45 (1.15)	0.64 (1.62)	0.90 (2.29)	



V Application

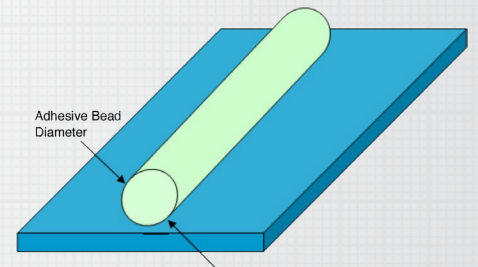
Engagement area is critical to adhesive performance, so it is important to apply enough adhesive to fill the designed joint. Insufficient adhesive quantity, or introduction of air into the adhesive, will cause a reduction in bond strength and a characteristic pattern known as “spider webbing” (the pattern is visible when parts are disassembled). This problem can also be caused by insufficient or ineffective clamping, as detailed in the section below.

Refer to the chart on the next page for estimated linear foot coverage based on cartridge size and bead diameter.



Tips

- ✓ Apply the adhesive to the part to ensure complete adhesive coverage to the bond area. The rule of thumb is to dispense a bead with a diameter about 1/6 to 1/4 the width of the bond joint. For example, if the bond joint is an inch wide, the bead diameter should be approximately 0.17 inches.
- ✓ Allow for variation in bondline thickness around the periphery of the part. Increase the bead size dispensed in areas of “poor fit” to ensure adequate coverage. For example, if the bondline thickness is 0.030 inches rather than 0.010 inches, the bead diameter should be approximately 1/4 of the bond width. In this case, a 0.25-inch bead diameter should be used when the bondline thickness is expected to be 0.030 inches on a 1-inch-wide bond area.
- ✓ Bead diameter is a measurement such as the figure below.



V Application

Bead Length Estimator – Feet (m)

Linear Coverage: Use the table below to determine the length of adhesive bead that can be obtained from a cartridge of adhesives.

Cartridge Volume (mL)	Bead Diameter – In. (cm)					
	0.125 (0.30)	0.188 (0.48)	0.250 (0.60)	0.313 (0.80)	0.375 (0.95)	0.500 (1.30)
40	17 (5.00)	7.4 (2.20)	4.1 (1.30)	2.7 (0.80)	1.8 (0.60)	1.0 (0.30)
50	21 (6.30)	9.2 (2.80)	5.2 (1.60)	3.3 (1.00)	2.3 (0.70)	1.3 (0.40)
200	83 (25.20)	37 (11.20)	21 (6.30)	13 (4.00)	9 (2.80)	5.2 (1.60)
375	155 (47.20)	69 (21.00)	39 (11.80)	25 (7.60)	17 (5.20)	10 (3.10)
400	166 (50.40)	74 (22.40)	41 (12.60)	27 (8.10)	18 (5.60)	10 (3.10)
485	201 (61.10)	89 (27.20)	50 (15.30)	32 (9.80)	22 (6.80)	13 (3.80)
600	249 (75.60)	111 (33.60)	62 (18.70)	40 (12.10)	28 (8.40)	16 (4.70)



V Application

Open Time/Working Time

Open Time is the amount of time from when the adhesive starts to travel down the static mix tip until the parts must be mated in order to deliver the specified bonding performance. Working Time is often used synonymously with Open Time, but working time can also refer to the time after the substrates are mated and can still be (slightly) re-positioned relative to each other.



OPEN TIME:

The elapsed time between the adhesive initially traveling down the static mix tip until the parts are bonded together.



It is important to work quickly to mate parts before the adhesive Open Time expires. Knowledge of the estimated Open Time or Working Time is particularly important when bonding large parts that have long adhesive bead lengths, and during periods of higher than normal temperatures within the production facility. Higher temperatures will generally reduce Open Times due to acceleration of the cure. In general, Open Time can be estimated by the hardness of the dispensed adhesive bead. If the adhesive bead cannot be readily

compressed and spread, it has most likely passed beyond its Open Time. However, epoxy adhesives can have an additional condition referred to as “blushing,” which can limit their Open Time without any indication of bead hardening. When the working time is exceeded, the adhesive will no longer wet out on one of the surfaces to be bonded. This will generally cause a reduced bond strength and be visible as a shiny, very smooth surface on the adhesive after disassembling the bonded parts, in contrast to the rough surface generated with good, cohesive failure. The Technical Data Sheet (TDS) for each adhesive should contain specific information related to Open Time/Work Time.

V Application

DID YOU KNOW?

Open Time can be estimated by the hardness of the dispensed adhesive bead.

If the Open Time is exceeded, **do not** proceed with the installation. The adhesive must be removed and reapplied.

Positioning Parts

Place parts in position as gently as possible, watching that the mating process works to eliminate trapping air in the bond line. Avoid applying pressure initially, allowing the clamping system to do this work. After a part has been mated and needs to be moved or repositioned, it is **CRITICAL** that the substrates are not pulled apart during the manipulation. This introduces air gaps into the adhesive that significantly weaken the bond, and

may even prevent the adhesive from curing completely. If a part needs minor repositioning, **ALWAYS SLIDE** the part to the new position. If a part needs major repositioning, it may be better to separate the substrates, remove the adhesive, and begin the bonding process anew. Sliding the part over a long distance may scrape all of the adhesive out from the intended bond area and result in poor bonding.



V Application

Clamping Parts

Parts should be positioned and clamped within the working time of the adhesive. Apply uniform pressure to the joint as soon as possible after mating the parts, spreading the adhesive bead and compressing it to the desired thickness. While clamping, special care should be taken to avoid “levering” the parts, causing the bond to separate on the opposite end. Uniform pressure (pressure spread out over the length of the bond line) is very important, especially when working with thin gauge or non-uniform parts. Effective methods for applying uniform pressure can include:

- Pre-built fixtures, which provide the most reproducible results.
- Multiple clamps or weights on spreader bars, which can be used on large parts when fixturing is not available. A spreader bar is a stiff material, often steel or aluminum channel or angle, which is clamped at several locations over the bond line.
- Standalone clamps or weights may be used on small parts, or when the mated parts are stiff enough to not need spreader bars.

Immediately after the parts are positioned correctly, they must be weighted with even pressure until handling strength is achieved. Some of the means typically used to accomplish this are clamps, boards/stiffeners, weights, mechanical fasteners or braces.

- Maintain even pressure across the assembly (Figure 1).
- Avoid applying pressure in areas that allow the assembly to “bow.”
- Boards can be used to apply even pressure across the bondline on flat assemblies (Figure 2).
- Weight bonded assemblies with sand bags, bean bags or other formable materials to distribute weight evenly.
- Mechanical fasteners (screws, rivets, bolts) can be used to fixture particularly difficult-to-clamp areas and can be removed after handling strength is achieved (Figure 3).
- Braces can be used to hold odd-shapes in place while curing (Figure 4).



Figure 1 – Clamps



Figure 2 – Boards & Stiffeners



Figure 3 – Mechanical Fasteners



Figure 4 – Braces

V Application

Clamping Time

Bonded parts should remain clamped until the Handling Time of the adhesive has passed. Handling Time is an estimate of the amount of time required from when the adhesive starts to travel down the static mixing tip until the adhesive has cured enough to ensure the bonded parts will not shift when handled (roughly 50-100 psi bond strength). Handling Time is usually dependent upon cure temperature, and can

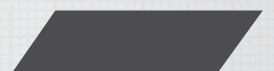
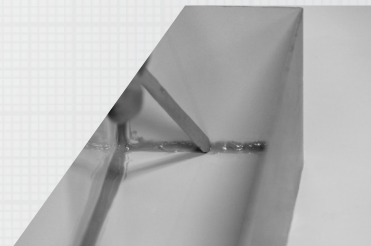
also vary based upon factors such as the amount of adhesive applied, the bond line thickness, the type of substrates being bonded, and environmental factors such as humidity. The Technical Data Sheet (TDS) for each adhesive contains specific information related to Handling Time.

HANDLING TIME:

The estimated time between the adhesive traveling down the static mixing tip to the moment when the bonded parts will not shift when handled.

De-roping of Adhesive

Excess adhesive that is squeezed out at the seams between mated parts may be removed (after it has gelled or partially cured at room temperature) by scraping it off with a putty knife. This de-roping process can also be used with a heat curing process, scraping off the excess adhesive while it is still hot enough to remain soft. Solvents such as isopropyl alcohol or acetone can be used to remove smears or adhesive residue left behind by the de-roping process.



V Application

Adhesive Removal

If substrates are accidentally pulled apart or need major repositioning after the adhesive is applied, the adhesive should be removed and the bonding process restarted. The process for doing this is outlined to the right.

1

Use a plastic putty knife to scrape off the adhesive. If this proves difficult because the adhesive has begun to cure, a heat gun can be used to soften the adhesive while scraping.

2

Wipe off the bond area using a clean cloth and isopropyl alcohol solvent. Acetone can be used as an alternative solvent, and can sometimes be more effective in removing adhesive residue.

3

Repeat the bonding process.

Bonded Part Removal

If for some reason, bonded parts must be separated after the adhesive has fully cured, a heat gun may be used to soften the adhesive. It may be helpful to remember that adhesives are generally stronger in tension or shear, and parts can be separated more easily if pulled apart with a peel load.

Ideal Failure

When bonded parts are separated, the residue pattern from failure of the cured adhesive, in addition to the bond strength, can be used to diagnose the quality of the bond. The preferred method of failure for adhesive joints is cohesive failure (COH), which can be identified by the residue of adhesive left on both substrates. Cohesive failure mode indicates excellent adhesion to the substrates, with the residue divided evenly (COH) or unevenly (Thin Layer

Cohesive, or TLC) between the failed surfaces. This can be contrasted with undesirable adhesive (ADH) failure, which is characterized by a clean, usually shiny surface exposed on one of the two separated substrates. The ability to gain both high strength and ideal failure mode will depend upon appropriately matching the correct adhesive with the substrate to be bonded, and following the user guidelines detailed above.

To request the complete instructions, *Trouble Shooting Guide*, contact customer.support@LORD.com or 877-ASK-LORD (275-5673).

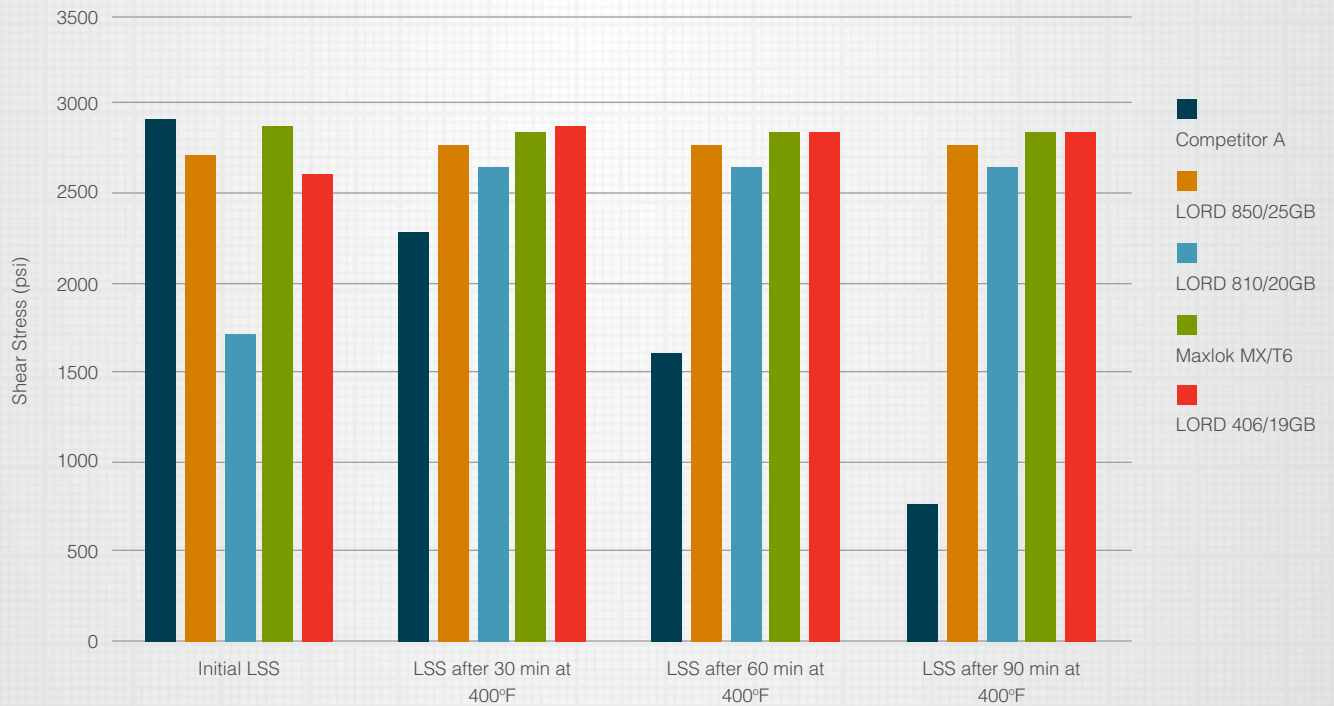
Specialized Applications

Powder Coating after Bonding with LORD Acrylic Adhesives

****Clamp or fixture the assembly prior to powder coating to avoid slippage during the powder coating process. The assembly should remain fixtured until the adhesive returns to room temperature and re-hardens.**

The LORD® 400, Maxlok, and 800 series acrylic adhesives have excellent heat resistance characteristics up to 400°F (204°C), thus reducing the concern of possible degradation of the cured adhesive during the high heat associated with the powder coating process.

6061T6 Aluminum



VI.

Specialized Applications

LORD acrylic adhesives will not degrade at the higher temperatures associated with powder coating. However, the hot tear strengths will be very low, causing the assembly to possibly sag and slide apart — especially if the assemblies are heavy. The lower strength values make it essential that the assembly is properly fixtured or placed to avoid slippage of the bonded pieces.

Spot welds or other type of mechanical fixturing are frequently used in the industry to aid in holding the assembly in place. The area to be bonded can also

be masked off the assembly prior to powder coating with bonding done after the process.

The integrity of the bond will remain unchanged after powder coating, and greater strength is often seen after exposure to heat once the assemblies have been returned to ambient temperature.

To request the complete instructions, *LORD Technical Tips, Powder Coating after Bonding with LORD® Acrylic Adhesives*, contact customer.support@LORD.com or 877-ASK-LORD (275-5673).

How to Avoid Bondline Read-Through (ghosting)

Read through is a condition where you can see the footprint of the adhesive through the material. This is caused by shrinkage that results in a pull on the bonded materials. Read through can occur on surfaces that are high gloss, high polish or have a mirrored finish. Thin gauge metals less than 0.030 inches are more susceptible to read through.

LORD 810/20 Low Read-Through (LRT) acrylic adhesive is a flexible adhesive system specifically designed for bonding metals, such as aluminum, galvanized steel and CRS, and engineered plastics, such as PC-ABS and ASA. LORD 810/20 adhesive delivers fast cure speed and strong bonding with minimal bondline read-through (BLRT).

The following are some application tips to help you avoid read through:

- Maintain a thin and consistent bond line of 0.010 inches (10 mils)
- Remove squeeze out
- Weight the bondline appropriately to ensure full surface contact between the materials being bonded, thereby avoiding gaps in the bondline



VI. Specialized Applications

UL Approval of LORD Adhesives

Below is a list of our UL Recognized adhesives and their corresponding substrates. In addition to being covered under the UL files provided, these adhesives are also described in the UL SIGN COMPONENTS MANUAL (SAM).

LORD UL Recognized Adhesives and Corresponding Substrates

Adhesive	Substrates	UL File #
201/19	Aluminum	E225855, MH26317
403/19	Aluminum, Stainless Steel, Cold Rolled Steel	E225855, MH26317
406/19	Aluminum, Stainless Steel, Cold Rolled Steel	E225855, MH26317
406/19 Red	Aluminum, Stainless Steel, Cold Rolled Steel	E225855, MH26317
410/19	Aluminum, Stainless Steel, Cold Rolled Steel	E225855, MH26317
7542 A/B	Polyphenylene Oxide (PPO)	E225855, MH26317
7542 A/C	Polyphenylene Oxide (PPO)	E225855, MH26317
7542 A/D	Polyphenylene Oxide (PPO)	E225855, MH26317
7542 A/E	Polyphenylene Oxide (PPO)	E225855, MH26317
Maxlok™ MX/T6	Aluminum, Stainless Steel, Cold Rolled Steel	E225855, MH26317
Signlok™ 403	Aluminum, Stainless Steel, Cold Rolled Steel	E225855, MH26317
Signlok™ 406	Aluminum, Stainless Steel, Cold Rolled Steel	E225855, MH26317
Signlok™ 810	Aluminum, Stainless Steel, Cold Rolled Steel	E225855, MH26317

To request the bulletin, *LORD UL Approved Adhesives*, contact customer.support@LORD.com or 877-ASK-LORD (275-5673).

VI. Specialized Applications

Laminating is the process of bonding two or more layers of material together with an adhesive.

Laminating with LORD No-Mix Adhesives

Designers can use select LORD resins in combination with LORD Accelerator 4 to laminate acrylic, bare metals, painted metals, aluminum composites, polycarbonate, vinyl and high density urethane foams. No-Mix adhesive components are applied on the opposite mating surfaces of the substrates to be bonded. Curing does not start until the parts are mated.

EXAMPLE:

The recommended bond line thickness of the LORD 201 or 204 is 10 mils. Estimate 2 oz. of Accelerator 4 per 1/10 gallon cartridge of LORD 201 or 204. Coverage would be 16 square feet per 1/10 gallon cartridge or 160 Sq. ft. per gallon (ten 1/10 gallon cartridges). LORD 201 has a thinner consistency and is best for brushing applications. LORD 204 is non-sag and best to spread with a notched trowel.

Laminating with LORD 7650

Brush or roll LORD 7650 with a recommended dry film thickness of 2-4 mils (0.002–0.004 inches) or a wet film thickness of 3-6 mils (0.003–0.006 inches). LORD 7650 can also be applied by spray if done in a spray booth with proper ventilation.

To calculate coverage, one gallon of LORD 7650 will cover approximately:

- 535 Sq. feet at a wet film thickness of 3 mils
- 267 Sq. feet at a wet film thickness of 6 mils

Once the adhesive has been applied, wait approximately 20-30 minutes for a good tack to develop as the solvent evaporates. Mate the substrates, slide to reposition, and apply uniform pressure with a board and/or weights. The assembly should remain under pressure for 10–24 hours at 75°F (24°C) to reach handling strength. LORD 7650 will fully cure in one to five days depending on humidity. Once fully cured, the bonded area can be cut on a router to the desired shape. Finish with a primer or sanding.

To request the complete instructions, contact customer.support@LORD.com or 877-ASK-LORD (275-5673).

VII.

Additional Information

Safety Precautions

Because adhesives contain chemicals, you need to wear protective equipment and clothing. Safety glasses or goggles and gloves should be worn when applying adhesives. The area should be sufficiently ventilated to protect you from fumes and vapors. Always refer to the Safety Data Sheet (SDS) of the adhesive for safe use guidelines.

To request the complete instructions, *LORD Acrylic Adhesives Safe Handling Guide*, (DS4045) contact customer.support@LORD.com or 877-ASK-LORD (275-5673)

Resources

Guides, User Instructions, Videos and Publications are available at www.lord.com.

Where to Buy

Adhesives and accessories are available for your unique needs. Contact us at:

www.LORD.com

877-ASK-LORD (877-275-5673)

customer.support@LORD.com

Values stated in this application guide represent typical values. Information provided herein is based upon tests believed to be reliable. In as much as LORD Corporation has no control over the manner in which others may use this information, it does not guarantee the results to be obtained. In addition, LORD Corporation does not guarantee the performance of the product obtained from the use of this information, including but not limited to any product end-user. Nor does the company make any express or implied warranty of merchantability or fitness for a particular purpose concerning the effects or results of such use.



Additional Resources

[LinkedIn](#) | [Webpage](#) | [Twitter](#)

If you have any questions, please call us at +1 877 ASK LORD (275 5673) or contact us [here](#).