

LORD® Adhesives for the Sign Industry

Advantages of LORD® Engineered Adhesives

LORD Engineered Adhesives offer advantages to Sign Designers over welding and mechanical fastening. They bond dissimilar materials, provide improved appearance, insulate against galvanic corrosion and offer excellent environmental resistance. Adhesive bonding provides cost savings due to reduced labor costs and assembly time.

Although a premium adhesive is the basis of a quality bond, it's only the beginning. Proper application is essential for best results. This resource is intended to provide an application guide for many of your bonding questions.

Adhesive Product Selection

Refer to *LORD Structural Adhesives for the Sign Industry selector guide* for adhesive product selection.

Following are some considerations that may influence your choice of adhesive. Please remember that these are guidelines and that you should always test for acceptable performance with your application.

Adhesive Basics

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

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 other chemistries. Exposure to water, humidity, oil, gasoline, solvents, and other environmental factors won't weaken bond strength in properly designed joints.

Cross-Bonding Dissimilar Materials

When bonding larger assemblies involving dissimilar materials, such as aluminum or steel to polycarbonate or acrylic, attention should be placed on the expansion and contraction of the materials. Differences may exist in the expansion coefficients of metal and plastic. Substrates will expand and contract at different rates with temperature changes. There are two factors to consider:

- 1) The design must be flexible enough to accommodate the expansion, and
- 2) The adhesive must be strong enough to tolerate the stresses that the thermal expansion produces.

LORD urethane adhesives (LORD 7542, LORD 7610DTM) provide flexibility and prevent stress fractures and/or bond failure of the plastic materials. Prime the bare metals, scuff the plastic, and bond with a LORD urethane structural adhesive.

LORD acrylic adhesives (Signlok™ 403, Signlok 406, LORD 400 Series, Signlok 810, Signlok 204) provide exceptional structural strength and are particularly formulated for assemblies with a bare metal substrate. However, they may not provide as much flexibility as needed for outdoor or large cross-bonded assemblies.

Indoor/ Outdoor Installations

Outdoor metal installations will benefit from using LORD 400 or 200 Series because these adhesives provide excellent corrosion and environmental resistance.

Outdoor installations may require greater adhesive flexibility because size of the assembly is large, if the metal is painted, or if the assembly will need to tolerate flexing. If these factors are present, consider bonding an outdoor assembly with LORD 7542 or 7610DTM adhesive. Prime bare metal surfaces when using LORD 7542 adhesive.

Indoor applications generally do not need to accommodate temperature or environmental changes as much as outdoor applications and can be bonded with the adhesive recommended based on the materials.

Size

Large pieces or panels may need to accommodate movement in the assembly. LORD 7542 or 7610DTM adhesive may be more appropriate for bonding applications requiring greater flexibility. Prime bare metal surfaces when applying LORD two-part urethane adhesives, such as LORD 7542 adhesive, to metal.

Large Surface, Laminating, or Tight Tolerance

Large assemblies with a tight tolerance, like mounting a sign face, may benefit from LORD No-Mix Series that allow for an indefinite open time for bonding. No-Mix adhesives components, also known as “honeymoon” adhesives, are applied on the opposite mating surfaces of the substrates to be bonded. Curing does not start until the parts are brought together. Recommended bondline thickness is 10 mils and can be no more than 20 mils. No-Mix options include LORD 201 and 204 adhesive used with LORD Accelerator 4.

Studs

Depending on the materials and application, LORD has adhesive solutions for common stud bonding applications:

- Metal studs and metal brackets - LORD 400 and 200 Series adhesives
- Plastic stud to Painted Metal – LORD 7542 or 7610DTM adhesive
- Stud Mount to brick or stone wall – LORD 320/322 adhesive

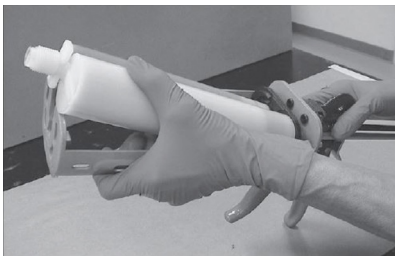
Preparing Adhesive Cartridges for Use

Purge and Run Mix Tip Length of Adhesive

Below are best practices on preparing two-part adhesive and adhesive/sealant cartridges for optimum bonding results (refer to Figures 1-6).

- Insert the cartridge into the dispensing gun with the proper mix ratio set up.
- Remove any cap and plugs.
- Level the plungers by applying pressure to the gun until both sides of the material flow through the openings in the cartridge.

Figure 1



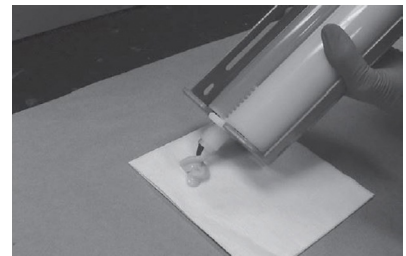
Load cartridge into dispensing gun

Figure 2



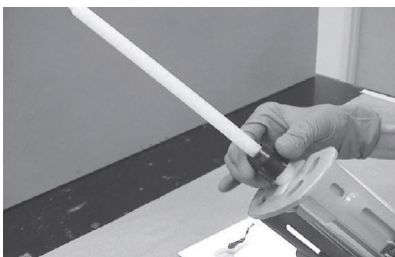
Remove and discard plastic plugs in outlet ports

Figure 3



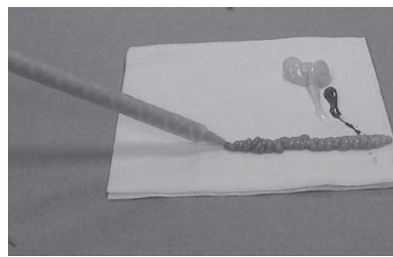
Level the plungers in cartridge

Figure 4



Attach static mix tip to cartridge

Figure 5



Dispense mixer length of adhesive on scrap material to ensure proper mix

Figure 6



Dispense adhesive through static mix tip on assembly

- Attach the mix tip.
 - 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.
- Position and dispense adhesive.

Follow the link to view training videos on proper dispensing of LORD adhesives:
<https://www.youtube.com/playlist?list=PL8B4631D7F4FBB9C9>

To request the complete instructions, *LORD User Instructions - LORD 400 Series Acrylics (Adhesive Operator Training)*, contact customer.support@LORD.com or 877-ASK-LORD (275-5673).

Estimating Adhesive Coverage

- 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 1/6th to 1/4th the width of the bond joint. For example, if the bond joint is 1" wide, the bead diameter should be approximately 0.17".

- Allow for variation in bondline thickness around the periphery of the part. Increase the bead size dispensed in areas of "poor fit" to assure adequate coverage. For example, if the bondline thickness is 0.030" rather than 0.010", the bead diameter should be approximately one quarter of the bond width. In this case a 0.25" bead diameter should be used when the bondline thickness is expected to be 0.030" on a 1" wide bond area.

- Bead diameter measurement is depicted in Figure 7. Refer to Table 1 for estimated linear foot coverage based on cartridge size and bead diameter.

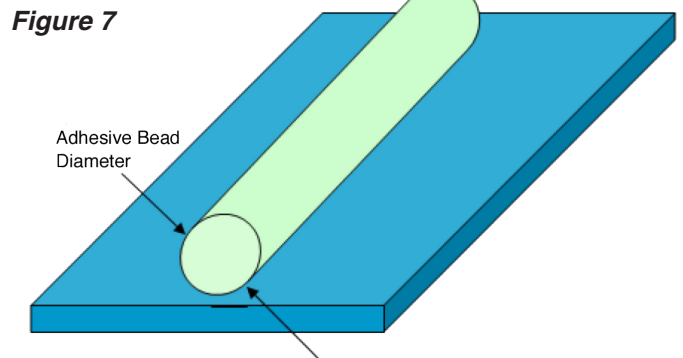


Table 1 – Bead Length Estimator - feet (m)

		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)
CARTRIDGE VOLUME (mL)	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)

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. The illustrations provided depict both recommended joint design alternatives and joint designs to be avoided (refer to Figure 8).

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 instructions, *LORD User Instructions - General Guidelines for Adhesive-Bonded Joint Design*, contact customer.support@LORD.com or 877-ASK-LORD (275-5673).

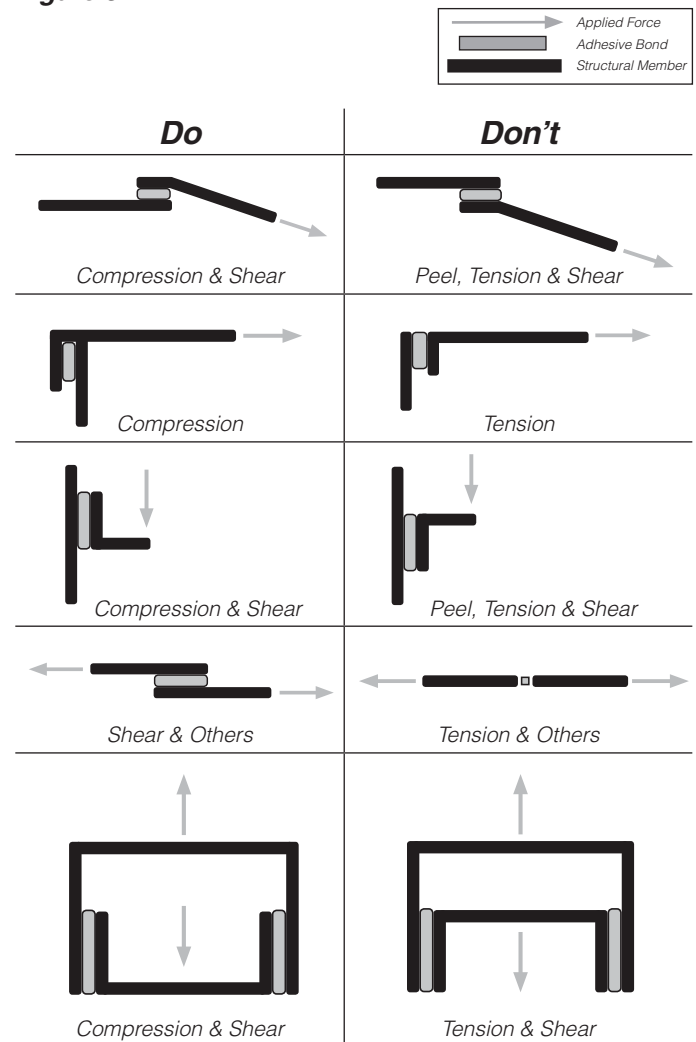
When are Adhesives not suitable?

Sometimes an adhesive is not appropriate. The rule of thumb is to use adhesives where the joint design is loaded in shear or compression, instead of peel or tension. Areas like butt joints or “T” joints do not always allow a sufficient overlap for the adhesive to bond properly. Sometimes it is more appropriate to assemble these designs by welding, fastening or with a combination of mechanical fasteners and structural adhesives.

Tips for Successful Bonding

Mate Parts – Mate the materials carefully to properly align the pieces. If the materials need to be re-positioned after mating, SLIDE the pieces into position. Do not lift up or separate the pieces as this can allow air into the bondline and cause voids, resulting in less than optimum coverage and strength.

Figure 8



Squeeze-out – A small amount of squeeze-out along the bondline may be desirable for use as a sealant and also as a visual assurance of adhesive presence. If the squeeze-out interferes with the aesthetic appearance of the final product, it should be removed before the adhesive completely cures. Refer to the product literature for product working time.

Non-structural Applications with LORD 7550, optically clear adhesive for Trim Cap & Plastics – For best results, follow these guidelines:

- Scuff polycarbonate and plastics to be bonded lightly – adhesive will fill in scuffed areas.
- Let LORD 7550 adhesive flow easily into spaces and fill up voids.
- Less adhesive is better than more – use only what covers the areas to be bonded.
- Let assembly sit in place for a minimum of 24 hours (72 hours is best) at room temperature – do not torque during cure process to allow adhesive time to create a “bite” to the surfaces.

Position Parts – 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 sign assembly (refer to Figure 9).
- 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 (refer to Figure 10).
- Weight bonded signs 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 (refer to Figure 11).
- Braces can be used to hold odd-shaped signs in place while curing (refer to Figure 12).

To request the complete instructions, *LORD Application Guide - Fixturing Guide for Metal Bonding Applications*, contact customer.support@LORD.com or 877-ASK-LORD (275-5673).

Figure 9 – Clamps



Figure 10 – Boards & Stiffeners

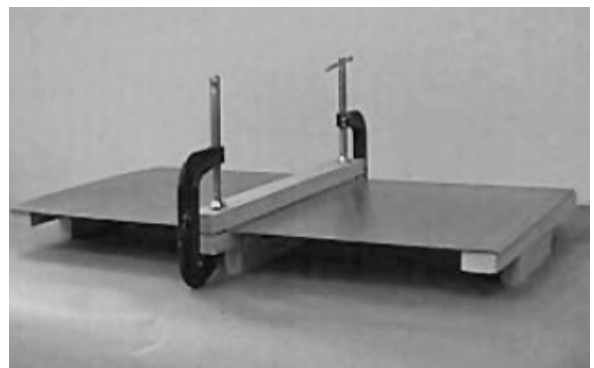
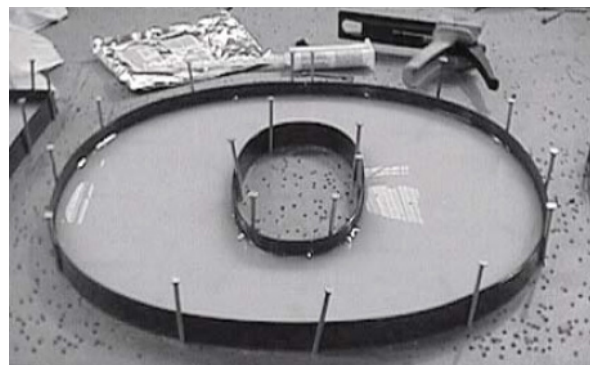


Figure 11 – Mechanical Fasteners



Figure 12 – Braces



Lamination

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

Laminating with LORD No-Mix Adhesives

Sign designers can use LORD 201 or 204 adhesive 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.

Recommended bondline thickness of the LORD 201 or 204 adhesive is 10 mils. Estimate 2 oz. of Accelerator 4 per 1/10 gallon cartridge of LORD 201 or 204 adhesive. Coverage would be 16 sq. ft. per 1/10 gallon cartridge or 160 sq. ft. per gallon (ten 1/10 gallon cartridges).

LORD 201 adhesive has a thinner consistency and best for brushing applications. LORD 204 adhesive is non-sag and best to spread with a notched trowel.

Laminating Sign Foam with LORD 7650 Adhesive

Sign Designers can use readily available grades and standard foam thicknesses to manufacture a variety of designs by layering the foam and laminating the layers. Laminating reduces the cost and the need to store and inventory of various grades and thicknesses of sign foam.

Brush or roll LORD 7650 adhesive with a recommended dry film thickness of 2-4 mils (.002-.004") or a wet film thickness of 3-6 mils (0.003-0.006"). LORD 7650 adhesive can also be applied by spray if done in a spray booth with proper ventilation.

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

- 535 sq. ft. at a wet film thickness of 3 mils
- 267 sq. ft. 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 to reach handling strength. LORD 7650 adhesive will fully cure in 1 to 5 days depending on humidity. Once fully cure, 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).

Powder Coating after Bonding with LORD Adhesives

Note: 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.

LORD acrylic adhesives have excellent heat resistance characteristics up to 400°F, reducing the concern of possible degradation of the cured adhesive due to heat during the powder coating process. Allow the adhesive to fully cure before powder coating. Tested products include the Signlok Series, LORD 400 Series and LORD 800 Series adhesives.

However, it is important to keep in mind that at these higher temperatures, the hot tear strength is very low. At about 180°F, the adhesive will begin to soften. These lower strength values make it essential that the assembly is properly fixtured or placed to avoid slippage of the bonded pieces, especially if they are heavy in nature. Mechanical or spot welds are frequently used in the industry to hold the assembly in place. Assemblies need to be fixtured to avoid any stresses during the time that the adhesives are soft and until adhesives return to room temperature and re-harden.

The integrity of the bond will remain unchanged, and in fact increase, once the assemblies have returned to room temperature.

To request the complete instructions, *LORD Technical Tips - Powder Coating after Bonding with LORD 400 Series Acrylic Adhesives*, contact customer.support@LORD.com or 877-ASK-LORD (275-5673).

How to Avoid 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" are more susceptible to read-through.

Sandwich panel material, such as DiBond® or Alucobond®, which are aluminum composite panels that are typically 0.3 to 0.5 mm thick aluminum sheets covering a solid polyethylene core with a total thickness of 3 mm or more, or similar panels from any manufacturer, may also be susceptible to read-through.

Following are some application tips to help you avoid read-through:

- Maintain a thin and consistent bondline of 0.010" (10 mils)
- Remove squeeze out
- Weight the bondline appropriately so that full surface contact results between the materials being bonded to avoid gaps in the bondline

Signlok 810 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. Signlok 810 adhesive delivers fast cure speed and strong bonding with minimal read-through.

UL Approval of Adhesives for Sign and Electrical Enclosure Bonding

Refer to Table 2 for a listing of LORD 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).

UL Online Certifications Directory: <http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.html>

To request the bulletin, *LORD Product Information - LORD UL-Approved Adhesives for Sign and Electrical Enclosure Bonding*, contact customer.support@LORD.com or 877-ASK-LORD (275-5673).

Table 2

Adhesive	Substrate	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
406/19GB 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
Signlok 204	Aluminum, Stainless Steel, Cold Rolled Steel	E225855, MH26317

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.

Resources

Guides, user instructions, videos, and publications for the Sign Industry are available at <http://lord.com/industries/building-and-construction#Sign>.

Where to Buy

Adhesives and accessories are available for your unique needs. Talk to your sign materials distributor or 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.

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LORD provides valuable expertise in adhesives and coatings, vibration and motion control, and magnetically responsive technologies. Our people work in collaboration with our customers to help them increase the value of their products. Innovative and responsive in an ever-changing marketplace, we are focused on providing solutions for our customers worldwide.

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