POST-VULCANIZATION BONDING GUIDE FOR CHEMLOK® AND LORD® ADHESIVES

Application Guide

Introduction

For many years, Post-Vulcanization (PV) bonding has been used to bond cured rubber to either itself or to a variety of substrates (ferrous, thermoplastic and thermoset substrates). This method provides greater product and mold design freedom while also delivering lower tooling, production and labor costs.

Many of the Chemlok® adhesives used for traditional in-mold bonding applications can also be used in PV Bonding applications. A variety of options are available to customers with one-coat, two-coat, solvent-based and water-based adhesives available in the product portfolio. Final adhesive selection will depend on the customer's elastomers and performance requirements and should be verified with performance testing.

LORD® thermoset urethane and epoxy adhesives can also be used for PV Bonding applications. These materials are usually selected when either gap filling properties or low temperature cure requirements are needed.

PV Bonding supplies users the ability to obtain adhesive performance without having to mold parts in the traditional in-mold bonding processes. This option is especially useful when components have complex geometries or when over-sized tooling is cost prohibitive. This is an excellent manufacturing tool to have with increased part performance requirements in more demanding applications.

Structural Strength and Reliability

PV bonding with Parker Lord adhesives offers exceptional reliability and performance. The products provide high-quality, rubber-tearing bonds over a wide range of elastomers. They can also provide excellent high-temperature and environmental resistance, comparable to vulcanization bonding.

Adhesive Selection

Parker Lord PV bonding adhesives are divided into two groups:

- Conventional Chemlok Primers and Adhesives
- LORD Epoxy and Urethane Structural Adhesives

Conventional Chemlok Adhesives

This product line is used where uniform contact is available between rubber and metal (5% to 20% rubber pre-compression) and elevated cure temperatures are possible.

Metal Preparation

Mechanical and/or chemical methods are typically used with vulcanization bonding, therefore similar processes can be used for PV bonding techniques. Mechanical preparation of ferrous substrates is accomplished by degreasing with an alkaline cleaner and blasting with 25-80 grit media. Chemlok primer is recommended to be applied within 1-2 hours, if possible, to bare metal substrates, or chemical conversion coatings such as iron phosphate or calcium-modified micro-crystalline zinc phosphate applied at up to 450 mg/sq ft to avoid metal oxidation. For more detailed information, consult the Chemlok Adhesives Application Guide.

Rubber Compounding/Preparation

PV bonding is applicable to cured NR, SBR, NBR, CR, BR, IIR and EPDM elastomers. Moderate-to-high sulfur cures are more easily bonded than low or non-sulfur compounds. Avoid wax type antiozonants or levels of other compounding ingredients that will bloom. Phthalate plasticizers can be used, but only at very low levels.

Avoid silicone containing mold releases. Semi-permanent type mold releases are recommended as they transfer minimally to the molded rubber surface.

If cleaning steps do not achieve satisfactory adhesion, abrading the rubber surface prior to adhesive application may improve performance. This step should be followed by a solvent wipe to remove residual rubber debris. In some instances, adding texture to the rubber mold cavity may improve bonding and be an alternative to abrasion. Slight under cure of the rubber, approximately 90% cure, can provide additional active sites to bond to and improve adhesion.

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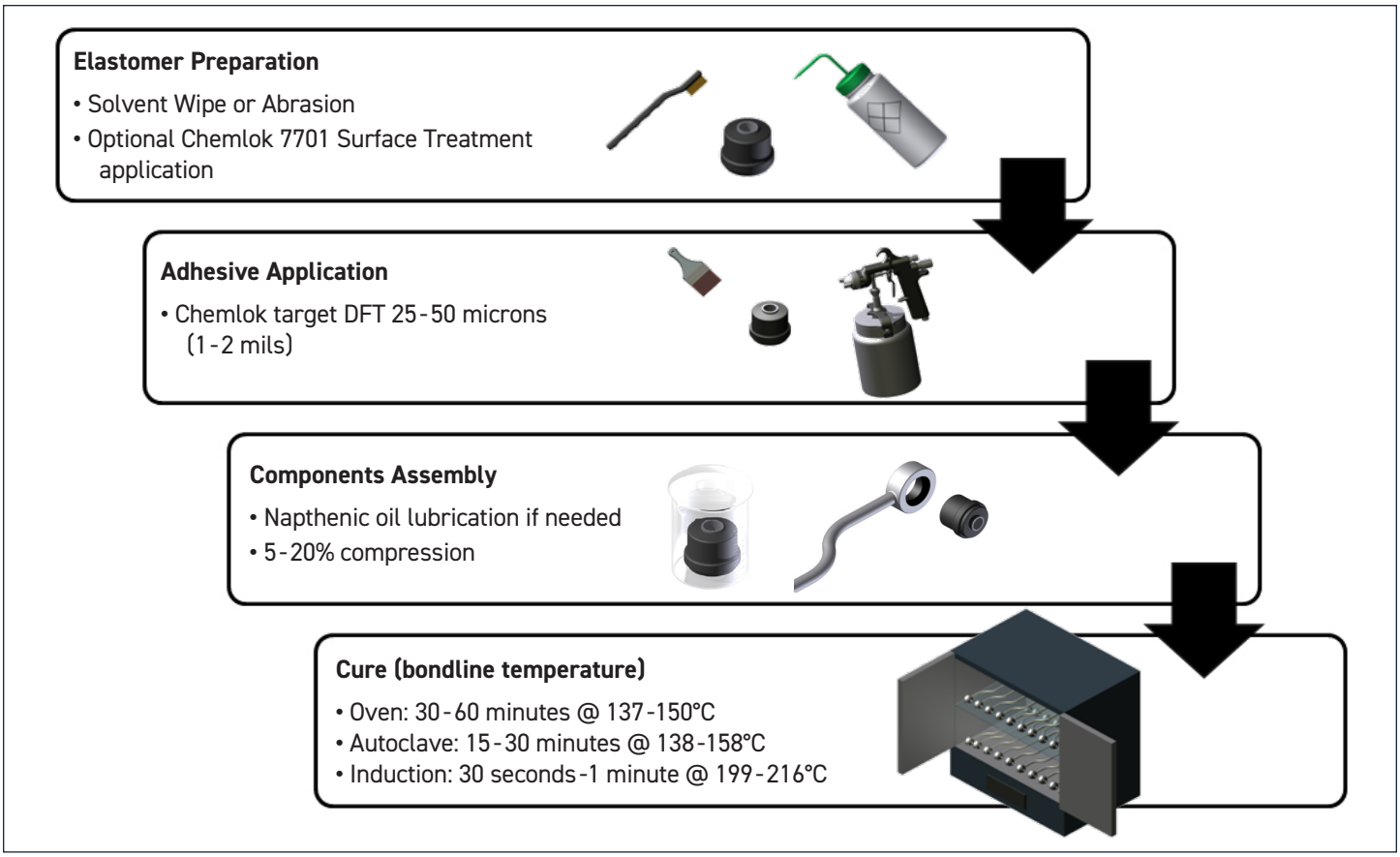


Figure 1. PV Bonding with Chemlok Adhesives

Cleaning of the rubber surface is always a best practice to remove surface contaminants. Cleaning will remove dirt, dust or bloom using one of the following steps:

- Wipe or briefly immerse in a suitable cleaning solvent.
- Tumble in an alkaline cleaning bath; followed with a warm water rinse; followed by an elevated temperature drying cycle. Avoid very high temperatures which can cause bloom to form again.
- For very difficult to bond elastomers, treatment by wiping or brushing with Chemlok 7701 surface treatment may improve performance.

Adhesive Selection

A variety of solvent-based Chemlok adhesives, such as Chemlok 234X (NW), 238 (NW), 6100, 6108, 6253, 6411 or equivalent GB product, as well as Chemlok 8560S-1 and 8560D-1 water-based adhesives work well for post-vulcanization bonding. Adhesive selection depends upon the type of elastomer and the design of the part. Be sure to use the appropriate primer on any metal surfaces bonded. For further product or technical assistance, consult the Parker Lord Application Engineering team.

Adhesive Mixing/Application

Chemlok solvent-based and water-based primers and adhesives must be well agitated prior to and during use to ensure homogeneous mixing of all ingredients. If the adhesives are to be diluted prior to application, use the proper diluent specified in the technical data sheet.

Use dip, spray, brush or roll coat application methods. A total film thickness of 25.4-50.8 microns (1.0-2.0 mils) is recommended for one-coat systems, and 5.1-10.2 microns (0.2-0.4 mils) of primer and 25.4-38.1 microns (1.0-1.5 mils) of covercoat for two-coat systems.

Dry the adhesive 10 minutes at 65°C (150°F) in a forced-air drying oven, or 2 hours at room temperature minimum before post-bonding the assembly.

Handle coated inserts with clean gloves to avoid fingerprints, dirt, grease, oil and other contaminants. Layover after coating should be minimized and components stored in clean, dry areas.

Assembly

Assembly lubricants may be necessary depending on the molded assembly configuration. Naphthenic assembly oils such as CoChem M, O and specifically Type R (Clark Oil and Chemical Co.) historically have performed well. Once the parts have been assembled, allow a minimum of 4 hours at ambient temperature for the oil to absorb into the rubber assembly prior to bonding. Maintain a minimum of 5% rubber compression during cure.

Adhesive Cure

Cure conditions can vary depending on the size and configuration of the part and the number of parts being cured. Forced air ovens, autoclaves and low-frequency induction heating have been used. Typical cure cycles are:

- Forced air oven: 30-60 minutes at 137-150°C (279-302°F)
- Autoclave cures: 15-30 minutes at 138-157°C (280-315°F)
- Induction cure: peak metal temperature at 199-216°C (390-420°F) for 0.5-1 minute

Post-Curing Processes

Post-curing processes such as machining, plating, chemical conversion coating, painting, etc. can be performed.

LORD Epoxy and Urethane Structural Adhesives

LORD epoxy and urethane structural bonding adhesives offer several advantages such as filling gaps between the rubber and metal and curing at room temperature. They are also environmentally compliant in the fact that some contain no VOCs.

Metal Preparation

The requirements are the same as for Conventional Chemlok Adhesives PV bonding; please refer to the previous section for guidance.

Rubber Compounding/Preparation

PV bonding using epoxy and urethane adhesives is applicable to NR, SBR, NBR, CR, BR, IIR and EPDM elastomers. Moderate-to-high sulfur cures are bonded more easily than low- or non-sulfur compounds although peroxide-cured and other cure package compounds can also be bonded. Avoid levels of wax-type antiozonants or other compounding ingredients that will bloom. Phthalate plasticizers should only be used at very low levels. Most importantly, bond testing with the specific compound will determine the level of adhesion that can be achieved. Avoid silicone containing mold releases. Semi-permanent type mold releases transfer minimally to the molded rubber surface.

For optimum performance, treat the rubber with Chemlok 7701 surface treatment. Apply this solution by dip or wipe methods. Allow solvent to flash at least 10 minutes before bonding.

Adhesive Selection

Several LORD epoxy and urethane adhesives are available depending on properties needed. For further product or technical assistance, consult the Parker Lord Application Engineering team.

Adhesive Mixing/Application

These adhesives are available in a variety of containers. Two-component adhesives are available in a variety of cartridges to be used with manual or pneumatic dispensing guns with disposable static mixer nozzles. Hand mixing of two-component products may provide acceptable results on prototypes if air incorporation is minimized. Containers of 5 gallons or larger may be used with automatic mix, meter, dispense (MMD) equipment. Do not return unused mixed adhesive to the original container. Refer to the product's technical data sheet for specific mix ratios and application information.

Assembly/Cure/Disassembly

Apply adhesive to the metal and/or rubber. Assemble and fixture in a single motion. Apply 0.5-1.0 psi to obtain intimate contact between the bonding surfaces. Refer to the product technical data sheet for bondline adhesive thickness target ranges. Maintain contact during the entire curing step. In some cases, clamping can help maintain good contact of mated parts until cured.

Glass beads, metal shims, or insert registration tabs can be placed within the adhesive bondline to prevent excess squeeze-out maintaining the target adhesive thickness.

Cure the bonded assembly to handling strength according to the information supplied in the product's technical data sheet. Many times this requires a maximum of 24 hours at room temperature or 4 minutes at 149°C (300°F). Large assemblies may require longer cure times or higher temperatures. Refer to the product's technical data sheet for guidance on working times and full cure specifications.

Post-Assembly Processes

Post-assembly processes such as machining, plating, chemical conversion coating, painting, etc. may be performed. Avoid processes that generate excessive heat or exposure to deleterious environments.

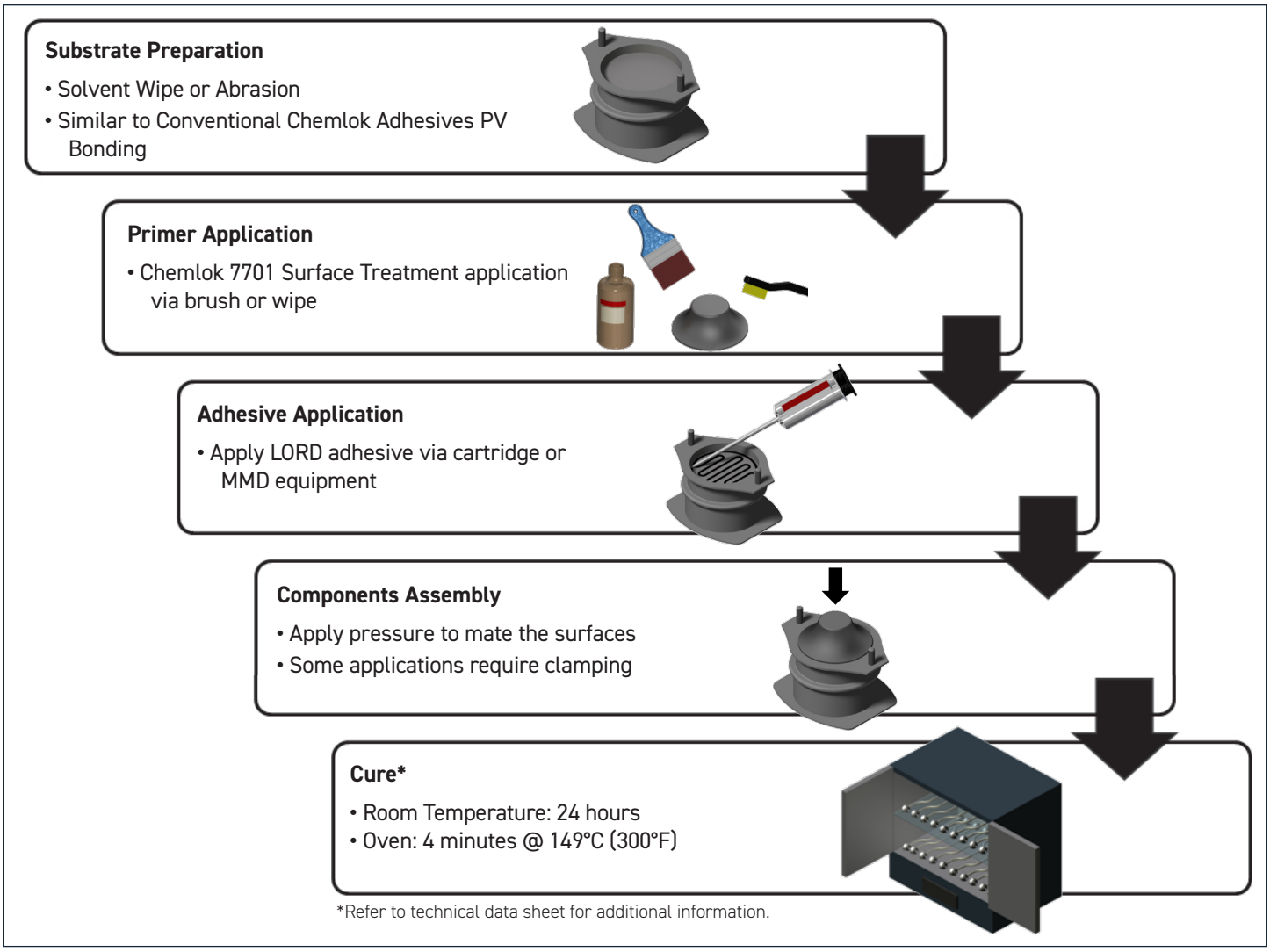


Figure 2. PV Bonding with LORD Structural Adhesives

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