

# Fixturing Guide for Metal Bonding Applications

## Apply Adhesive

Apply the adhesive to the part in a manner that will insure complete adhesive coverage to the bond area. (Refer to chart below). The rule of thumb is to dispense a bead about one-sixth the diameter of your bond joint.

Allow for variations in bondline thickness around the periphery of the part. While a 0.010" (0.254 mm) bondline thickness is ideal, the fit of the parts to be bonded is not always ideal. Therefore, increase the bead size dispensed in areas of "poor fit" to assure adequate coverage.

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. However, if this 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 and remove the squeeze-out before the working time has elapsed.

The chart below provides a general guideline on what bead diameter to dispense to assure complete coverage of the bond joint at various bondline thicknesses.

## Mate Parts

Mate the parts to be bonded within the specified working time of the product. Once mated, it is important the parts not be separated. To properly position the mated parts, do this by sliding, not lifting.

## 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 and braces.

## Clamps

Many varieties of clamps can be used, e.g., C-clamps, vise grips, flat end clamps. The type of clamp is not nearly as important as the clamping method. Two approaches are recommended:

### • **Clamp Method #1**

Place the first clamp in the center of one of the sides. Continue clamping from the center to the end, spacing the clamps approximately 4 inches apart. Repeat this process for the other half of the part, placing the clamps from the center to the end. Continue in this manner around the entire periphery of the part. Maintain an even clamp pressure throughout this process. This is the preferred method, as it helps maintain dimensional stability to the parts being bonded together.

### **Bead Size to Dispense Based on Overlap Area and Bondline Thickness**

Joint Overlap	Bondline Thickness - inches (mm)					
	0.005 (0.127)	0.010 (0.254)	0.020 (0.508)	0.030 (0.762)	0.040 (1.016)	0.060 (1.524)
0.25 inches (6.35 mm)	1/16 (1.588)	1/16 (1.588)	1/8 (3.175)	1/8 (3.175)	1/8 (3.175)	3/16 (4.763)
0.50 inches (12.7 mm)	1/16 (1.588)	1/8 (3.175)	1/8 (3.175)	3/16 (4.763)	3/16 (4.763)	1/4 (6.35)
0.75 inches (19.05 mm)	1/8 (3.175)	1/8 (3.175)	3/16 (4.763)	3/16 (4.763)	1/4 (6.35)	1/4 (6.35)
1.0 inch (25.4 mm)	1/8 (3.175)	1/8 (3.175)	3/16 (4.763)	1/4 (6.35)	1/4 (6.35)	3/8 (9.525)
1.25 inches (31.75 mm)	1/8 (3.175)	3/16 (4.763)	3/16 (4.763)	1/4 (6.35)	1/4 (6.35)	3/8 (9.525)
1.5 inches (38.1 mm)	1/8 (3.175)	3/16 (4.763)	1/4 (6.35)	1/4 (6.35)	3/8 (9.525)	3/8 (9.525)

- **Clamp Method #2**

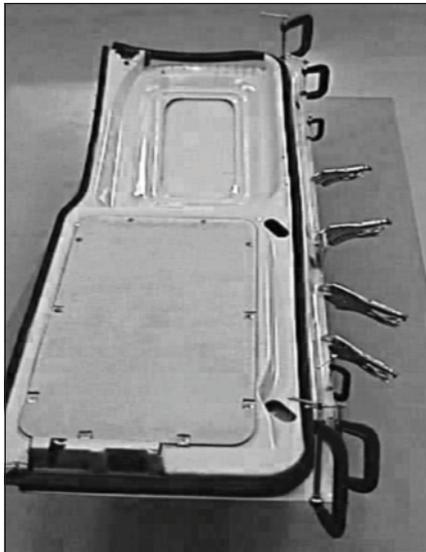
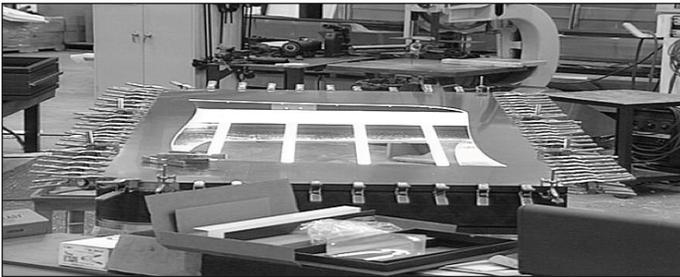
Start clamping on one end and proceed down the length of the part, spacing the clamps about 4 inches apart. Continue in this manner around the entire periphery of the bonded part. Maintain an even clamp pressure throughout this process.

- **Incorrect Clamp Method**

Do not place a clamp on both ends of the bondline and then clamp the area in between. This could force the part to “bow” slightly in areas between the clamps, resulting in poor adhesion in these areas and stress concentrations in other areas.

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## Clamps



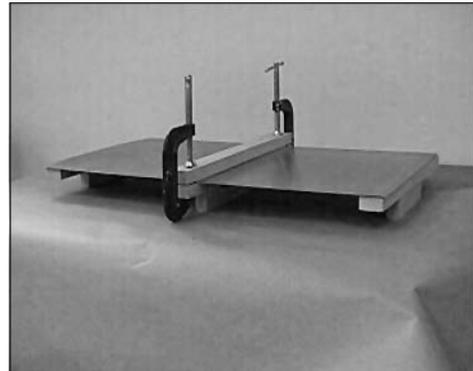
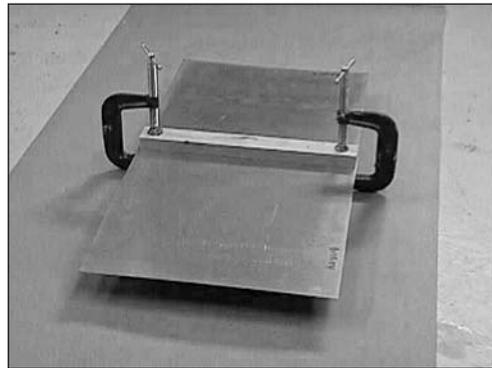
## Board Stiffeners

Another way to apply even pressure across the bondline with a flat (not contoured) part is through the use of boards or other stiffeners. Frames to accommodate this method of clamping can easily be constructed for the specific part being bonded.

It is recommended that the bottom panel to be bonded is first laid on top of the bottom board/stiffener. Apply the adhesive to the bond area and place/position the mating panel on top. Place the second board/stiffener down the length of the bondline and clamp the ends of the two boards together. This creates a “sandwich” with the bonded part in the interior, with even pressure across the entire length. Repeat with all other bondlines, starting with the opposite side, and then followed by the two remaining sides, if the design of the part so requires.

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## Boards/Stiffeners



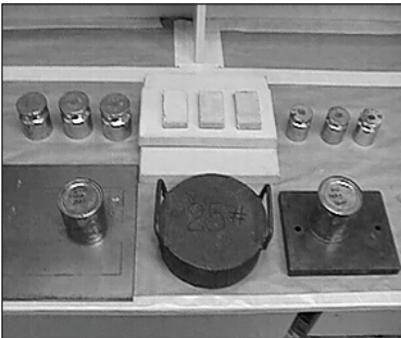
## **Weights**

If the bonded part is very large or difficult to clamp, weights can be applied with sand bags, bean bags or other formable materials. These can be used to follow the contour of the molded or contoured bond surface. For smaller bond areas, simple weights (heavy, available items) can be placed over the bondline.

One other means of fixturing is simply using gravity and the weight of the part being bonded. This would only be relevant in applications when the weight and design of one of the parts is heavy enough to enable the two parts to remain in intimate contact during cure. However, even if the individual parts are not particularly heavy, simply stacking them on top of each other on a hard, flat surface can also work with some success. This can only be done if the parts are flat, and the process is automated enough that stacking begins before the working time of the product is exceeded. Also, when using this fixturing method, caution must be taken when stacking the parts to avoid movement of the assembled parts.

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## **Weights**



*Non-Formable*



*Formable*

## **Mechanical Fasteners**

Mechanical fasteners such as screws, rivets, bolts, etc. can also be used as a means of fixturing particularly “difficult to clamp” areas. Since the use of fasteners can create areas of stress concentration, they are typically recommended only when the design of the part does not accommodate other means of fixturing. Minimize the number of fasteners used whenever possible.

Mechanical fasteners can offer some benefit by increasing the peel strength of the assembly. Since adhesives are relatively strong in shear and weak in peel, if the working environment of the bonded assembly will place high peel loads on the bond joint, it would be advisable not to remove the fasteners after the adhesive has cured. In most applications, however, the mechanical fastener should be removed after the handling strength time listed on the product literature has elapsed.

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## **Mechanical Fasteners**



### **Braces**

When bonding odd-shaped parts, creativity must be given free reign. Often, braces can be easily constructed using items as simple as nails to hold assemblies in place while curing. The figure below is a simple example of how odd-shaped parts can easily be fixtured by bracing.

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### **Braces**



### **Magnets**

When bonding ferrous metals, strong magnets can be used for fixturing the parts, and are particularly useful in hard to clamp areas. If magnets are used, however, it is imperative that they remain on the part beyond the handling strength time of the adhesive. Depending on the strength of the magnet, the force required to remove it may be greater than the strength the adhesive has developed. This could result in separation of the bonded panels in the area the magnet was attached.

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