JOINT DESIGN

Stress Resistance, simplification, economy and more.

The benefits of adhesive technology...

One of the primary benefits of adhesive is that it holds something together resisting the stress trying to pull it apart.

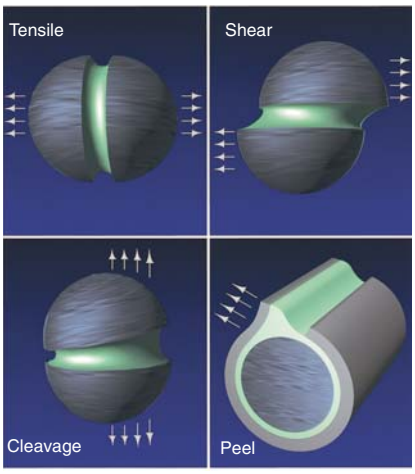
Tensile stress is exerted equally over the entire joint straight and away from the adhesive bond.

Shear stress is across the adhesive bond. The bonded materials are being forced to slide over each other.

Cleavage stress is concentrated at one edge and exerts a prying force on the bond.

Peel stress is concentrated along a thin line at the bond's edge. One surface is flexible,

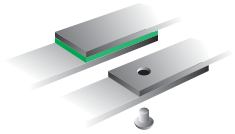
Most applications combine stresses.



Structural adhesives offer several important advantages over conventional fastening methods:

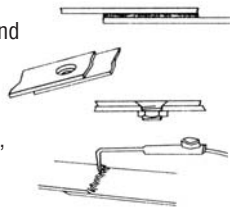
1. Uniformly distribute stress over the entire bonded area.

The concentrated stress of rivets, bolts, spot welds and similar fastening techniques is eliminated. Lighter, thinner materials can be used without sacrificing strength.



2. Effectively bond dissimilar materials.

Laminates of dissimilar material can often produce combinations superior in strength and performance to either material alone. Adhesive flexibility compensates for different coefficients of expansion between materials such as aluminum bonded to glass, for example. Adhesives also provide a film barrier to reduce or prevent bi-metallic corrosion between different metals.



3. Maintain integrity of the bonded material.

Mechanical fastener holds are eliminated, as well as surface marks from spot welding and brazing. With this "blind fastening," you have greater design flexibility and reduced finishing.

4. Provide maximum fatigue resistance.

Adhesive flexibility permits extension and recovery under repeated loading. Energy absorption properties provide up to 20 times t fatigue resistance of riveted or spot welded assemblies.

5. Provide continuous contact between mating surfaces to effectively bond and seal against the environment.

6. Cut costs; increase and simplify production.

Several factors combine for savings and efficiency.

- Reduced material requirements
- Weight reduction
- Elimination of drilling, welding, screw fastening and similar operations
- Minimal training
- Usually no solvents to be vented
- Bond primed or pre-painted surfaces

5 STEPS TO INSURE OPTIMUM PERFORMANCE

With either film or liquid, there are 5 considerations to make and steps to be taken to insure adhesive performance consistent with your specific requirements.

I. Joint Design — proper design can maximize adhesive performance.
II. Surface Preparation — amount of preparation should be consistent with your requirements.
III. Application Methods — depends on adhesive type.
IV. Heat Curing Equipment — many methods available.
V. Pressure Equipment — must provide uniform pressure over entire bonded area.

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JOINT DESIGN

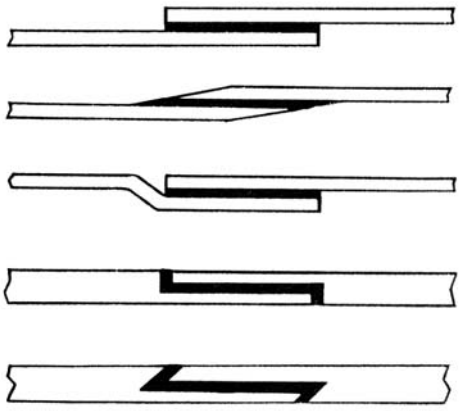
JOINT DESIGN . . .

Specific stress resistance in a major consideration.

Generally, joints should be designed so that basic stress is shear or tensile with cleavage and peel minimized. All of the bonded area should equally share the load. The following structural joints and their advantages/disadvantages illustrate some typical design alternatives. They are not, of course, the limit of possible adhesive bonded joints.

LAP JOINTS . . .

are most common. They are most practical and applicable in bonding thin materials.



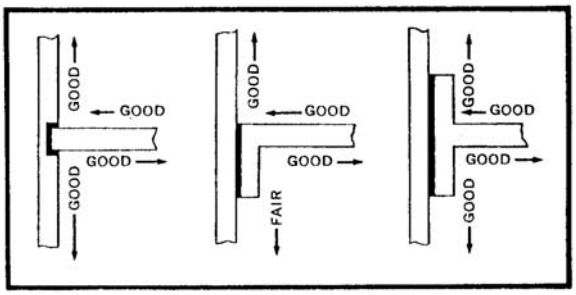
The simple lap joint is off-set when using thin materials. This can result in cleavage and peel stress under load.

A tapered single lap joint is more efficient than a simple lap joint. The tapered edge allows bending of the joint edge under stress.

The joggle lap joint gives more uniform stress distribution that either the simple lap or tapered lap joint. The joint can be formed by simple metal forming operations. The curing pressure is easily applied.

The double butt lap joint gives more uniform stress distribution in the load-bearing area than the previously mentioned joints. This type of joint, however, requires machining which is not always feasible with thinner gauge metals.

Double scarf lap joints have better resistance to bending forces than double butt joints. This type of joint however also requires machining

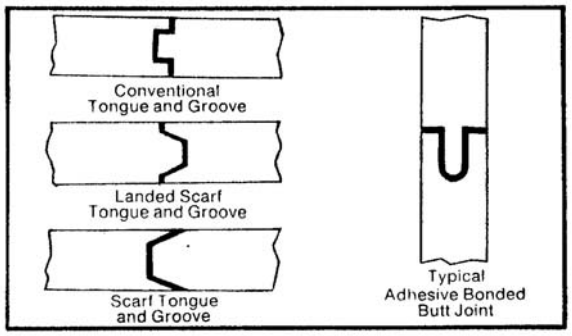


ANGLE JOINTS . . .

... give rise to either peel or cleavage stress depending on the gauge of metal. Typical approaches to the reduction of cleavage are illustrated.

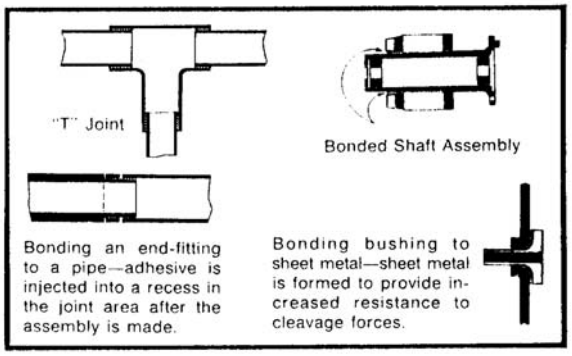
BUTT JOINTS

A straight butt joint has poor resistance to cleavage. The following recessed butt joints are recommended: landed scarf tongue and groove, conventional tongue and groove, and scarf tongue and groove. Landed scarf tongue and groove joints act as stops which can control adhesive line thickness. Tongue and groove are self-aligning during assembly and act as a reservoir for mastic type void filing adhesives.



CYLINDRICAL JOINTS

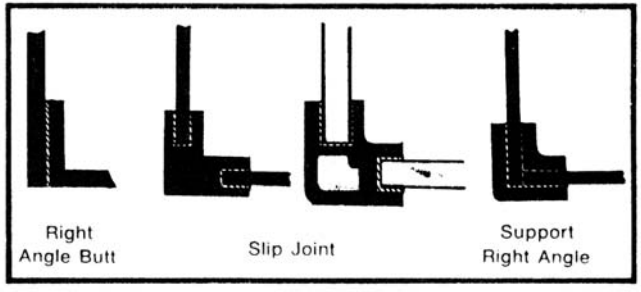
The joint and overlap slip joint are typical for bonding cylindrical parts such as tubing, bushings, and shafts. With adhesive bonding, all available contact area contributes to carry the load. Adhesives also provide a joint with better appearance and eliminate distortion caused from high welding temperatures.



JOINT DESIGN

CORNER JOINTS — SHEET METAL

Corner joints can be assembled with adhesives by using simple supplementary attachments. This permits joint and sealing in a single operation. Typical designs are right angle butt joint, slip joints increase the structure's rigidity. Void filling adhesives are most frequently used. Use of a heat curing adhesive depends on the heat resistance of the materials being bonded. With this technique, thin gauge metals or sandwich panels can be easily formed into boxes, case, housing, vehicle bodies, metal boat hulls, etc.



CORNER JOINTS — RIGID MEMBERS

Corner joints, as in storm doors or decorative frames, can be adhesive bonded. End lap joints are the simplest design type although they require machining. Adhesives requiring pressure during cure may be utilized in such designs. Mortise and tenon joints are excellent from a design standpoint but also require machining. Mitered joint with spline is best if members are hollow extrusions. In this case, a void filling adhesive is recommended