



Adhesives are applied to large surface areas by rolling, brushing, or spraying.

## Bonding, Joining & Sealing

### Large Surface Area Bonding

#### Adhesives Systems Provide Choices For Large Surface Area Bonding Applications

Making kitchen countertops by sticking Formica or other similar laminates to a wood substrate with contact cement may be the most familiar of all large surface area bonding applications. The instant, durable adhesive bond was the perfect solution for contractors and users alike since Formica debuted in the 1920s.

Large surface area bonding (LSAB) applications have grown considerably since then as designers recognized the performance, production, and cost advantages of adhesives over conventional fastening techniques. This is particularly true in areas requiring faster, better, or more stylish assemblies, such as transportation, aerospace, manufacturing, furniture and bedding, architectural, and home contracting.

Joining large surface area materials – high-pressure laminates (HPL), foam, fabric, rubber, plastic film, cardboard, paper, and other materials to substrates such as metal, wood, plastics, glass, ceramic, and concrete – usually involves completely covering one or both surfaces with a thin, uniform coating of adhesive. LSAB is a relative term because bonded items can be of significantly different sizes, from large fabric-covered wall panels, tabletop veneers, ballroom-size carpets, and multilayer foam mattresses to smaller items such as gaskets, equipment name plates, and trim details for vehicles.

Adhesives used for LSAB are considered non-structural, having bonding strengths typically less than 1,000 psi. They can be formulated to allow repositioning – useful where adjustments may be needed – or to provide high initial tack and bond strength greater than the substrate being bonded, which eliminates the need for jigs and holding time.

Here's a look at the most common types of non-structural adhesives commonly used for LSAB today.



Aerosols are generally based on latex and neoprene solutions.

### Contact Adhesives

Contact adhesives are applied to two surfaces to be mated and allowed to dry. When the surfaces are pressed together a strong bond forms immediately. Designers can select from a range of bonding strengths, time to maximum bond strengths, viscosities, solids content, and solvent or water-based formulations to suit their application needs. Many formulations meet military and other government specifications.

Solvent-based nitrile rubber products with solids content of approximately 18% to 25%

can generally be brushed, rolled, or sprayed. They produce strong, immediate bonds that achieve maximum overlap shear strengths of 480 psi to 540 psi in a short time (30 minutes maximum). Bonds resist heat, creep, and continuous load stresses.

While solvent-based systems have the advantage of quick dry times, they have the disadvantages of growing health, safety, and environmental concerns, and the time and work of managing controlled substances like n-propyl bromide and methylene chloride solvents. OSHA, EPA, and many local and regional regulations mandate reduced

solvent use, in some areas all but rendering traditional solvent-based contact adhesives obsolete. This has increased the popularity and availability of water-based contact adhesive formulations using latex or neoprene rubbers with performance specifications similar to solvent-based products.

Water-based systems are not new – 3M introduced Fastbond™ Contact Adhesive 30NF more than 40 years ago. It is compliant with the stringent California South Coast Air Quality Management District Rule 1168 for contact adhesives. Formulations like 30NF have about twice the solids content of solvent-based systems and provide up to 3.5 times more adhesive coverage for more economical use. Its ultimate shear strength of 480 psi exceeds many solvent-based adhesives.

Because water-based adhesives are non-flammable in the wet state, fireproof cabinets are not needed for storage. There is no solvent odor, and that means healthier, more productive workers. Various application methods can be used: spray (including low-maintenance gravity feed), brush, or roller. Fans and heat accelerate drying, thus shortening the production cycle.

### LSAB Applications for Solvent- and Water-based Contact Adhesives

- Bond HPL to countertops and tabletops
- Assemble cabinets (particle board, plywood, plastic laminate)
- Assemble compound cushions (foam to substrate)
- Assemble furniture (foam, fiber fill, fabric)
- Assemble mattresses and bedding (foam to foam, quilted fabric to solid core)
- Attach carpet to fiberglass flooring (boats)
- Adhere insulation inside metal doors, wall panels, and refrigerators
- Bond rubber to metal flooring (buses, trains) and headliners (boats)
- Bond fabric to drywall
- Attach foam insulation to concrete
- Bond felt to wood (audio speakers)
- Bond flexible urethane and latex foams to themselves
- Bond fabric to metal, wood, or plastic office partitions

To overcome slower dry times for water-based products, newer two-part systems create quick initial tack so mated surfaces have the strength to be handled, increasing throughput and production rates. Two-part systems require special spray equipment: a double-nozzle, low-pressure spray gun that mixes the two-part adhesive outside the nozzle to avoid plugging. The adhesive is also activated by heat for even faster post forming. These systems produce ultimate shear strengths of 350 psi, while high solids content makes more economical use of adhesive.

Other fast-tacking, one-part, water-based neoprene contact adhesives strongly bond foam-to-foam in 15 seconds (or on contact when an activator is used) – the foam will fail before the adhesive bond line. Neoprene adhesives have better heat resistance than water-based latex adhesives and conventional non-flammable and flammable foam adhesives. Further, they have excellent resistance to aging, rapid strength buildup, long bonding range, and good resistance to water and chemicals. This advanced

formulation bonds foam to fiber fill, fiber fill to fabric, leather to foam, and more.

### **Aerosol Adhesives**

Aerosols, generally based on latex and neoprene adhesives, are similar to contact adhesives but most are formulated for applications requiring less strength and the ability to be repositioned. They are used for bonding light-weight materials including fabrics, plastics, flexible foams, paper, cardboard, and thin-gauge metals. They are available in handy aerosol cans, although for larger applications pressurized cylinders of various sizes provide easily managed, self-contained spray systems. Water-based aerosols are not yet available.

Aerosol adhesives are formulated with a range of tack and bonding properties. Some have very aggressive tack yet permit materials to be repositioned, other create immediate one-surface bonds, while others have fast, aggressive tack with low soak-in for long lasting bonds with many lightweight materials. Some specifically adhere difficult-to-bond, low surface energy (LSE)

plastics like polyethylene film while others are designed for bonding expanded or extruded polystyrene insulation materials to themselves or other surfaces without degrading the foam. A plasticizer-resistant aerosol bonds vinyl, leather, and all types of rubber except EPDM. Another one-surface, pressure-sensitive spray formulation has tape-like instant adhesion to hold foam in place for shipping containers or for permanently bonding insulation in HVAC systems, appliances, and walk-in coolers.

### **Sprayable Hot Melt Adhesives**

Hot melt adhesives are one-part, 100% thermoplastic resins that flow when heated so they can be sprayed for LSAB applications. Applied to one or both surfaces, the sprayed material cools, hardens, and reaches ultimate bond strength in seconds. Hot melts are not for heavy-duty applications and are generally used for lightweight substrate bonding where high-temperature environments are not a factor. However, hot melts are an alternative to some solvent-based adhesives for quickly bonding many materials. They eliminate the need for solvent handling, and assemblies can be moved immediately after cooling.

Hot melt adhesives are available in low-melt and hot-melt formulations. Choose melt temperature based on materials to be glued (higher temperatures may be undesirable for some materials) and bond strength desired (higher melt temperature adhesives have better heat resistance).

### **LSAB Applications for Aerosol Adhesives**

- Adhere difficult-to-bond LSE plastics (polypropylene film, foam)
- Bond foam and fabric
- Temporarily hold badges during stitching, T-shirts during screening, etc.
- Permanently attach carpet, nameplates, pool liners, pipe insulation
- Attach paper-back fiberglass insulation, thin decorative films, foils, etc.
- Bond expanded or extruded polystyrene and other insulation materials
- Bond rubber, vinyl, leather, metal panels, kick plates, etc. (contact adhesive)
- Form high-strength bonds for decorative laminates and signage
- Seal cardboard cartons, hold palletized plastic bags in place for shipping, apply labels



Hot melts are an alternative to some solvent-based adhesives for quick bonding.

### Low melts (250-270°F)

- Formulations: hot tack, delayed tack, or removable gummy glue in a variety of clear and colored formulations
- Usually hand-applied (not sprayed)
- For smaller parts and perimeter sealing where 100% coverage is not required
- Shear strengths for low melts: 350-600 psi (on Douglas fir at 72°F); peel strengths: 6-13 PWI (on canvas at 72°F); failure temperatures: 120-140°F

### Hot melts (350-385°F)

- Formulations have higher heat resistance, the ability to bond LSE plastics, good environmental and electrical resistance, low viscosity for high flow rates and increased production, and excellent hot tack, quick grab, and fast setting properties.
- Shear strengths for hot melts: 250-700 psi (on Douglas fir at 72°F); peel strengths: 6-29 PWI (on canvas at 72°F); failure temperatures: 125-300°F.

There are hot melt adhesives to bond virtually any substrate, including wood, thin metal, glass, ceramic, vinyl, leather, polyolefin (such as polyethylene), plastic (ABS, PVC, acrylic), paper, coated and uncoated cardboard, fabric, and rigid (beadboard/styrene) and flexible foam.

### LSAB Applications for Hot Melt Adhesives

- Attach headliners in specialty vehicles (RVs, ambulances) and boats
- Assemble point-of-purchase displays and trade show exhibits
- Assemble a range of products (metal or plastic name plates, luggage, speaker fabric, or protective metal grilles)
- Assemble novelties, toys, games, and costumes

### Sealants

Sealants are high-solids (90%), viscous adhesives that change state to become solid, once applied, and are used to flexibly adhere substrates and prevent the intrusion of air, gas, ultraviolet light, dust, smoke, fire, and liquid through the bond or joint. They must resist water, solvents, fuel, temperature extremes, and corrosion while maintaining adhesion. Sealants fall between higher-strength adhesives and extremely low-strength putties and caulks. Because sealants are designed to provide an environmental barrier for assemblies and

joints, they are formulated with elastomeric properties for adequate flexibility and elongation without shrinkage to remain bonded over the expected life of an assembly.

Sealants are formulated from one-part polyurethanes, acrylics, polysulfides, and butyl rubbers into various consistencies – from heavy liquids and pastes to mastics – and offer cured properties to suit a wide range of applications.

### LSAB Applications for Sealants

- Fill and seal gaps in boat cabin roof panels; seal marine rigging, hardware, and fittings above and below the waterline
- Seal seams and gaps in HVAC systems
- Hold carpeting in place (plasticizer-resistant formulations hold vinyl and polypropylene backed carpets)
- Affix shower and tub enclosures to drywall



Some spray formulations have tape-like instant adhesion.

### Thin Bonding Tape Systems

Bonding tapes have pressure-sensitive adhesive on two sides to adhere mating surfaces with strengths that ranges from repositionable to permanent. Conformable foam tapes, removable/repositionable tapes, and adhesive transfer tapes provide toughness and durability for applications that demand strength, flexibility, and resistance to harsh environments. These systems are based on acrylic formulations that assure instant adhesion to a specific material or a broad range of materials – from aluminum and steel to difficult-to-bond LSE plastics and powder coatings.

For LSAB applications, adhesive peel-and-stick tapes can be die-cut to precisely fit any shape, size, or profile. Pressure-sensitive adhesives bond parts instantly, eliminating the need for fixtures or long cure times. Because of their viscoelasticity, tape

adhesives absorb shock and flexing and improve fatigue resistance caused by wind, vibration, and substrate expansion and contraction due to thermal cycling. They have capabilities to 450°F. For example, peel-and-stick adhesive, die-cut for a perfect fit, has replaced conventional fasteners to adhere heat shielding panels inside the engine hoods of popular military all-terrain vehicles. The thin bonding system has proved itself in this extremely harsh environment.

Thin tape systems are used for large surface area bonding in electronic, transportation, aerospace, medical, architectural, and industrial applications.

Advanced adhesive formulations and application methods are enlarging the performance envelope for LSAB to extend operating temperatures, withstand greater

physical stresses, tolerate more challenging environmental conditions, and comply with more stringent production health and safety requirements. Designers have more adhesive solutions than ever and the ability to choose from a variety of bonding approaches that include solvent- or water-based contact adhesives, sprayable hot-melt thermoplastics, aerosol formulations, sealant adhesives, and thin bonding tapes.

### About Fabrico

Fabrico is a recognized leader in cost-effective product design and engineering, as well as converting and custom fabrication services for flexible materials. The company designs and manufactures components and sub-assemblies using flexible materials for industries as diverse as transportation, medical device, general industrial, solar, and military.

### LSAB Applications for Thin Bonding Tape Systems

- Assemble electronic devices, from GPS units and cell phones to flat screen TVs and marine equipment
- Bond automotive interior and exterior trim pieces, headliners, under hood insulation; commercial vehicle signage
- Attach stainless steel anti-chafing strips to aluminum wing flaps on commercial jets
- Bond exterior building skin panels; architectural signage and traffic signs
- Attach name plates on industrial equipment



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