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Hot Melt Assembly

ASC Hot Melt Short Course
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3M Innovation

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Assembly Agenda

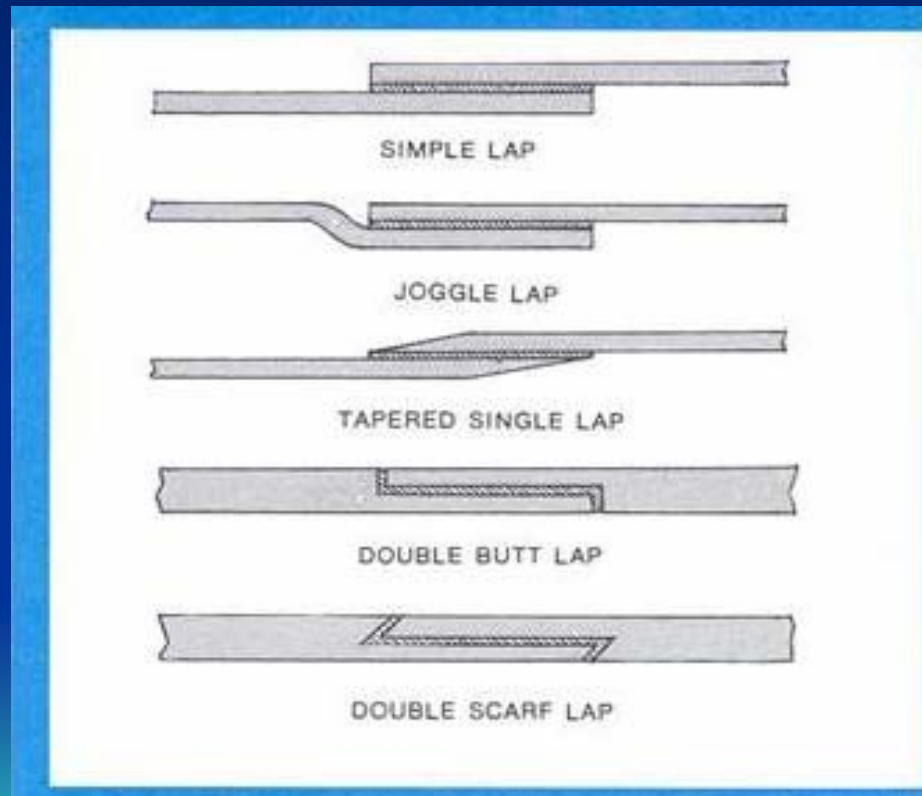
- Joint design
- Advantages of Hot Melt Adhesive
- Substrates
- Key components to assembly success
- Requirements
- Limitations of Hot Melt Adhesive
- Bonding Techniques

Joint Design

- Make sure Joint design is optimized and suitable for hot melt adhesives.

Lap Joint (Most common joint)

Lap joints are most practical for bonding thin materials

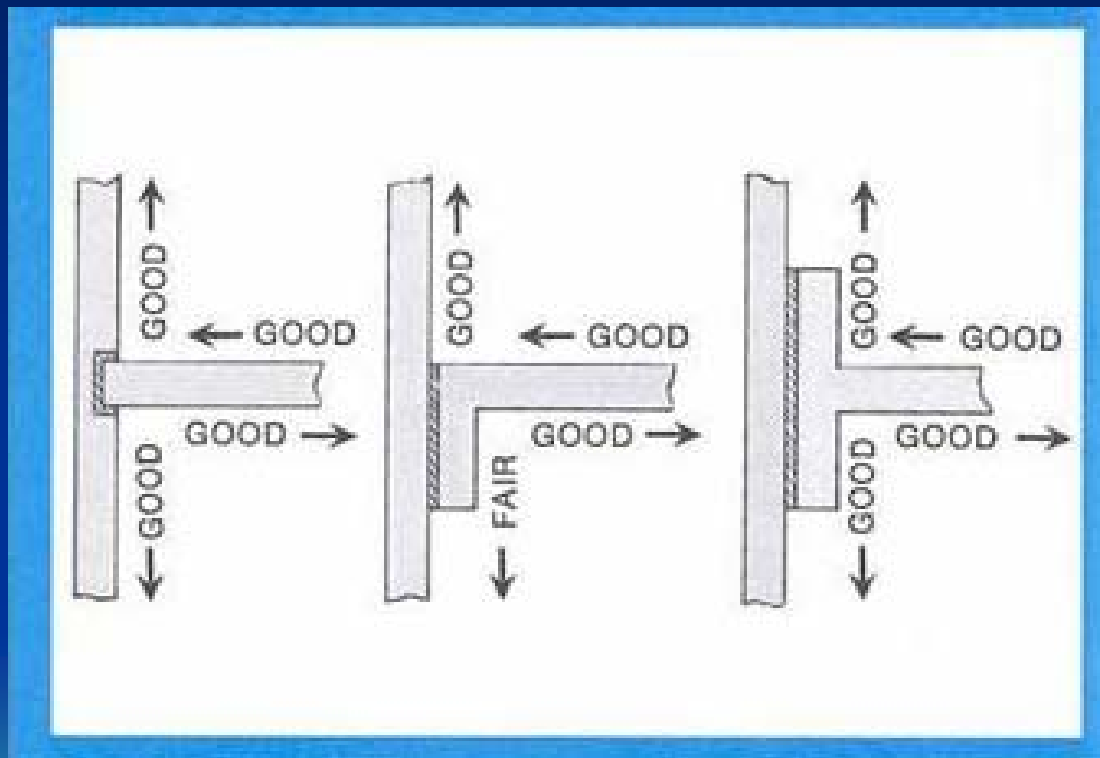


Joint Design

- Angle Joint

(Very susceptible to peel or cleavage)

Examples of methods to reduce cleavage

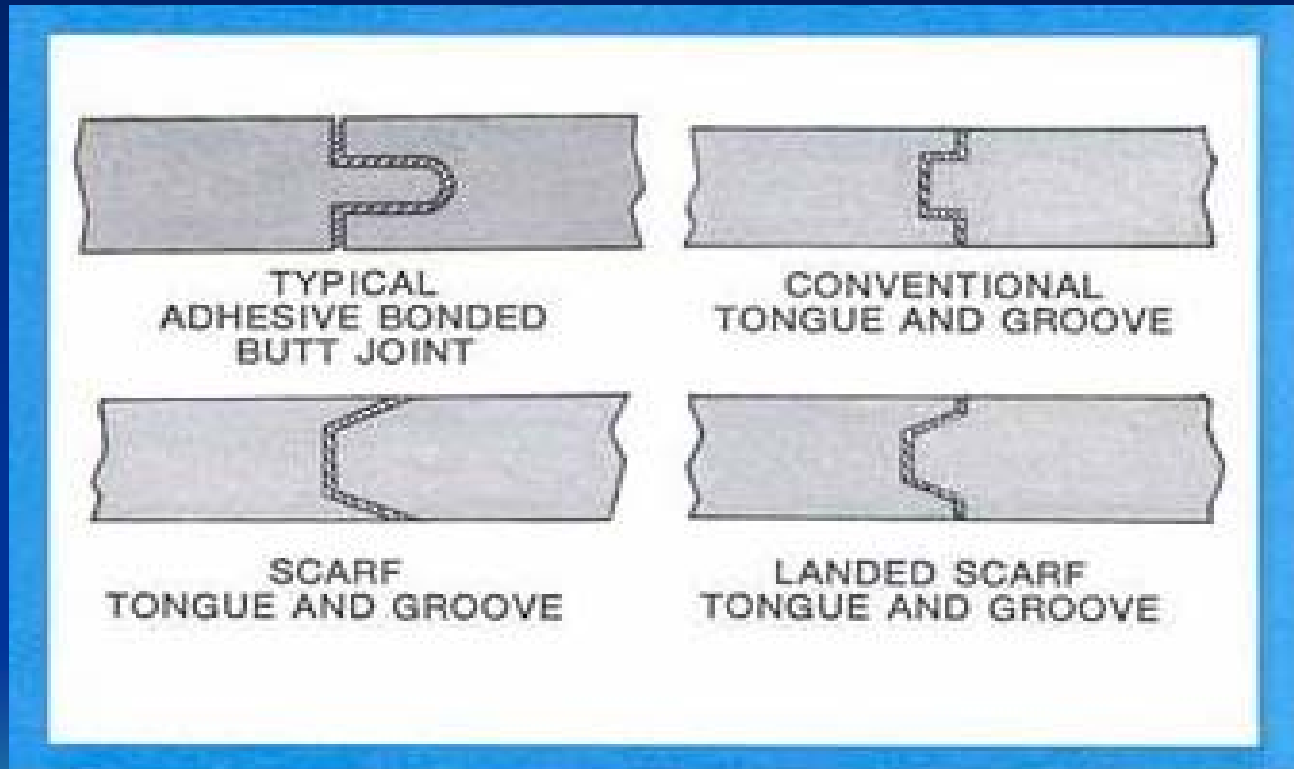


Joint Design

- Butt joints/end grain joints

(very poor cleavage resistance)

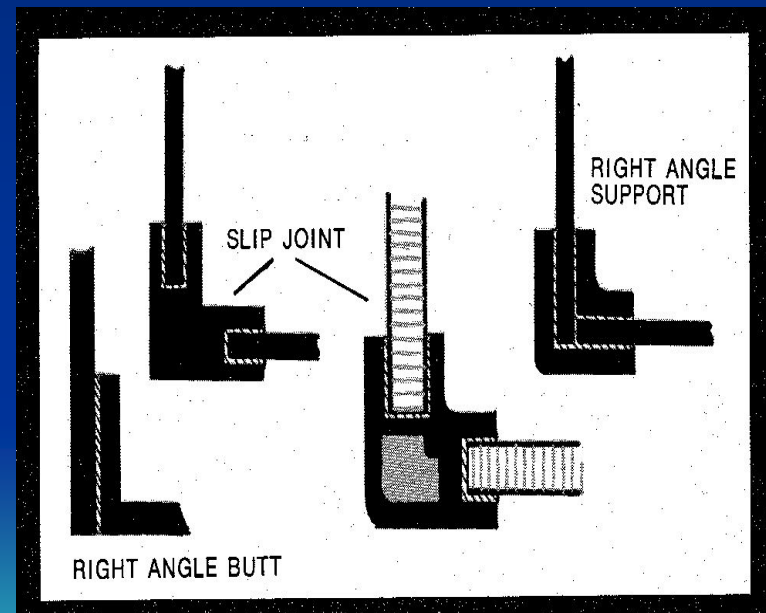
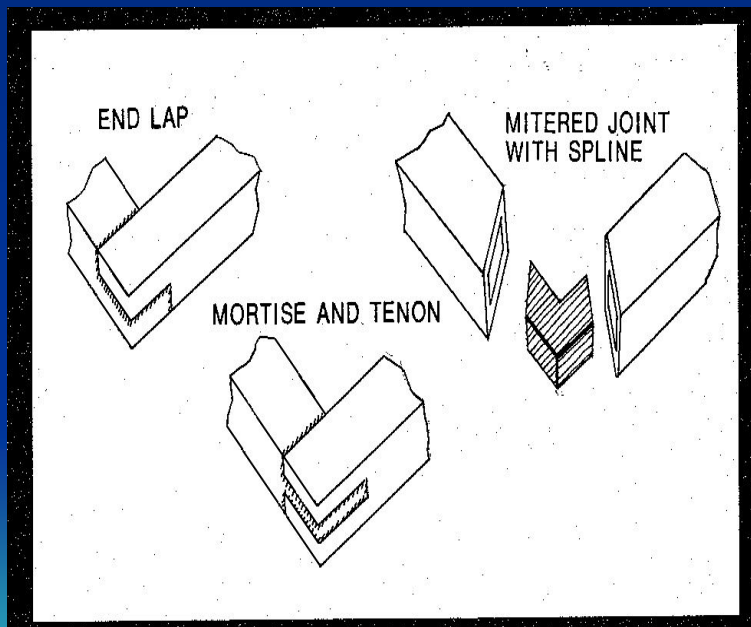
Examples of methods to reduce cleavage



Joint Design

- Make certain joint/bond has been designed for hot melt adhesives.
- The following joints are typically designed for low viscosity liquid adhesives such as carpenter glue.

Examples of poor joints for hot melt adhesives are mortise and tenon and slip joint or dowel applications.



Customer Requirements/Assembly Considerations

- Hot Melt Adhesives are typically utilized to provide a balance between performance and application characteristics

Customer Requirements/Assembly Considerations

- 5 Assembly considerations for Hot Melt Adhesives
 - * Bond Strength
 - * Heat Resistance
 - * Chemical Resistance
 - * Low temperature flexibility
 - * Environmental resistance

Bond Strength

- Hot Melt Adhesive bonds are usually not considered structural strength.
- Hot Melt Adhesives are prone to creep under constant stress.
- Most often recommended for applications having negligible load requirements

Heat Resistance

- Hot Melt Adhesives remain temperature sensitive even after bond is made.
- As the temperature increases, the strength decreases!
 - Hot Melt Adhesives = Thermoplastic
 - Curing Hot Melts (CHM/PUR) = Thermoset

Chemical Resistance

Chemical resistance of Hot Melt Adhesives will vary depending on the base polymer and how it is compounded.

- EVA based polymers demonstrate good resistance to water and poor to organic solvents.
- Polyamide/polyester and some polyolefin base polymers are preferred where oil and solvent resistance are needed.

Environmental Resistance

- Bonds made with Hot Melt Adhesives are not generally a good choice for exterior applications due to:
 - Poor low temperature
 - Lower/moderate heat resistance
 - Surface attachment versus chemical or mechanical attachment

Advantages of Hot Melt Adhesive

- Non-flammable
- Fast setting
- Gap filling
- Relatively high strength
- Wide temperature range
- Bonds to problem surfaces

Limitations of Hot Melt Adhesives

- Thick Glue lines
- Sensitive to stains
- Poor resistance to stress under load
- Limited heat resistance

Customer Substrates

- Generally, Hot Melt Adhesives are used to bond wood, cardboard, particle board, plastics, foams and fabric.
- Substrate Examples:
 - Difficult to bond: polyethylene, EPDM etc.
 - Heat sensitive: styrene foam
 - Insulator: polyethylene foam, cardboard
 - Heat sinks: metal, cool surfaces

Bonding Techniques

- Adhesive volume
- Adhesive open time
- Joint Pressure
- Low melts
- Third Hand

Volume

- This refers to the depth and width of the adhesive being applied.
 - Ribbons cool faster than beads
 - Beads cool faster than puddles
 - When bonding large areas, use puddles

The larger the volume of adhesive, the slower the cooling. The larger the volume, the better the wetting.

Open Time

- Open time is the maximum time allowable between applying the adhesive , and joining the substrates. Open time can decrease or increase depending on substrate or ambient temperatures.
- The less time between application and joining the substrates, the better the bond.
- Rapid joining of substrates allow for the adhesive to stay hotter for better wetting and produces a stronger bond with a thinner glue line.

Pressure

- Usually hand pressure is adequate.
- Higher pressure equals better bond.
- Higher the pressure the thinner the glue line
- Maintain pressure until adhesive solidifies.
- The thinner the adhesive, the faster it solidifies.

Low Melts

- Thermoplastic adhesive taking advantage of high flow resins.
- Low temperature applied adhesive cause little or no damage to heat sensitive substrates. (heat sensitive substrates usually do not require high strength)
- Physical properties of low melt adhesives similar to high temp applied counterpart.
- Low melt adhesives offer less equipment and part maintenance/replacement and offer added operator safety.

“Third Hand” or temporary bonding

- If assembly application dictates the need for a slower curing/drying adhesive producing structural strength, remember the hot melt advantage!

Use Hot Melt Adhesive in conjunction with the other form of adhesive to “clamp” or “hold the parts together” while the other joining system is building strength.

“Third Hand” or temporary bonding

- RESULTS -- The best of both worlds!
 - Fast handling strength/speed production
 - Maximum adhesive performance without the cure or clamp time

Key components to assembly success using Hot Melt Adhesives

- WETTING IS THE KEY!!!!!!
- Wetting can be enhanced by allowing the adhesive to stay molten longer.

Key components to assembly success using Hot Melt Adhesives

- Use larger beads or puddles.
 - The larger the mass the slower the product crystallizes.
- Increase the temperature of the adhesive.
 - Only increase temperature within the adhesive manufacturers recommendation.

Key components to assembly success using Hot Melt Adhesives

- The **BEST** way to lengthen open time, increase surface wetting and secure the best possible bond, is PREHEAT one or both surfaces you are bonding.

Summary

For the best results when using Hot Melt Adhesives for product assembly, follow these simple steps!

- Clean bondable surface
- Preheat substrates
- Pressure
- Use Hot Melt as third hand
- Minimize open time
- Correct joint design
- Use sufficient adhesive volume
- Use low melts on heat sensitive substrates

For more information...

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