

guidelines for working with and fabricating 3form Koda

The completion and installation of applications produced from 3form Koda XT, an engineered thermoplastic panel product, may involve secondary fabrication operations including cutting, drilling or bonding. This publication covers the properties and characteristics of Koda XT that need to be taken into account if secondary operations are to be performed successfully.

Storage Instructions

Koda XT should be stored at room temperature in a dry environment that is not exposed to direct sunlight or heat. Koda XT panels should be stored horizontally (flat), as delivered, to prevent warpage. The protective masking must be removed within 30 days of receipt to prevent adhesive from sticking to the panel. Due to possibilities for expansion or contraction, allow material to come to room temperature prior to fabricating.

Cutting and Drilling Techniques

Koda XT can be fabricated with most tools used for machining plastics, wood or metal. Tool speeds should be such that the Koda XT panels do not melt from frictional heat. The highest speed at which overheating of the tool or sheet does not occur will give the best results.

It is important to keep cutting tools sharp at all times. Hard, wear-resistant tools with greater cutting clearances than those used for cutting metal are suggested. High-speed or carbide-tipped tools are efficient for long runs and provide accuracy and uniformity of finish. Bring the blade to full speed before starting the cut. Secure the sheet to minimize vibration. Since engineered resins are poor heat conductors, the heat generated by machining operations must be absorbed by the tool or carried away by a coolant. (A jet of air directed on the cutting edge will aid in cooling the tool and removing chips.) Another method of reducing heat is by making several passes while cutting or trimming the part rather than trimming "deep" through the part.

DO

- Leave the original masking on the sheet during cutting operations.
- Practice on pieces of scrap before cutting parts.
- Use recommended saw blades.
- Use sharp, clean blades and bits.
- Use slow, consistent feed rate.
- Hold sheet firmly while cutting to minimize vibration; use just enough clamp pressure to prevent vibration.
- Use compressed air to minimize heat buildup.
- Feed against the rotation of the blade or tool.
- Wear proper safety equipment.

DO NOT

- Cut or drill with a dull blade, cutter or bit.
- Apply excessive clamping pressure.
- Use a blade with side-set teeth.

SAW CUTTING

Any of the following saw types, commonly used for wood or metal, should be satisfactory for cutting Koda XT sheets: circular saws, band saws, saber saws, jigsaws, hacksaws, or handsaws. However, some saw designs are better suited than others for sawing Koda XT because they produce smoother or faster cuts. Panel saws and table saws usually produce the best surfaces, and they can be used in most sawing operations.

Blade design plays an important part in successful sawing of Koda XT sheets. A skip tooth band saw blade is preferred because the wide gullet provides ample space for the plastic chips to be carried out of the kerf (the cut made by the saw). For best results, the teeth should have zero rake and some set. For a curved cut, the blade should be narrower and have more set than for a straight cut. The blade must be kept sharp to prevent melting or chipping of the sheet, and the blade guide should be placed very near the cut to minimize vibration.

A panel saw is the preferred cutting method for straight cuts. A panel saw should be operated at approximately 8,000 to 10,000 RPM and 10-20 feet per minute with carbide-tipped saw blades having 40 teeth and should have plenty of set or be hollow ground. A perforated saw blade will run cooler than a solid blade. It is essential that the spindle bearing be tight so that the saw will run true.

Remember: Be sure to hold or clamp the panel securely while sawing to prevent chattering which can cause cracking.

DRILLING

Drills bits designed especially for plastics are widely available. It is suggested that the fabricator utilize such drill bits when drilling Koda XT. Standard twist drills for wood or metal can be used however they require a pilot hole, slower speeds and feed rates to produce a clean, non-gummed hole. Optimum bit speed, feed rate, and applied pressure will depend on hole size and sheet thickness. Drill speeds up to 1,750 RPM are best for smaller holes, while speeds as low as 350 RPM work well when drilling larger holes.

Twist drills used for plastics are suited to working Koda XT — they should have two flutes, a point with an included angle of 60 to 90 degrees, and a lip clearance of 12 to 18 degrees.

Wide, highly polished flutes are desirable since they expel the chips with low friction and thus tend to avoid overheating and consequent gumming. Drills with substantial clearance on the cutting edge of the flutes make smoother holes than those with less clearance. Drills should be backed out often to free chips, especially when drilling deep holes. Peripheral speeds of twist drills for plastics ordinarily range from 100 to 200 ft. (30.5 to 61 m) per minute. The rate of drill feed into the plastic sheet generally varies from 0.010 to 0.025 in (0.254 to 0.635 mm) per revolution.

Remember: When drilling be sure to hold or clamp the part securely to prevent it from cracking or slipping and presenting a safety hazard to the operator.

ROUTING

Routing with sharp two-flute 1-1/8" diameter straight cutters produces very smooth edges. Routers are useful for trimming the edges of flat or formed parts, particularly when the part is too large or irregular in shape for a band saw. Portable, overarm, and under-the-table routers work equally well. Koda XT should be fed to the router slowly to avoid excessive frictional heating and shattering. The router or sheet, whichever is moving, must be guided with a suitable template. It is good practice to employ compressed air during the routing operation to cool the bit and aid in chip removal.

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REFINISHING

Light scratches and scuffs on the patent and sandstone surface finishes can be repaired with a plastic polish. See directions below.

Use 3M Perfect-it Extra Cut Rubbing Compound (06060). Use with the 3M Superbuff™ III Buffing pad (05703). Apply a small amount of compound to the surface of panel before using the wool pad. Apply medium pressure to remove the light scratches. When the scratches have been removed, use light pressure and work the residual compound back into the pad. Use a clean soft cloth to remove any remaining compound. Inspect the surface for scratches, and repeat above if necessary.

COLD BENDING

Koda XT can be cold bent for simple bends and curved areas. The minimum cold bend radius is 100 times the thickness of the panel. For smaller panel dimensions, cold-bends close to the minimum radius may require significant force that may require that the panel to be heat formed.

HEAT FORMING

Some thermoforming techniques can be used to force Koda XT, once heated, into the shape of a mold by mechanical means. For the most part, Koda XT is not vacuum formable (please contact 3form if an application required vacuum forming).

Use only uncoated product for thermoforming. Textured sheets can be formed, but the texture may not remain uniform across tight bends. Tooling can range from low-cost plaster molds to expensive water-cooled steel molds, but felt covered medium density fiberboard is most common. Other materials including wood, gypsum, expanded foam and epoxy can also be used. Forming processes to be discussed include drape, matched-mold, and mechanical.

Temperature for forming ranges from 325°F to 360°F (162°C to 182°C). When forming textured sheet, temperatures should not exceed 330°F (165°C) to prevent complete deformation of the texture. Always test a sample piece before forming the final part.

Koda XT is commonly formed using drape forming techniques. Drape forming is achieved by allowing a heated panel to form to a male mold under gravity or applied pressure. The use of vacuum during cooling is recommended as it keeps the part tight to the mold. For large or very complex parts, it may be necessary to use matched molds. Matched molds, also known as male-female molds apply much greater pressure to the part during the cooling process.

DO

- Inspect sheet prior to molding to confirm that you have the correct product and to verify face and back of sheet.
- Keep molds and sheet very clean. Remove dust with a damp cloth or blow it off with pressurized air.
- Allow parts to cool sufficiently before removing from mold.

DO NOT

- Use coated Koda XT sheet for forming.
- Lay larger formed parts face up while cooling.
- Nest formed parts during storage.

Fastening and Adhesion Techniques

MECHANICAL FASTENING

Koda XT can be fabricated attractively with mechanical fasteners. Mechanical fastening using through-holes is recommended. Self-threading screws should not be used with Koda XT panels. Mechanical fastening is recommended for assembly of larger articles.

3form offers mechanical fasteners designed to work well with Koda XT panels. Hardware solutions can be reviewed on our website, www.3form.com or contact 801-649-2670 for more information.

MECHANICAL FASTENING GUIDELINES

DO

- Use 3form Hardware for best results
- Drill holes oversized to allow for thermal expansion and contraction.
- Insure drilled holes have smooth edges.
- Use washers for better load distribution.

DO NOT

- Over-tighten fasteners. Hand tightened fasteners are sufficient.
- Use self-tapping screws or countersinking hardware
- Use Cyanoacrylate or solvent type thread locking materials.

BONDING (WITH ADHESIVES & CEMENTS)

Koda XT can be fabricated and assembled into a variety of applications and articles with adhesive bonds. Please check with our technical service department before designing an application utilizing adhesive joints. Exterior applications subject the panels to large temperature changes and adhesive joints can crack or break if not designed properly.

We do not recommend using solvents, or cyanoacrylates (superglue) for bonding or seaming Koda XT panels. The use of solvents will permanently damage Koda XT panels by causing solvent induced crazing or stress whitening.

Two-part adhesives are recommended when bonding Koda XT to dissimilar plastics and to bond Koda XT to itself. Plexus Acrybond MA685 is when bonding Koda XT panels to other Koda XT panels.

Although many adhesives are listed as translucent or colorless the bond will NOT be invisible.

When larger articles are to be joined or fastened, mechanical fastening is recommended.

SURFACE PREPARATION

Ensure that all substrates are clean, dry and free of oils, dust or other surface contaminants. The amount of surface preparation directly influences the final bond strength of an adhesive.

- Wipe resin substrates with a 50/50 solution of Isopropyl Alcohol (IPA) and water

DIRECTIONS FOR USE.

When working with a 35 mL or 50 mL adhesives cartridge, verify that you have all of the materials in hand, dispensing gun, plunger (correct ratio), adhesive cartridge(s) and mixing tips. Hand mixing is not recommended and may result in unpredictable results.

Begin by loading the plunger into the dispensing gun. Hold the lever on the back of the gun up to install the plunger. Next slide the back plate off of the bottom of the adhesive cartridge and install into dispensing gun. Snap the cartridge holder in place. Finally remove the tip off of the cartridge and install a mixing tip by twisting into place.

Dispense and discard a small amount of adhesive to assure even ratio and free flow. Full bond strengths for all urethane and acrylic adhesives is 72 hours. See the 3form Adhesives Matrix available on www.3-form.com for specific working times and cure times.

When bonding the edges of Koda XT panels, first mask the the face of the panels with masking tape closest to the edge to be bonded. Next apply the adhesive to the edge of the panel with an adhesive gun. Spread the adhesive evenly along the joint. Apply the adhesive to the second surface to be bonded. Finally, use a clean rag with isopropyl alcohol to clean any adhesive that dripped out of the joint. Apply light to moderate pressure to joint during curing process.

BONDING TECHNIQUES: VHB TAPE

Clear 3M™ VHB™ tape 4910 or 4905 can be used to adhere Koda XT to a variety of substrates while still achieving desirable aesthetics. 3M VHB tape can be used to attach Koda XT to sealed wood, sealed ceramics, metal, glass and some other plastics. VHB tape is UV stable and can be used in interior and exterior conditions as well as in the toughest environmental conditions. 3M VHB tape provides an excellent seal against moisture, however splices or seams in the tape may require additional sealing. The tape can tolerate some shear extension due to substrate movement from thermal expansion and contraction. Special

surface preparation is needed before applying 3M VHB tape to a Koda XT panel. First both surfaces are to be cleaned with a 50:50 mixture of isopropyl alcohol and water. Next the Koda XT surface to be used should be primed using 3M Primer 94. (On the area to which the tape is to be applied requires primer). Follow the manufacturer's directions on how to safely handle and apply this primer. After the area has been primed and is dry, the tape can be applied to the first surface. Only handle the tape by the edges and apply firm pressure to the tape using a roller. Attach the second bonding substrate and apply pressure on the finished joint with a roller. Apply firm application pressure to the entire length of the taped area (at least 15 psi is necessary) to develop good adhesive contact and to improve the bond strength. Bond strength will increase over time with 90% of the ultimate strength developing after 24 hours and full strength after 3 days. Ultimate bond strength can be achieved more quickly by exposure to higher temperatures (e.g. 150°F for 1 hour). If the entire weight of the Koda XT panel is supported by the 3M VHB Tape, a minimum of 4 in² of tape should be used for every pound of panel weight to be supported. Call the 3form Technical Help desk at 877-649-2670 for help, especially when bonding Koda XT to other nonmetal substrates.

DO

- Seal porous materials like cement and wood before bonding.
- Keep tape away from debris and handle tape by the edges.
- Make sure both surfaces are clean and dry.
- Use a 50/50 isopropyl/water solution for metal and plastic surfaces.
- Apply 3M Primer 94™ on Koda XT surface to be bonded.
- Apply VHB Tape to first surface, apply firm pressure (more than 15psi) with a roller.
- Remove liner from second side and apply to second surface.
- Apply very firm pressure to entire bond line.
- Wait 72 hours until tape has reached full adhesion strength (1 day = 90% strength).

APPLICATION TECHNIQUES: SILICONE SEALANTS

Momentive Performance Materials SilGlaze II SCS2800 and Construction SCS1200 can be used to seal Koda XT in glazing applications. SilGlaze II is not a structural silicone and should not be used to create a bond that may experience any type of loading. For structural applications use Construction SCS 1200. SilGlaze II is a one part, neutral, fast curing silicone sealant. This can be used as a general-purpose weather and glazing sealant for Koda XT panels. SilGlaze II is not recommended for applications where the product will be in continuous contact with water. Further SilGlaze II sealant cannot be used on bare metal or surfaces that are susceptible to corrosion. This silicone sealant is formulated to adhere to glass, vinyl extrusions, fluoropolymers, acrylics, polyester paints, powder coated aluminum, and most other plastics. Momentive SS4004P (or tinted SS4004P) silicone primer can be used to enhance adhesion to substrates if desired.

To apply, the surface must be wiped free of debris then wiped with a cloth wetted with pure 100% isopropyl alcohol, then followed by wiping with a clean dry cloth. In a continuous operation apply the sealant horizontally in one direction and vertically from bottom to the top. Apply the sealant with positive pressure by pushing the bead ahead of the nozzle and making sure the entire cavity is filled. Tooling should force the sealant into contact with the sides of the joint or cavity, eliminating any voids. (Dry tooling is recommended.) Maximum cure depth from an air interface should not exceed 3/8". Excess sealant should be wiped away with a solvent (IPA) before curing. Additional technical support can be reached by contacting the 3form Technical Help Line at 877-649-2670.

DO

- Insure all surfaces are clean and free of debris.
- Use proper surface preparation on all surfaces to be sealed.
- Use in applications where the silicone has access to atmospheric moisture.
- Use a colored sealant when necessary (white, black, aluminum, blue white, bronze and beige are available).

DO NOT

- Use in underwater applications or applications where there is continuous contact with water.
- Use in food contact applications.
- Use on bare metals or surfaces that can corrode (i.e. mill aluminum, bare steel, etc.)
- Use in cavities or designs where the cure depth exceeds 3/8" (9.6 mm) from an air interface.

The following table lists several solvents and adhesives that provide strong bonds when used in product sheeting fabrication operations.

ADHESIVES AND SEALANTS FOR PRODUCT FABRICATION

PRODUCT NAME	DESCRIPTION	APPLICATION
Plexus Acrybond MA685	2-Part Acrylic Adhesive	Koda XT to Koda XT, polycarbonate
Devcon Plastic Welder II	2-Part Acrylic Adhesive	Koda XT to wood, metal, concrete or drywall
3M VHB 4910 Clear Tape	2-Sided Tape	Koda XT to sealed wood, metal, glass or other plastics
Momentive SilGlaze II SCS2801	Clear Silicone Sealant	For sealing applications (glazing)
Momentive Construction SCS1201	Clear Structural Silicone	For structural silicone bonding

DO

- Start with a flat surface.
- Insure sheet edges and surfaces are clean and free from contamination.
- Wipe surface with a 1:1 mixture of isopropyl alcohol (IPA) and water.
- Allow surface to dry thoroughly before bonding.
- Insure that surfaces to be bonded are smooth, mate well, and are accurately aligned.
- Mask both sides of each sheet near the edge during bonding operation.
- Use a jig or fixture to securely hold parts being bonded together while curing.
- Wipe extra adhesive away from the panel using a rag with IPA before it is fully cured.

Cleaning Instructions

3form Koda XT, like all thermoplastic resin materials, should be cleaned periodically. A regular, seasonal cleaning program will help to maintain the aesthetics and life of the material.

Rinse the sheets with lukewarm water. Remove dust and dirt from Koda XT with a soft cloth or sponge and a solution of mild soap and/or liquid detergent in water. A 50:50 solution of isopropyl alcohol and water also works well. Rinse thoroughly with lukewarm water.

Always use a soft, damp cloth to blot dry. Rubbing with a dry cloth can scratch the material and create a static charge. Never use scrapers or squeegees on Koda XT. Also avoid scouring compounds, gasoline, benzene, acetone, carbon tetrachloride, certain deicing fluids, gasoline, lacquer thinner or other strong solvents.

3FORM RECOMMENDED PRODUCTS

Windex, Formula 409, Simple Green, Fantastik, 10:1 Water/Bleach Solution

DO:

- Use warm water, mild detergent and a soft cloth or chamois.
- Blot dry with a slightly damp soft cloth or chamois.

Keep cleaner one inch away from stand-offs or other mounting hardware.

DO NOT:

- Use squeegees or scrapers as they may scratch the sheet.
- Use scouring compounds or solvents such as: acetone, gasoline, benzene, carbon tetrachloride, or lacquer thinner to clean sheet.
- Clean in hot sun or elevated temperatures.
- Use a dry cloth or a cloth of synthetic fiber such as rayon or polyester as they may scratch the sheet.
- Use cleaners around edges or holes where the cleaner can wick into the interlayer.

Note: If a cleaning material is found to be incompatible in a short-term test, it will usually be found to be incompatible in the field. The converse, however, is not always true. Favorable performance is no guarantee that actual end-use conditions have been duplicated. Therefore, these results should be used as a guide only and it is recommended that the user test the products under actual end-use conditions.

For more information, please visit 3-form.com or call 877-649-2670.