

# WORKING WITH ASTARIGLAS®

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ISO 9001: 2008 Certified Quality Management System

# CARE & MAINTENANCE

Before starting, there are ways to store ASTARIGLAS® Cast Acrylic Sheet. There are many problems occurring when the sheets are not store carefully and properly as they might warp.

## • **Storage | Do's and Don'ts**

### **DO**

- Keep in a well ventilated room or area with consistent temperature: The sheets are best to keep in a cool and dry place.
- Store the sheets horizontally on a flat surface: It is best to store the sheets on top of wooden pallets.
- If the sheets are stored vertically, keep in special or customized racks: Allow the sheets to lean approximately 10°.

### **DON'T**

- Avoid keeping the sheets in an extreme temperature: The sheets might deform or expanded.

## • **Handling**

- Do not slide the sheets across work surface debris as dirt and chips can penetrate the masking, scratching the sheet.

## • **Masking Removal**

- It is recommended to remove the film or paper masking starting from the corner of the sheet.
- Avoid handling unmasked sheet.
- Do not use sharp-edged objects such as razor blades. If there is any oily film left behind by solvents, it should be removed immediately by washing.

## • **Cleaning**

- You can use soap solution to remove any dirt, oil or grease on the sheet.

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# SAFETY

- Wear mask when sanding or when working in an area and/or produce small particles.
- Work in a proper environment with well-ventilated room.
- Always wear safety glasses/ goggles.
- When gluing, always wear rubber gloves.
- Wear protective gloves when mobilizing ASTARIGLAS® products with sharp edges especially thick sheets.
- Wear hearing protection, when working with heavy equipment or in high noise work areas.

# CUTTING

## 1. TABLE OR PANEL CIRCULAR SAW CUTTING

The fastest and easiest way to cut ASTARIGLAS® is by using circular saw. Below are the dos and don'ts when cutting ASTARIGLAS®:

### DO

- **Keep the blade sharp:** Sharp teeth are essential for achieving good results.
- Always use safety glasses.

### DON'T

- **Don't use the saw blade to cut other materials:** It's important to dedicate saw blades for cutting acrylic only. Cutting other materials on saw blades intended for acrylic will dull or damage the blade and lead to poor cutting performance when the blade is used again to cut acrylic.
- Never cut Acrylic freehand always have it securely fastened down of safety.
- Never cut Acrylics on slow speed setting.

## 2. HAND HELD SAW

It's important to have the ASTARIGLAS® well secured while cutting. This can be achieved by using clamps or in this case we are using a hand held saw with a guide. Using this system will give you a straight and even cut and helps holds ASTARIGLAS® down. For the best results use a triple chip blade this will give a fine cut edge ready to polish no need to sand. Using a triple chip blade, you will get a nice even cut. This result will save you time if you need to polish the cut edge.

## 3. BAND SAW

For all thicknesses of material, the saw guides should be kept as close together as possible in order to reduce the tendency of the blade to twist. This ensures straight cutting and longer working life for the blade. Compressed air should be directed at the point of contact to cool the acrylic and the blade, as well to clear the chips.

## 4. SCRIBE – BREAKING

ASTARIGLAS® up to 5mm thick may be cut in a straight line by deeply scribing one surface with a sharp metal scriber, clamping the sheet with scribed line uppermost and aligned with the edge of a bench, and breaking the sheet by pressing steadily downwards on the free part. In general, however, sawing is a more reliable and controllable method of cutting ASTARIGLAS®.

## 5. LASER CUTTING

Laser cutting is a compute controlled cutting method. Greater creativity and precision for cutting ASTARIGLAS® are advantages of this method. Thicknesses up to 30mm can be cut although there is some reduction in the quality of the edge finish above 12mm. Laser cut edges can be a high standard with a polish equal to that produced by flame polishing depending on the power and feed rate.

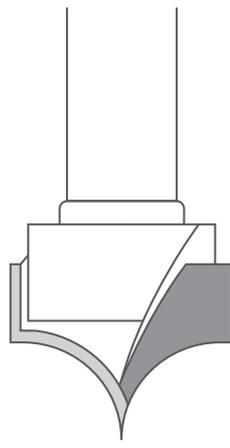
## 6. ROUTING

### a. Manual Feed Routers

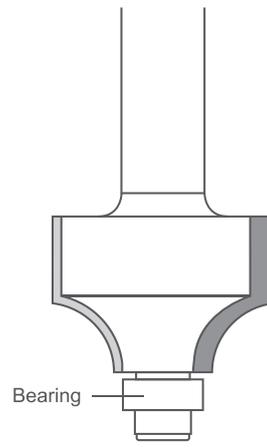
- When cutting ASTARIGLAS® with a freehand router you will find it will want to grip the acrylic causing the router to jump and that will cause all types of problems.
- When using a hand router, we recommend you should use a jig as this will help keep the router in line and give you good results every time.
- Being that a router spins at high speed it will give you a good finish.
- For the best results in cutting ASTARIGLAS® make sure the panel is secure and don't allow any movement while cutting.
- Standard high-speed wood working routers may be used for machining ASTARIGLAS®.



Straight Router Bit



Needle Nose Router Bit



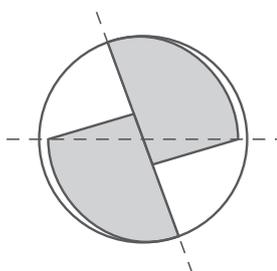
Carbide Tipped Corner Round; Requires jig

### Common Router Bits

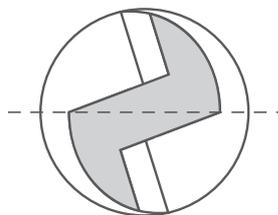
These are the typical router bits used for routing ASTARIGLAS®. There are many kinds of router bits available in the market depending on your needs.

### b. Computerized Numerical Control (CNC) machines

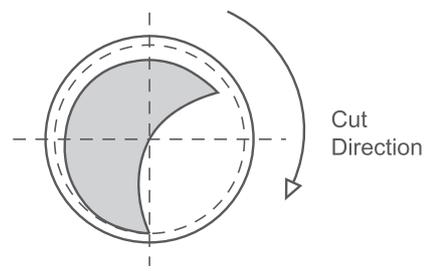
CNC machines are available from several manufacturers for high volume production. Today there are many companies manufacturing CNC routers servicing industries that fabricate wood, metal, and plastic products. As a result, a variety of machine designs are available to fit different job requirements. It is highly recommended to use one flute high rake low clearance router bit to cut ASTARIGLAS®.



Low or no rake;  
Low clearance  
**For Metal**



Medium rake;  
High clearance  
**For Wood**



High rake;  
Low clearance  
**For Plastic**

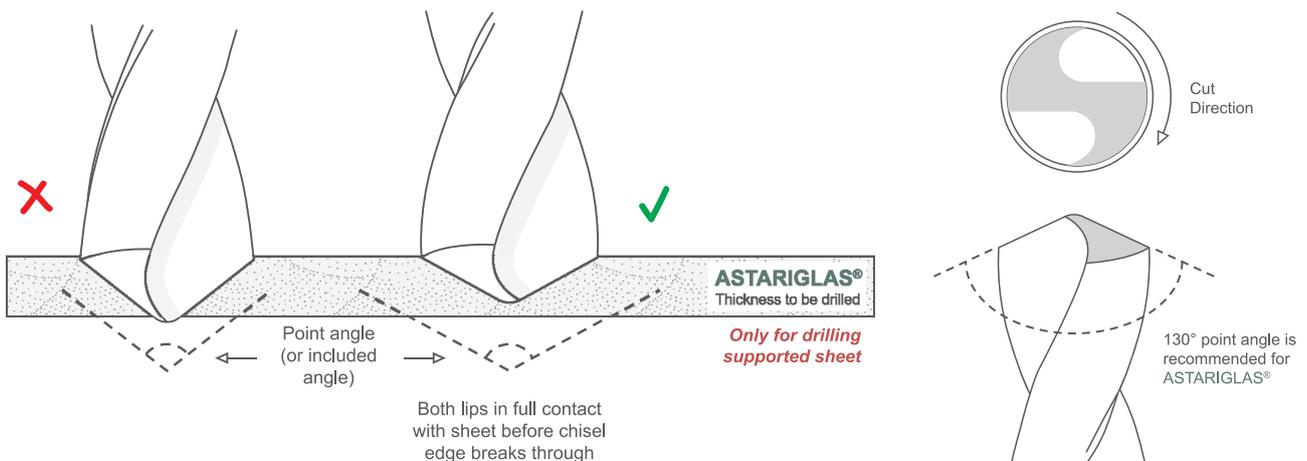
## 7. PLANING

Planing ASTARIGLAS® can be easy as long you give a few millimeters tolerance. A planer is a tool that spins at high speed that scrape off acrylic edge and if used correctly will give you good results. You will not need to sand the edge after planing ASTARIGLAS®, just wipe clean and the sheets are ready for gluing, hand or flame polish. Planing is one of the fastest way to give ASTARIGLAS® a great finish.

## 8. DRILLING

Drilling ASTARIGLAS® can be difficult however if you take your time and use the right drill bit you will have success. You must have ASTARIGLAS® supported at all times and reduced the heat generated during the process to a minimum, this will stop the acrylic from flexing while drilling and obtained a well-finished results. You can reduce the heat by applying coolant, adjusting drilling speed and feeds. For drilling thin sheet, the standard included angle of the point may require modification to ensure that the whole of the cutting edge is in contact with ASTARIGLAS® before the point breaks through the sheet. If this precaution is neglected, an untrue hole will result.

It is important that the drill point should not penetrate the back surface until the drill flights have entered the top surface. This will reduce the chance of the drill snatching at the acrylic as it breaks through and hence generating notches on the back surface.



# FORMING

## 1. LINE BENDING

Line bending is a process to bend acrylic in a straight line. It's a very simple process which is to heat ASTARIGLAS® in a straight line until it can bend easily.

### • Heaters

There are three types of heating equipment to choose depending on ASTARIGLAS® thickness:

### A. Straight Nichrome Resistance Wire Heater

- This is the most common equipment to bend ASTARIGLAS® up to 3mm (0.125 inches) thick. It functions similarly to a household electric toaster by passing electricity through a wire.
- You can bend material thicker than 3mm (0.125 inches) on this unit, but the material must be flipped over halfway during the heating cycle.
- Heat the material until it bends easily. Experience will teach you how long to heat each part. Don't overheat or lay acrylic sheet directly on the heating element - doing so will blister and/or mark the sheet.
- Bend the heated part to the desired shape and quickly place it in a cooling jig. To retain the bend while you do other work, secure the part in the jig with weights or clamps. Cooling time normally equals heating time.
- When line bending with only one heating element, be sure to bend away from the heated side. For example, if the nichrome wire is on the bottom, bend upwards.

### B. Tubular Rod Heaters

- It has the heating element of an electric stove. Able to heat sheet thicker than 3mm (0.125 inches).
- Power the heater with a variable transformer.
- Place a reflector, preferably of split aluminum conduit for its good reflectivity, beneath the rod.
- For shorter heating cycles, mount heaters above and below the sheet.



### C. Radiant Quartz Tube Heaters

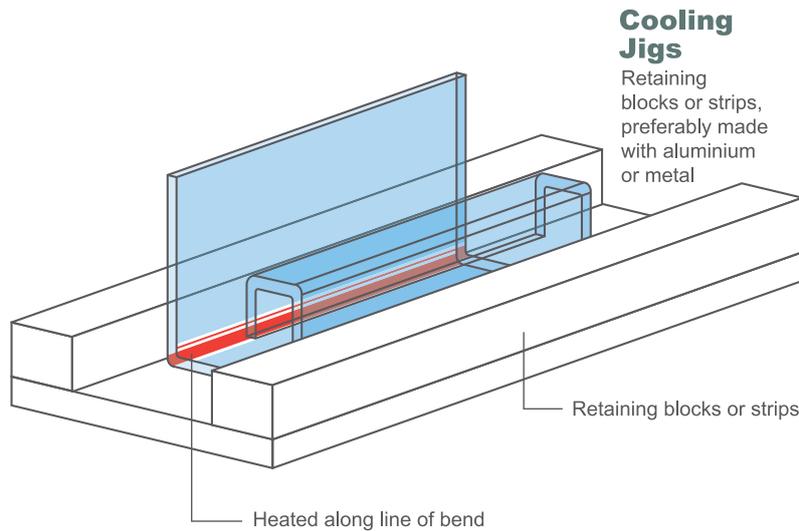
- Quartz tube heaters are among the most efficient sources of radiant energy. They look like a thin fluorescent light bulb. These units provide capability to bend acrylic sheet 6mm (0.25 inches) thick or greater.
- The heater consists of a coiled resistance wire housed in a quartz-coated glass tube.

#### **Application Tips:**

- Use a reflector with a quartz tube heater for most efficient heating.
- For short heating cycles, mount heaters above and below the sheet.
- Power the heater(s) with a variable transformer

• **Cooling Jigs**

A cooling jig assures that your bend is at the proper angle and to prevent the piece from “springing back” into its original shape. On the left is an all-purpose jig for 90° bends. You can modify it to suit the part. A cooling jig which exposes both sides of the heated sheet to air (right) will accelerate cooling and reduce stresses. The sheet springs back slightly when released, so it must be bent slightly further than is required in the finished article. ASTARIGLAS® may shrink along the line of heating, therefore some bowing may be expected where there are narrow flanges.



• **Sharp Line Bends**

For sharp line bends with no deflection, it’s a good idea to v-groove the sheet, as show above. Use a v-rabbit router bit or a table saw; making two opposed 45° cuts. To have a bigger fold radius, make the cut approximately 1/3 of the sheet thickness, and to have a sharper line bends, cut the v-groove deeper. V-grooving the sheet reduces the material cross-section at the point of bending, reducing stresses and making bending easier. A wire heater beneath the cut will help create a sharp angle bend without deflections or bowing.

**2. THERMOFORMING**

Another way of shaping ASTARIGLAS® is by thermoforming. It is a manufacturing process where a plastic sheet is heated to a pliable forming temperature, formed to a specific shape in a mold, and trimmed to create a usable product. The sheet temperature is critical. If not heated enough, the sheet will not acquire good part definition, too hot and the acrylic will pick up mark-off from minor imperfections in the mold. Mold temperature is also important for good part definition, and to provide gradual cooling to minimize stress and crazing

When ASTARIGLAS® is first heated to thermoforming temperature its shrinks to 2% smaller after cooling in both length and breadth and approximately 4% thicker. If the sheet is subsequently re-heated, no further change occurs. There should be a few adjustments and allowance when cutting ASTARIGLAS® to size before thermoforming.

**COOLING**

After thermoforming ASTARIGLAS®, it should be kept on the mold or jig until it has cooled to 60°C or below. Uniformity of cooling is important to avoid warpage and stress and therefore forced cooling is not recommended.

# GLUING

## 1. ANNEALING

Annealing is the process of relieving stresses in fabricated ASTARIGLAS® by heating to a predetermined temperature for a set period of time, and slowly cooling the parts. Sometimes, fabricated parts are placed in jigs to prevent distortion as internal stresses are relieved during annealing. Stresses in ASTARIGLAS® can cause crazing when the acrylic comes in contact with solvents such as glass cleaners and some paints and inks. Stress due to water absorption can also cause crazing.

*Studies have shown that annealing can also increase bond strength by more than 50%.*

### **Annealing Procedures:**

#### **Before Annealing**

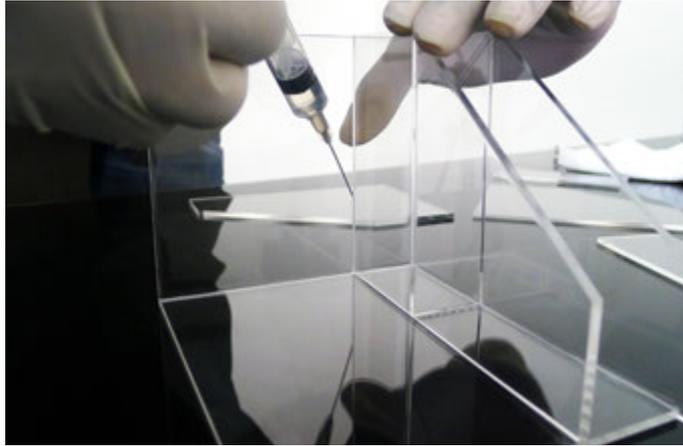
- Support part that is being anneal to avoid stress. Lack of support may inhibit relaxation or cause warpage.
- Be sure parts are clean and dry before annealing.
- Remove paper masking to avoid baking it onto the material.
- Remove any spray masking, protective tape, or similar material.
- Plastic masking may remain in place.
- If the only fabrication you have done is surface machining and you do not need to anneal glued joints, heating time can be reduced. This reflects the fact that machining forms stresses only at and slightly below the surface - the entire sheet thickness needn't be annealed. Heat at least two hours; cool the same amount of time.
- If holes have been drilled entirely through the sheet, position the part so heated air flows through the holes.
- If you are annealing following gluing, allow the part to sit at least six hours to avoid bubble formation resulting from rapid solvent evaporation in the joint.

#### **Annealing ASTARIGLAS®**

- Heat acrylic sheet to 180°F (80°C), just below the deflection temperature, and cool slowly.
- Heat one hour per millimeter of thickness - for thin sheet, at least two hours total.
- Cooling times are generally shorter than heating times - see chart on next page. For sheet thickness above 8mm, cooling time in hours should equal thickness in millimeters divided by four. Cool slowly to avoid thermal stresses - the thicker the part, the slower the cooling rate.
- Wait until oven temperature falls below 140°F (60°C) before removing items. Removing a part too soon can offset annealing's positive effects.

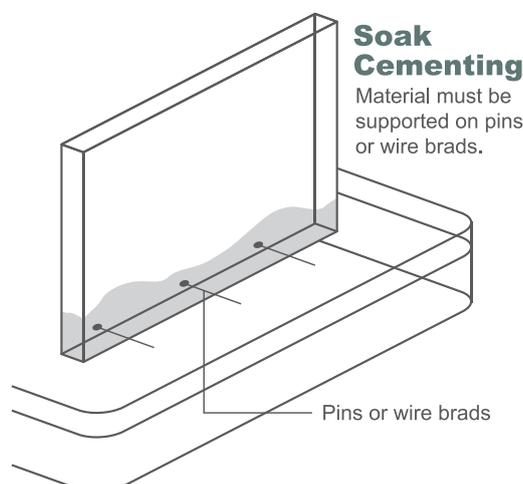
## 2. CAPILLARY GLUING

- The most popular way to join ASTARIGLAS® is by capillary gluing. It is mainly because of the ability of low viscosity, solvent type glue to flow through a joint area by capillary action. Properly done capillary gluing yields a strong, transparent joint.
- If the glue does not flow completely into the joint, tilt the vertical piece very slightly (about 1°) toward the outside. This should allow the solvent to flow freely into the entire joint. Then, tilt the piece back again for a square corner.
- The initial bond forms in five to ten seconds. Wait three hours before doing subsequent processing. High strength is reached in 24 - 48 hours. Strength will continue to build for several weeks.



## 3. DIP OR SOAK GLUING

- Pour solvent glue into a dip pan.
- Dip the edge to be joined in the solvent 20 seconds for thin sheet and 30 seconds for relatively thick material. Time varies for different solvents and bond strength requirements.
- Do not expose too much area to the solvent, it will produce a weak, slow-setting joint.
- Lift ASTARIGLAS® from the glue and allow excess solvent to drain off.
- Place the soaked edge on other part to be joined and hold it together for 30 seconds with no pressure
- Apply pressure just to squeeze out air bubbles. Be careful not to squeeze out the cement.
- Use a jig or clamp to maintain firm contact for 10 to 30 minutes.
- The initial bond forms in five to ten seconds. Subsequent processing can be carried out after three hours. The bond will achieve high strength in 24 to 48 hours. Strength will continue to build for several weeks.



#### 4. VISCOUS GLUING

- Use viscous glues to join parts that can't be glued by the capillary or soak solvent methods. Either because the joints are hard to reach or because the edges don't fit well together. Viscous glue is thick. It will fill small gaps and make strong, transparent joints where solvent glues can't.
- Remove the masking from around the joint area.
- Apply a bead of glue to one side of the joint using a brush, spatula, or the cement applicator.
- Join the pieces together as described under 'soak gluing'.
- A solvent resistant tape may be applied to protect the area around the joint and should be removed after five minutes, while the glue is still wet. ***Don't touch the parts at all for the critical first three minutes, or the joint will not hold.*** The part may be carefully moved after ten minutes.

For all types of gluing, there are some dos and don'ts that must be followed when gluing ASTARIGLAS®:

#### **DO**

- Edges must be cleanly cut and/or properly machined.
- Finish all rough edges on a jointer, shaper or edge finisher: If you cannot do so, wet-sand the edges with a flat surface or block.

#### **DON'T**

- Don't use a dull blade to saw cut: It will cause melting or chipping on the edge, that may result in crazing of the material when in contact with solvent.
- Don't polish edges that are to be glued: Polishing will produce a convex edge with rounded corners and will result in an unsightly, weak joint. Also, a flame-polished edge may craze when it contacts solvent glue.

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## FINISHING

### 1. SURFACE POLISHING

Finishing ASTARIGLAS® can be achieved by polishing a treated acrylic surface. There are several steps to buff or polish ASTARIGLAS® surface:

1. ***Dry and wet sanding (Hand polishing):*** It is preferable for dealing with minor scratches and other slight surface damage.
  - To remove deep scratches, start by dry abrasive paper, progressively to the finer sanding grade with water. Water helps to not making more scratches or notches to ASTARIGLAS® surface.
  - The abrasive paper should be pinned into position on a 50mm (2in) square cork sanding block with chamfered edges and used with a circular motion and only finger-tip pressure.
  - The larger the area of abrasion the less distortion will be noticed. Using 600 or 1200 grade as a final abrasive the gloss surface can then be restored by polishing.

- 2. Applying polishing liquids or compounds:** After sanding, put a proper amount of polishing liquids or compounds onto the acrylic surface.
- With the buffing wheels, start by wetting the whole buffing pad surface as you push the acrylic onto the bottom part of the pad. The wheels should move clockwise if you are right-handed, and vice versa. Start turning the wheel slow and progressively fast.
  - Polishing ASTARIGLAS® requires a compromise between the speed of the buff and the pressure applied.

## 2. EDGE POLISHING

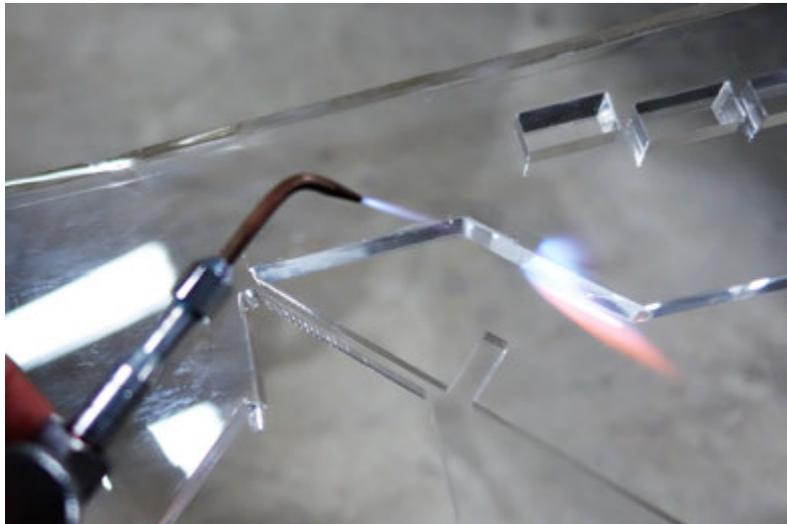
### a. BUFFING

Polishing ASTARIGLAS® edge using buffing wheel has the same process as polishing acrylic surface.

The edges must be sanded to a certain level of grade before using the buffing wheels.

### b. FLAME POLISHING

- Polishing method using torch for a rounded and detailed acrylic edge.
- Flame polishing should be done with an oxygen-hydrogen welding torch.
- The flame should be bluish, nearly invisible, approximately 75mm (3 inches) long and narrow.
- Hold the torch at the angle shown and draw the flame along the edge of the sheet. Practice will help you to estimate the speed and distance.
- If the first pass does not produce a completely polished edge, allow the piece to cool, then try a second pass.



### c. DIAMOND POLISHING

Diamond Polishing ASTARIGLAS® will help to obtain high quality polished edge in large quantity.

Edges of acrylic sheets are moved over sharp with fast-rotating diamonds. Polishing result is so good that can be compared with cast surfaces. The method is relatively inexpensive. It is suitable for large batches.

**Straight and sloping edges only.**



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