CORIAN® ENDURA™ CUTTING AND EDGE POLISHING

Introduction

This bulletin discusses important guidance for cutting Corian® Endura™ high performance porcelain. There is general guidance that applies to all cutting methods, as well as specific saw, CNC and waterjet parameters.

Overview

Corian® Endura™ requires a specific cutting sequence and placement of cutouts. The placement of cutouts, direction and sequence of cuts all are important. All cutting operations are performed with water to safely manage crystalline silica and provide cooling for the tooling.

A. Silica Safety

Operations such as sawing, routing and sanding can generate dust. Dust generated during the handling of porcelain products can contain particles of crystalline silica (quartz) and overexposure to airborne quartz dust can lead to silicosis. DuPont has created a silica safety education video on the health hazards associated with silica dust exposure, as well as engineering controls, personal protective equipment needed and fabrication techniques/ procedures to be used to reduce or eliminate this exposure. This video can be found at: https://www.youtube.com/watch?v=dAIb0hOYcZs

B. Cutting Principles

Cutting sequences are designed to minimize stress on the slab and avoid creating conditions that could lead to cracking. Proper support is required to prevent movement and cracking of the slab during cutting.

The slab is trimmed before additional processing. This removes any area where the pattern was not printed and an area with higher stress around the perimeter.

In general, the slab is cut from the exterior to the interior. Cuts that don't completely exit the material should be made to a drilled hole or radius. Do not perform partial cuts or cross cuts that result in a sharp cut tip. This greatly concentrates stress and can lead to product failure.

Cutting should be done with an abundance of water, this keeps the part and cutting tool cool and prevents airborne crystalline silica.

After cutting, rinse the material to remove any residue before the pieces have dried. The residue may be difficult to remove after it dried and could affect the finish of the surface.

C. Trim Removal

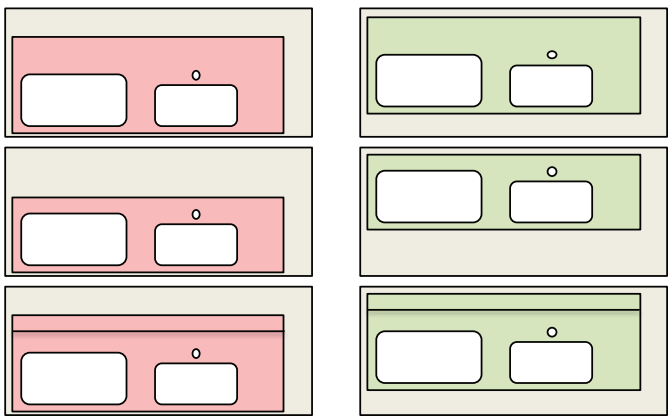
Remove a minimum of 15 mm (0.6") from each edge. For slabs with decorative surface patterns make sure the trimming removes any areas lacking the pattern. Cut the longer edges first, then the shorter edges of the slab.

Figure C-1: Slab Trimming, Cut Long Sides (blue) First

D. Part Orientation

Holes, such as for lavatory, sink, or cooktop cutouts should be placed towards the center of the slab. Edges (miter or straight) should be located towards the edge of the slab.

Figure D-1: Workpiece Orientation, Left – Incorrect, Right - Correct



E. General Bridge Saw Guidelines

Use blades designed to cut ceramic/porcelain/ultracompact materials. Sharpen/dress the blade regularly.

WARNING

The cutting direction must always be the same as the saw blade rotation direction.

Use an abundance of water when cutting. Direct the water at the front and sides of the saw blade, as close as possible to the cutting area (as shown in the figure below).

Figure E-1: Use Water to Cool Blade and Slab

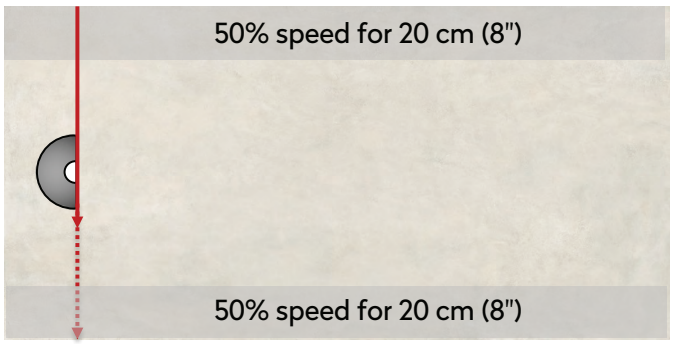
Caution: insufficient water flow can cause the saw blade and slab to overheat, potentially leading to slab or blade failure.

Make sure that the saw bed is in good condition and flat. If the saw bed is in poor condition, place a sheet of high-density rubber between the slab and the table, reducing vibrations and improving the cut finish. Poor support can lead to cracking if the parts shift at the end of the cut.

It is important to slow the feed rate down 50% for the first 20 cm (8") and the last 20 cm (8") of each cut.

Make sure the blade completely exits the slab before stopping blade.

Figure E-2: Reduced Speeds at Entry and Exit



Restrain small pieces to prevent moving during cutting.

Always wash the slab to remove residue before it dries.

The saw blade rotational speed varies with blade diameter to maintain tip velocity. If the spindle speed is fixed, you should choose the saw blade that requires a speed as close as possible to that of the spindle.

TABLE E-1: SAW BLADE RPM SETTINGS

Saw blade Ø	Spindle revolutions (RPM)
12 in - 300 mm	2300-2500
14 in - 350 mm	2000-2200
16 in - 400 mm	1700-1900
18 in - 450 mm	1400-1800

TABLE E-2: WET SAW FEED RATE

Slab Thickness	6 mm (1/4") 12 mm (½")	20 mm (¾")
Cut entering from above the slab	4"/min 100 mm/min	4"/min 100 mm/min
Straight cut	47-63"/min 1200-1600 mm/min	32-39"/min 800-1000 mm/min
Inclined cut	28-35"/min 700-900 mm/min	24-28"/min 600-700 mm/min

Note: The parameters listed above are intended for best practices of an oversized flange on the saw blade for rigidity, plenty of well-directed water, a flat cutting surface and reduced cutting rate on entry and exit. If the above conditions cannot be met, reduce the feed rate to the minimum of the listed speeds. The high end of cutting speeds requires the blade RPM to be at high end of range from Table E-1. 6 mm slabs may be more prone to movement while cutting.

Warnings

Any increase in the saw's input current indicates that the saw blade needs to be dressed with a grinding stone. If the blade is sharp this indicates the feed rate is too high.

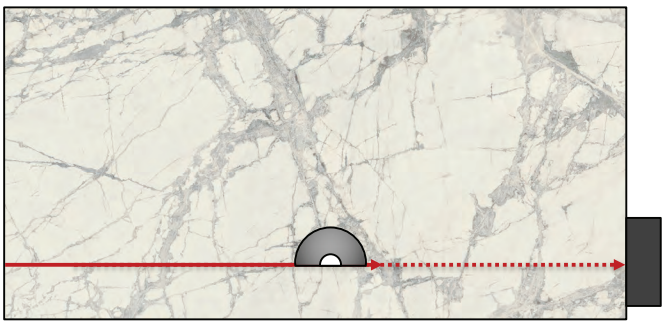
E.1 FLANGE DIMENSIONS FOR STRAIGHT OR INCLINED CUTS

Use a flange that minimizes the distance from the flange to the top surface of the slab. This keeps the blade rigid and helps prevent chipping. The saw blade should extend past the bottom of the slab by about 1 mm.

E.2 QUARTZ

A scrap piece of a quartz slab placed where the saw blade exits the slab will limit deflection of the blade as it exits the slab, reducing chipping of the material. This also will hone the saw blade.

Figure E-3: Use of Composite Stone



E.3 CUT ORDER FOR SINK WITH SAW BLADE

Sink cutouts are best done with a waterjet or CNC. If necessary, a sink cutout can be created with a combination of drilled holes and a saw. The minimum distance to edge from cutout is 5 cm (2").

First, drill holes at corners. The holes must have a minimum radius of 5 mm ($^3/_{16}$"). Once the holes are cut the sides may be cut, starting with the long sides first.

E.4 KEEP PART CLEAN

After each machining task, rinse the surface liberally with clean water before the workpiece has dried. Cutting debris will be more difficult to remove after drying and could act as an abrasive, damaging the finish.

F. General CNC Guidelines

Corian® Endura™ requires proper support during cutting and proper machining paths. The parameters provided are starting points. Exact tool sequence and material removal will depend on the specific tooling used.

F.1 CNC TOOL PARAMETERS

TABLE F-1: MILLING TOOL PARAMETERS (ALL THICKNESSES)

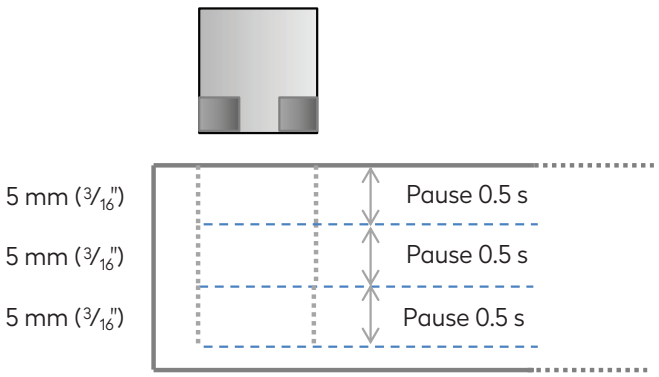
Cutting Operation	Spindle RPM	Feed rate
Core Drill Kit (35 mm, 1 $^3/_8$")	4000-5000	15-20 mm/min (0.6-0.8"/min.)
Cutting tool (candle miller) 19-22 mm Dia.	4000-5000	300-350 mm/min (12-14"/min.)
Flush Countertop tool (15 mm, ½" Dia. or Incremen-tal Milling Tool	5000-6000	300 mm (12")/min Maximum Removal 3 mm (0.12")/pass

The maximum depth of rebate for flush mount sink or appliance installation is 3 mm.

Do not make cuts with an oscillating tool.

Core drilling should be cut from the face to the back. To avoid chipping on the back of the workpiece, stop 2 mm ($^1/_{16}$") from the bottom and complete plug removal by hammering from the side opposite the hole.

Figure F-1: Core Drilling



Excessively reducing the cutting speed may cause damage to the cutting tool diamond concretion, generating excessive force on the workpiece and causing it to break.

During machining, use plenty of carefully directed water on the outside and inside of the tool.

F.2 SINK CUTOUTS WITH A CNC

Use only suction cups and Teflon® positioning end stops. Devices that apply mechanical force on the slab could cause fracture.

Distribute the suction cups appropriately to support the areas of the workpiece that are the most highly stressed during the machining process. Make sure the cups are positioned to support the resultant pieces from cutting, particularly place suitable suction cups to support the narrowest areas of the workpiece. This highest stress will be just before a cut separating separate pieces is completed. The slab must be supported so there is no deflection. Before positioning the workpiece make sure the suction cups are clean and free of residues from the previous work process; if necessary, rinse the suction cups thoroughly with clean water before starting any processing.

Figure F-2: Improper Suction Cup Support Placement

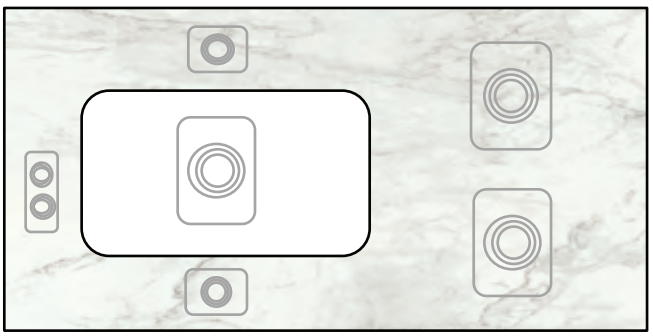
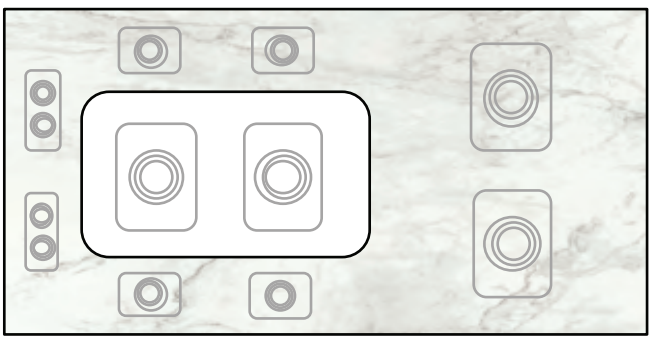


Figure f-3: Proper Suction Cup Support Placement



Entry should be made inside the cutout 50 mm (2") from the final perimeter. The radius of entry of the milling tool to the perimeter must be wide to facilitate exit of the tool at the end of the machining process and prevent chipping that could damage the workpiece.

Figure F-4: Improper Radius of Entry (90°)

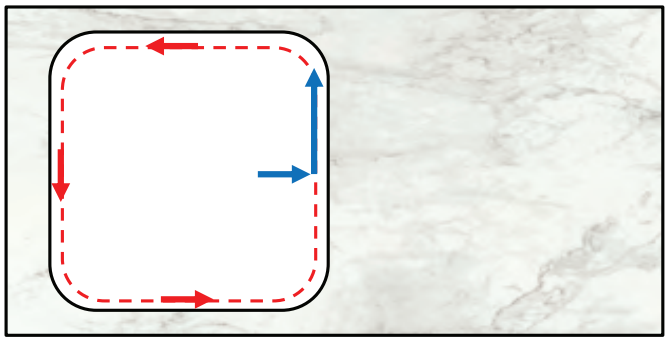
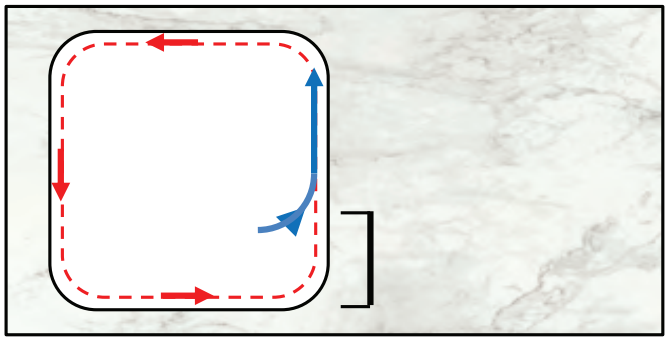


Figure F-5: Proper Radius of Entry, Reduce Speed 50% for last 150 mm (6")



Internal corners should have larger radii than the radius of the milling tool, this ensures smoother machine movements less stress.

Figure F-6: Incorrect Inside Radius

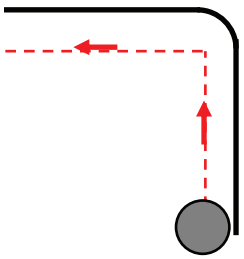
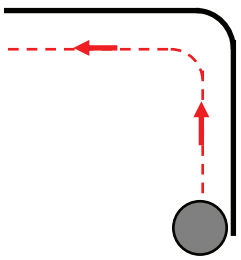


Figure F-7: Correct Inside Radius



When milling it is good practice to center the tool with respect to the thickness of the slab: this precaution reduces vibration and reduces the force exerted on the workpiece and on the tool.

Do not oscillate the tool back and forth during the cutting operation.

Figure F-8: Tool not Centered

Figure F-9: Tool Properly Centered

F.3 PROBLEM SOLVING

Tool breakage may be due to:

a. excessive feed rate

b. RPM far below recommendation

c. insufficient cooling water

Top fracture may be caused by improper support. Make sure support is based the separate part remaining after cutting. This avoids excessive stress caused by parts shifting when the cut is almost complete. Alternatively, for large cutouts the interior of the cutout may be cut into several pieces, reducing the weight of any individual piece, before cutting the outer portion of the cut.

F.4 KEEP PART CLEAN

After each machining task, rinse the surface liberally with clean water before the workpiece has dried. Cutting debris will be more difficult to remove after drying and could act as an abrasive, damaging the finish.

G. Edge Polishing

The following guidance is for CNC or dedicated edge polishers.

The edge design requires a ≥2 mm (3/32") radius (preferred) or bevel to prevent the edge chipping for all edges. Edges that will be exposed when installed should have a ≥3 mm (1/8") radius (preferred) or bevel.

Inspect polishing sets for defects prior to polishing. Use abrasives in the specified sequence for the desired finish. Approximate parameters (may vary by tool vendor):

Abrasive sequence: Satin finish 120-220-500

Abrasive sequence: Glossy finish 100-200-500-1000-2000

Speed: 60-80 cm/min. (24-32"/min.) Higher speeds may be possible on flat profiles.

After processing, treat the newly cut surfaces of the edge that will be exposed when installed with a suitable oil- and water-repellent impregnating agent designed for ceramics.

H. General Waterjet Guidelines

The placement, direction of cutting, and sequence of cutting all contribute to a successful outcome.

H.1 WATERJET PARAMETERS

TABLE H-1: LOW PRESSURE PIERCING PARAMETERS

Thickness	Minimum pressure	Abrasive (80 mesh)
6, 12, 20 mm 1/4", 1/2", 3/4"	1,200 31,300 bar 17,400-18,900 psi	0.8 -1 lbs./min. 0.35-0.45 kg/min.

Suggestions

When possible, make the entry from outside of the slab. Alternatively, make the entry hole within the cutout at the point furthest from the edge of the slab a few centimeters away from the cutting perimeter and never less than 5 mm (3/16") away. Exit at the point of entry.

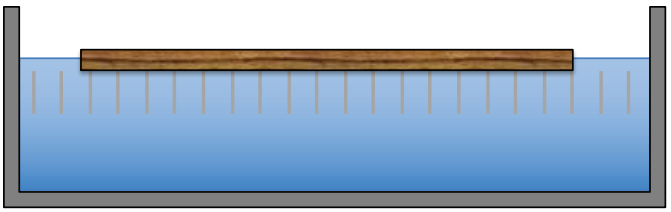
TABLE H-2: HIGH PRESSURE CUTTING PARAMETERS

Thickness	Minimum pressure	Feed rate	Abrasive (80 mesh)
6mm 12 mm	3500-3700 bar 50,800-53,700 psi	31-51"/min. 80-130 cm/min.	0.8-1 lbs./min. 0.35-0.45 kg/min.
20 mm		20-31.5"/min. 50-80 cm/min.	

Cut quality varies with speed. These are maximums, reduce speed to achieve desired finish.

Make sure the work table of the cutting machine is in good conditions, perfectly flat, with no processing waste or gaps in support. The slab can be cut on cement board or on slats. If cutting directly on the slats the spacing should be such that the slab and resulting pieces are well supported. The water level should be about 3 mm (1/8") above the bottom of the slab so there is no air gap. If using cement board as a cutting surface, replace heavily used areas, particularly where cutouts will be made so the cutout is well supported.

Figure H-1: Cutting on Slats

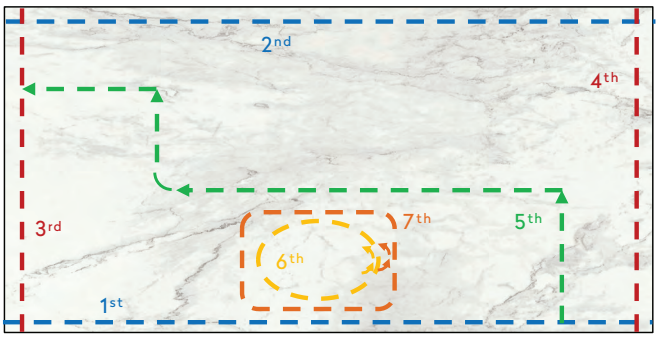


If creating a cutout, pierce inside the cutout at least 5 mm (3/16") inside the final cutout. Pierce at the point within the cutout that is closest to the center of the slab Do not approach the edge of the cutout at a ninety-degree angle. Approach the edge cutting a curve so it transitions smoothly to the cutout. Do not pause motion as this can create additional material removal where the jet was paused. Exit at the point of entry.

H.2 CUTTING SEQUENCE

While the entire slab can be cut with a waterjet, if a sawjet is used the long straight cuts may be cut with the saw, with the waterjet reserved for curves and radii. Optionally a cutout for a sink or appliance may have a precut, removing most of the material. This reduces the weight of the cutout on the final pass, reducing the potential for fracture.

Figure H-2: Sawjet/Waterjet Cutting Sequence



Machining steps:

1-2. Trim the long side (1 & 2 are interchangeable).

3-4. Trim the short side (3 & 4 are interchangeable).

5. Cut outer perimeter of workpiece.

6. Sink/appliance pre-cutting, (optional - removes most of the interior)

7. Sink/appliance cutting (final cut)

H.3 CUTOUTS

Cutouts should be a minimum of 50 mm (2") from the nearest edge and have minimum inner radii of 5 mm (3/16"). The greatest risk of failure is at end of a cut when there is little material connecting the cutout from the rest of the slab. Any lack of proper support may cause the material to fracture.

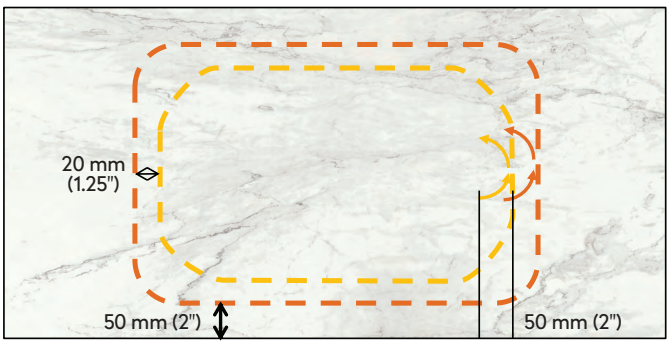
CORIAN® ENDURA™ CUTTING AND EDGE POLISHING

When support is not perfectly flat, the cutout for sinks or appliances is equal to or greater than 60 x 50 mm (24 x20") in dimension, or cutting to the minimum distance from an edge of 50 mm (2") then a precut to reduce the mass of the cutout is recommended.

The precut should be 30 mm (1.25") inside final cutout, with larger radii at corners. Start the precut 50 mm (2") inside the cutout and the cut path approaching the perimeter should be an arc. Exit at the point of entry, also on an arc.

Cut final shape, again approaching the perimeter on an arc and exiting at the point of entry, also on an arc.

Figure H-3: Waterjet Sink Cutting Special Conditions



H.4 RADII

All inside corners (edges or cutouts) must have a radius of at least 5 mm ($^3/_{16}$").

A greater radius imparts greater structural strength to the workpiece, while any non-radiused angle will create a stress point in the top.

H.5 DEBRIS REMOVAL DURING PROCESSING

After each machining task, rinse the surface liberally with clean water before the workpiece has dried. Cutting debris will be more difficult to remove after drying and could act as an abrasive, damaging the finish.

I. Treatment of cut surfaces

All exposed cut surfaces such as sink cutouts, radius on mitered edges, etc. with a water- and oil-resistant sealant designed for ceramic surfaces. This addresses any microroughness from the cutting process that could collect dirt.

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