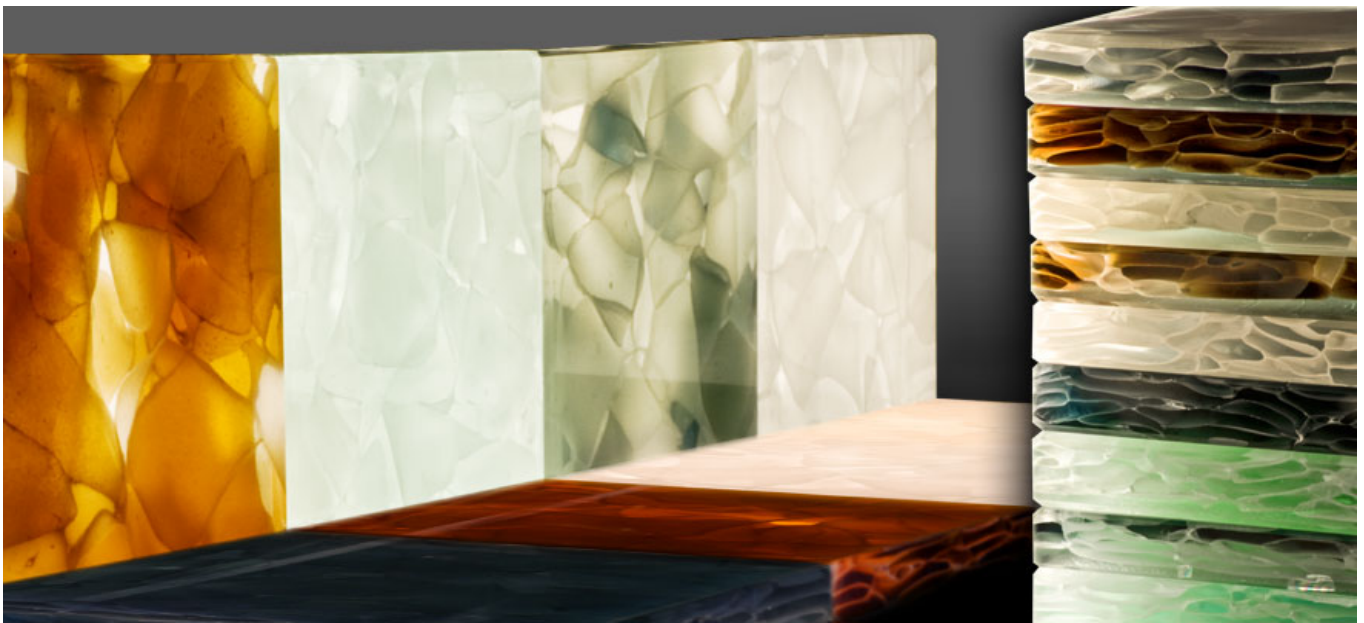

glass²



design with the **earth** in mind.



an INSTRUCTION MANUAL for the Transportation, Handling, Fabrication, and Installation of glass²

Introduction

glass² is a high-grade, inorganic material produced by high temperature forging; it is an environmentally friendly material for countertops, bar tops, vanities, shower doors, flooring, cladding and paneling. It can be used for both indoor and outdoor applications. **glass²** is resistant to weathering due to wind, rain, and sunlight. **glass²** is produced from 99% fused recycled glass and is resin free. This material is easy to clean and 100% non-porous. **glass²** is available three (3) slab thicknesses: 16mm, 20mm, and 30mm. **glass²** is now produced with an epoxy/nylon mesh backing to improve its ability to withstand abuse during transportation and to give extra strength for cut-outs (sinks, stove tops, etc)

Note: This manual supersedes all previous manuals. Content is subject to change at anytime without notice.

Date effective: May 06, 2013

Distribution: Architects, Distributors, Fabricators, and Installers

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1. Saw Cutting

glass² only recommends and supports the use of a waterjet for cutting.

- The best cutting result is reached by using a water jet and following manufacturer's guidelines for cutting and drilling into glass; which includes using the correct abrasive.
- A solid surface barrier made of ½ inch thick plywood or minimum ½ inch thick high-density foam insulation sheets is required on top of the steel waterjet grating. Both of these items will provide a level, clean, and vibration dampened surface.
- This is a proven method of insuring a clean, damage free, and safe cut with minimal to no edge chipping.
- The waterjet can perform all cutting and drilling operations and should be used.

If the fabrication is to be done using traditional methods and techniques as for natural stone or a man-made solid surface, then the following procedures must be performed to maximize the chance for a successful cut:

- Every cut must be done using as much water as possible.
- The proper blade speed, authorized blades, and extremely flat table beds are prerequisites for clean cuts with no chips.
- Every blade to be used should be first tested by the fabricator, to find the optimum cutting speed for the bridge saw, CNC, or other type of machine used.
- A medium bond diamond blade gives the best cutting results and the type saw blade of choice for cutting **glass²** is a porcelain or ceramic type blade with a maximum thickness of 2.5mm. When making any cut, the blade must pass through the **glass²** by a minimum 2mm.
- When using a stone/concrete cutting table, it must be very clean with no stone fragments but this is not recommended.
- If the stone table is not perfectly flat, then it must first be leveled and then a surface barrier put over the stone or concrete table is required, just as it is with a waterjet. A ¾" thick plywood sheet is an authorized surface barrier as well as 1" thick high-density foam insulation sheets. Both of these items will provide a level, clean, and vibration dampened surface.
- A piece of scrap stone (granite) or solid surface (quartz) must be placed adjacent to the **glass²** slab at the end of the saw rip. The cut from the **glass²** slab should continue into the scrap material. This allows the blade's energy to be transferred to the scrap stone and will help protect the corners and final edges of the **glass²** piece being cut.
- Saw blade rotational speed should be approximately 4,000 – 4,500 rpm's, the cutting speed at no more than 1 LF per minute travel, and the highest amount of water volume possible should always be used. Blade speed and travel are based on a bridge saw with a 20 hp motor using a 14" silent core continuous rim blade. This is for reference only because each fabricator must test, evaluate, and determine the proper rotational speed of the saw blade and the proper cutting speed through the material being used, which is dependant on all individual equipment performing the cut.

2. Hand Cutting

Hand cutting blades should be the continuous rim ceramic or porcelain type.

- Hand cutting must be done utilizing an abundant amount of water; never can **glass²** be cut dry or with minimal water. Water fed tools that cool the blade from both sides work best when making any type of cutout (sinks, bowls, cook tops, faucet holes, electrical receptacles, etc). If water is not available, as on some installation sites, then the **glass²** material must be taken to a location where water is available. Cutting the **glass²** material dry will most likely result in large chipping, breakage, or fractures.

- It is necessary to wear safety glasses and a mask to prevent possible injuries, especially to the eyes. Water fed cutting also helps prevent injuries from occurring should chipping occur.
- When performing any cutting of **glass²**, never put too much pressure on the blade. The fabricator should allow the blade to perform the work and this will produce the best possible cut.
- Standard electrical receptacle cut outs have square corners and are not allowed in **glass²**.
- The only authorized method for providing an “opening” is to drill a hole.
- Using an abundance of water is the key to success in any cutting or drilling situation and this is not optional, whether at the shop or the job site.

3. Grinding

To perform grinding by hand, use aluminum-backed cup wheels with medium-bond diamonds.

- Aluminum backed wheels limit vibration and since it is softer than steel-backed wheels they allow minor flexing so there’s more control. This type of the wheel gives a very smooth grind and will minimize chipping.
- You cannot use aggressive diamond tools on **glass²** without great risk of material damage (chips and fractures).
- After cutting, when making a sink cutout with a CNC or handheld profiling machine, DO NOT start grinding with Position 1 (coarse). Start grinding with Position 2 and insure that your diamond wheel has holes for the water feed.
- Before you start grinding, be sure that you put a small bevel on the top and bottom to prevent chipping.
- Do not use the grinding tool like you would on granite. Grinding has to be slow (let the diamond tooling do the job) and make sure that the water feed is continuous, abundant, and consistent.

To make a straight polish for glass, grinding is not needed if the proper saw blade is used for the initial cut; this is especially true with the water jet.

- The grinding cup wheels will be used only for fabricating non-straight edges (bevel, round, etc.).
- The cup wheel of choice has either a smooth surface or is filled between the segments with epoxy resin or some other appropriate material.
- L-Shaped countertops require an inside corner radius that is equal to or greater than the thickness of the material being used
 Example 1 - 2cm thick material = 2cm radius
 Example 2 - laminated edge at 2cm x 2 = 4cm diameter and 4cm = 1.57” so a 1-9/16” drill bit is best to form the corner).
 All 90 degree inside corners must be avoided, whether countertops, sink holes, stove tops cutouts, etc.
- Grinding stones are not allowed in the fabrication of **glass²**.

4. Filling holes

Similar to other glass materials, **glass²** will have some holes on the edges. Filling up these holes must be done before polishing.

- After the material has been cut-to-size, the surface must be thoroughly dry; use a high-pressure air nozzle to get out all water and debris from the holes.
- After drying, wipe the edge with acetone as this also cleans the smallest of holes.
- If you use a torch to assist in the drying process, you must monitor the temperature of the glass and not let it get above 90 degrees Celsius (195 degrees Fahrenheit).

- **glass²** is heat resistant but all glass absorbs heat at least two times faster than stone! Excessive heat will damage all glass, including **glass²**.
- Surface holes should be filled with clear flowing epoxy and the excess cut off with a razor blade.
- The area filled can then be polished using the proper pad and Cerium Oxide, as discussed in the next section.

Three ways to fill holes:

1. Fill up the entire edge to be polished with polyester resin (similar to how you fill up travertine) and then after it is dry, start polishing with a Grit 100 polishing pad. In this case, because it is very coarse, this pad will grind away all of the extra glue (resin) so you must be very sure that the water feed is has plenty of pressure, otherwise this pad will “pull out” the glue from the small holes and could possibly burn the epoxy.
2. Fill up only the visible holes and then start polishing with Grit 200 polishing pad. This pad will take off any extra polyester resin and will polish all of the desired edge to be finished.
3. After making the cut, start polishing with Grit 100 polishing pad and continue to Grit 200 polishing pad. After this is done, then completely “dry out” all edges to be finished and clean the holes. Fill up all holes with polyester resin and let it dry. Do not apply too much resin, just enough to cover each hole. Next, continue polishing with Grit 400 polishing pad. Spend a little more time until all of the excess polyester has been removed. Again, continue polishing with Grit 800 polishing pad through Grit 3000 polishing pad. This method gives the best results; the whole process is a little slower than #1 and #2.

NOTE - In the case that not all of the holes were filled using one of the above three (3) methods, you can also fill up holes after the polishing is done. Just be sure that the surface is dry before filling up any holes that were missed or that were removed during polishing. Just before the resin cures (gets hard), cut off any excess with a razor blade and smooth it all with a very fine steel wool (#0000) or use the last two polishing pads again. For all transparent colors (Ash White, Pine Green, Ocean Blue, and Coral Blue), be sure to use “water-clear” resin and for dark colors (Azurite and Chorus) create a matching resin color using “water clear” resin and resin dye.

5. Polishing

glass² has very good polishing qualities; the polishing technique is very simple and very similar to natural stone polishing. The difference is that **glass²** is a consistent material so there are no “soft & hard spots” within the material.

Polishing with glass specific sand-based pads

- Follow the manufacturer's directions, from first pad to the last pad. Since these pads differ greatly, consulting the manufacturer is required to achieve the finish desired.
- Stepped polishing will achieve a smooth finish without waves or ripples.
- There is no need for buffing or waxing.
- Dry polishing can be accomplished if pad manufacturer's directions are followed and the operator wears the proper OSHA approved AFM (air filter mask).
NOTE - everyone in the shop or the job site must also wear OSHA approved AFM's if dry polishing is being performed
- Use of cerium oxide as a final step will give the highest shine possible by hand and is the only way to closely replicate the factory surface finish.

-
- Steps to Repair the Surfaces or Edges (3-step dry pad method)
 - 1) Thoroughly clean the surface or edge to be repaired so the pads will not pick up dust or debris that could negatively affect the repair process.
 - 2) GRIND. Start with 180 grit ventilated sanding disc and pad to grind (remove) the scratch to its lowest level making sure the haze (cutting pattern) left in the glass is consistent and uniform. Be sure to periodically check your progress as this also avoids the glass from overheating. Exceeding a surface temperature of 150 degrees Fahrenheit can be detrimental to the glass, causing cracks or fractures, especially in the darker colors.
 - 3) Thoroughly clean AGAIN the surface before going to the next polishing pad.
 - 4) POLISH. Continue with 320 grit ventilated sanding disc and pad to polish the repaired areas and be sure to move outside the previous repair area by half the pad's width. Note – each sanding pad should have its own sanding disc so no grit is transferred from one disc to another.
 - 5) Thoroughly clean AGAIN the surface before going to the next polishing pad.
 - 6) SHINE. The last step is to shine the surface using a high density felt pad and cerium oxide. A water-fed system on the electric or pneumatic grinder will make the process faster and give a higher gloss. The surface needs to be kept as cool as possible as the water lubricates the surface and hydrates the cerium oxide for maximum performance. Note – add water every 5-6 seconds is proper.
 - 7) Thoroughly clean AGAIN the surface for final inspection of the repaired area. Repeat any or all of the above steps, as necessary, to achieve the desired results.
 - 8) When working with on the surface, keep the pad as flat as possible but when working on the edge it can be beneficial to angle the disc so that the outer 30% of the pad is doing the work. You will have to change the pads often as the glass particles quickly fill up the pad and/or the sand is dissipated during the grinding or polishing process.
 - 9) Considering a minor scratch on the surface of **glass²** at 5" long or less and 0.15mm deep or less, a skilled glass technician can repair the surface in 15-20 minutes. Please note that the surface can be repaired very nicely and to an acceptable level but to match "exactly" the surface produced by the factory is nearly impossible

Polishing with stone type diamond-based pads:

- The polishing should begin from Grit 100-200 and then go up to Grit 3000.
- Stepped polishing will achieve a smooth finish without waves or ripples.
- There is no need for buffing or waxing.
- Dry polishing is not allowed and must be avoided, even on the job site.
- Use of Cerium Oxide as a final step will give the highest shine possible by hand and most closely replicate the factory surface finish.

The top and bottom edges of ALL sides of the finished **glass²** piece must be beveled to a minimum 5mm because:

- It helps relieve stress in the material.
- It creates a safer edge for both the fabricator and the end-user.
- This is the proper way to start all other edge details.

6. Drilling

A water jet is the preferred method of drilling faucet holes or forming the inside corners.

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For mechanical drilling, an abundant amount of water must be used for cooling the bit while drilling. Before buying a special drill bit, test the ones you already use for natural stone drilling.

- The best drilling results are achieved by using “water fed, medium coarse, continuous rim, bonded diamond” drill bits.
- Drill bits, like saw blades, must be prepared (sharpened) before use; prepare in the same manner as the saw blade, using a fireproof tile or grinding stone to clean the diamonds.
- **glass²** can be drilled very smoothly as long as the proper speed is used (2,000 – 2,500 rpm’s).
- Avoid twisting and applying extra pressure while drilling; drill slowly, allowing the drill bit to cut steadily.
- The backside of the **glass²** material must be “fully supported” with a wood or stone product when drilling a faucet or other type hole. The support should not allow the **glass²** to either flex or move in the slightest. Drilling into the wood or stone support also avoids “blow out” on the backside and prevents excessive tool penetration, which could result in “high speed tool contact” with the **glass²** surface, an excessive force likely to create damage to the **glass²** countertop.

7. Cut-Outs

The best preparation for cutting a sink-hole or drop-in type stove hole is to apply epoxy resin with a nylon mesh to the backside of the **glass²** (if it has been removed or if it was not applied at the factory) as this increases the cutting quality and material durability during fabrication. Drill holes into each corner of the sink template before cutting out the appropriate sink hole dimensions. For example, if you have a square or rectangle sink hole, you should drill all four corners with a drill bit that creates the required radius and then start cutting.

- Drilling the holes first will relieve the stress and will prevent the **glass²** from opening (fissures and cracks). Unlike other baked glass materials, **glass²** has a very limited percentage of stress, which allows you to cut holes into any size slab produced.
- Before making a cut, be sure that the fabrication table is flat with no gaps or spaces at any point-of-contact and that there is no movement of the counter top during the sink cutting process.
- There must be a minimum of 4” of **glass²** on either side of the kitchen sink-hole or the bathroom vanity bowl hole.
- The minimum radius of all inside corners equal to the thickness of the **glass²**
2cm or 3/4”
3cm x 1 = 3cm or 1-3/16”
- Note - the radius requirement is for a holes or shapes regardless of the item’s final use.

8. Transportation and Handling

Handling of **glass²** is one of the most important aspects and listed below are very important procedures and details. Following these proven methods is required to maintain the integrity of the product and to avoid damage:

- a. **glass²** will be loaded into special wooden crates for all slabs sizes at the factory. These special crates are very specific in design and made with such a high quality that these can be used again for transportation from the distributor to the end-user. It is best to use these crates or have similar ones made to the same dimension tolerances and quality. This not only gives the supplier and the distributor confidence in material being delivered in a good state, it eliminates the majority of credit claims by the end-user against the distributor or the factory.
 - It is required that the distributor verify the shipment’s condition to the factory within 10 days from receiving the material, after that time the factory will not assume or accept any claims for material problems.
 - **glass²** strongly suggests that the distributor require the end-user to verify the material

condition upon receipt of goods.

- if distributors decide to repack **glass²** and send to their customers and/or fabricators then the distributors are required to make sure the slabs are packed in fully enclosed wood crates which meet the below conditions:
 - 2" x 4" wood frame and platform
 - 1/2" plywood sides, top, and ends
 - 4" x 4" full length skids
 - screws only (no nails)
 - high density foam all around (4" bottom, 1" sides-top-ends), and 1/2" between each piece)
- b. For all aluminum or steel framed storage racks, whether inside or outside, use high-density rubber on top of wood to avoid any contact between **glass²** and the metal. The slabs must be set into the storage racks with the long side down at an angle between 5 degrees to 11 degrees from vertical. Be 100% sure that the rack frames are flat and that the **glass²** contacts all points equally before clamping or securing with nylon straps. If fabrication tables are metal, there must be wood or high-density rubber between the frame and the **glass²** material.
- c. When moving slabs, take great care to avoid any contact with any object to maintain the **glass²** integrity. The proper method of moving **glass²** is via nylon web slings and not "pinch type" clamps.
- d. At the installation site, should the cabinets be made of aluminum or steel, these too should have a "high- density rubber" or wood surface barrier.
- e. Prior to loading a fabricated piece, clean the **glass²** slab's finished surface thoroughly to ensure that there are no bits of glass, stone, dust, dirt or other debris on the surface. During the loading, transportation, and unloading extra caution should be used to prevent any type of debris from getting in between the slabs or from coming into contact with the slabs.
- f. Since **glass²** has very little flexibility, unlike marble or granite, it is very important to protect against any kind of bending, tension, and stress during the clamping and/or strapping for transportation.
- g. **glass²** may never be transported "flat" in any manner nor on any type vehicle; moving **glass²** either vertically or near vertical is the only accepted position (7 degrees is optimum angle and the accepted range is between 5 degrees to 11 degrees).
- h. Anytime a hole is to be cut that leaves the minimum allowable stock (4") of **glass²**, be it a kitchen sink hole or a vanity bowl hole or stove top cut out, the cut is ideally to be done at the job site with the **glass²** placed in proper position, secured to the countertop, with the corner holes already drilled to correct size. Extra care must be taken to support the entire circumference of any hole that is cut into **glass²**. The "hole" remnant shall not be allowed to drop away upon completion of the cut.
- i. Sink supports are required for **glass²** installations; these are not optional, even for lightweight under mount sinks such as stainless steel and copper. Heavy-duty sink supports are required for heavy type under mount and top mount sinks such as cast iron, porcelain, and composite stone types.
- j. **glass²** should be kept in a dry and ventilated place. Use spacers between each piece in order to allow moisture to escape as this eliminates mold and mildew in a high humidity environment. If **glass²** is to be stored outside, then cover with either an awning or a waterproof cloth; be sure to remove the waterproof

cloth after the rain which will allow the excessive humidity to escape. Should mold get on **glass²** it is easily cleaned with vinegar and a cotton cloth.

k. If more than one (1) slab is needed for a job and those slabs are to be joined by a common seam, the slabs must be "shade matched" before cutting. The slabs do not have to be from the same Heat Lot but the "shade" must be nearly identical. This can only be determined by the human eye to insure the color hue and intensity or the color, and the crystal structure is as close as possible; similar to matching the colors of an exotic granite. Also, the direction by which the slabs are cut is crucial to the color looking the same due to light transparency and refraction.

Details for how to match & cut the same shade of **glass²**:

- 1) Before any slab is CUT, it is standard and required procedure to inspect the slab before the final cut. . It is highly recommended to cut off a small piece from the ends or sides of each slab to be matched, placing them side-by-side under varying light conditions to determine if the slabs are an acceptable match.
- 2) Before any material is cut-to-size, it has to be "templated" and part of the template process is to insure that the material truly is the correct material.
- 3) Before a job it transported to the job site, it is also standard and required procedure to put all joining pieces (seams) together to be sure the fit is correct, this is often referred to as a "mock up".
- 4) once at the job site, set the pieces in place to "match" all the pieces (joining all seams at this time).
- 5) once all pieces are in place then the installer can check for proper fit and color matching (again). This is not only fixing the **glass²** material to the counters but sealing the seams, attaching any sinks or cook tops, and attaching hardware.

9. Installation

Adhesives

- Silicone is primary adhesive product used with **glass²** and in some applications polyester resin is also acceptable
- There are two types of silicone: (1) Seam Sealer and (2) Setting Compound
- Applications for silicone and polyester resin are listed below

Countertops

- **glass²** is currently produced in two types of coloring patterns: (1) dark opaque and (2) semi-translucent.
 - 1) Dark opaque colors require only "clear" Silicone Sealer as the bonding agent; polyester resin is not required. Perform installation by making the **glass²** pieces level from the bottom side with either wood or composite shims. Suction-type leveling devices may be used to "pull" the pieces together but NOT for "pressing" them to a level status.
 - 2) Semi-translucent colors require the use of "water clear" Silicone Sealer. It is very important because other types of silicone will tend to magnify the seams when back lighting or under lighting is utilized.
- **glass²** cannot be leveled like other solid surfaces because it needs to expand and contract slightly with changes in surface temperature.
- It is important to remember that **glass²** is not very flexible, much less than natural stones or man-made solid surfaces. Therefore, with regards to leveling, pressing down on one side or edge or corner to achieve a level on the opposite side or edge or corner is never allowed and must be avoided.
- For interior applications, allow for a minimum 3mm seam gap and for exterior applications

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allow for a 5mm seam gap. This gap is for all seams and between the wall and the **glass²** material, which will provide space for it to expand and contract.

- Silicone Seam Sealer is authorized for use with **glass²** as a (1) seam filler, (2) seam sealer, and (3) contact substance for attaching **it** to cabinets, walls, fireplace surrounds, shower panels, and various other uses.
- Silicone may be used to fill the gap next to the wall but this is usually not necessary since coverage normally will be provided by the backsplash.
- **glass²** does not require an underlayment, such as plywood, but the maximum width of any unsupported area is 24" in any direction with ¾" wide cabinet material.

Laminated Edges

- **glass²** can be laminated in the same manner as granite and the same rule follows that the laminated strip must be cut next to the countertop piece it is to be laminated to.
- For widths 9cm or smaller, the strip to be laminated can be attached to the main piece with polyester resin, regardless if the thickness is 16mm, 20mm or 30mm. Just paint the resin on the entire thickness (edge) to be attached.
- For widths larger than 9cm, both polyester resin and silicone are required, to be used in conjunction with each other; both the resin and the silicone must be used on the mating surfaces with each covering 50% of the width for the entire length of the laminated piece. Use a small bristled brush to paint the resin on the outside or exposed half and then run a 1/8" bead in the center of the other half to apply the silicone.
- For extremely wide laminated pieces, like hotel aprons, support pieces (or an entire support strip) can be added to the back side, again using resin and silicone, in ensure the security of the laminated piece.

Wall Cladding

- **glass²** can be used for both interior or exterior applications.
- Kerf cuts can be produced at the factory, upon request, with appropriate and approved drawings. This is likely to require a special **glass²** production called CGB (Clear Glass Backing), where 7mm of clear glass is laminated to the backside of the **glass²**. This CGB option is only available as produced at the factory at a minimal additional cost.
- Wall retaining clips and anchors can be provided, upon request.
- For interior applications, standard allowance requires a minimum 3mm gap and for exterior applications a minimum 5mm gap is required. Large format sizes, more than 2 sf per piece, may require a larger gap, depending on the application, size, temperature, exposure to direct sunlight, etc. The factory must be contacted and consulted to get the proper gap requirement.
- The gap provides space for **glass²** to expand and contract, which is normal for all types of glass.

Flooring

- Standard tiles must be set (laid) with Silicone Setting Compound only.
- Thinset, mastic, or cement are never allowed to be used as a setting compound for **glass²**.
- If utilizing **glass²** in an elevated state, for the purpose of lighting or insulation, **glass²** requires clear glass at 7mm thick to be laminated to the backside (CGB), which may only be produced at the **glass²** factory.
- Make sure that the flooring is flat before setting **glass²**.
- No sand, cement, or other type of concrete may be in the gap before setting silicone. If there is any material in the gap, it must be cleared away first, before filling the seam. The best technique is to insert a rubber or elastic pad (strip) in the gap (seam) in order to have enough space for the **glass²** to expand and contract.

- Background of the floor must be the same color in order to avoid any color variation that would result after installation of the **glass²**.
- For interior applications allow for a 3mm gap between each piece of **glass²** and at all ends or edges of the flooring.

Undermount Sinks

- Installations must not utilize under mount sink clips that require drilling into the **glass²** material.
- Silicone is the only adhesive approved to attach an under mount sink rim to the bottom side of the **glass²**.
- Heavy sinks made from such materials as porcelain covered cast iron, granite, or marble and even stainless steel with a garbage disposal attached must be supported from the bottom side via a cabinet bracket or a frame that rests on the cabinet's bottom shelf.
- It is acceptable to put polyester resin on a wood or composite shim, then to place the resin at each corner and at mid-points of the longest sections of the under mount sink for added security.

Other applications

- When **glass²** is to be utilized in pools, spas, and other applications there may be size restrictions and increased seam width requirements.
- When attaching the faucet fixtures, extra care must be taken not to over tighten any of the parts that come in contact with the **glass²**.
- The range of sunlight, air, water temperatures, and atmospheric pressures may require additional special attention and consideration. Therefore, consult the factory for design, fabrication, handling, and installation guidance for any situation not specifically covered in this manual.
- REMEMBER that (1) silicone is the only approved seaming and setting material and (2) thinset, mastic, or cement are never allowed to be used in conjunction with **glass²**.
- **glass²** cannot be installed in a way that it is enclosed within a fixed area or "frame" since this would severely or completely limit it from expanding and contracting.

10. End User Guidelines

When **glass²** is being used as a countertop, it must not come into direct contact with any object that has a temperature in excess of 205 degrees Celsius (400 degrees Fahrenheit). Temperatures up to 90 degrees Celsius (195 degrees Fahrenheit) may stay on the surface of **glass²** for a maximum of ten (10) minutes. **glass²** has an incredible transparent effect but DO NOT use any large "heat producing" type lighting when establishing a light source to enhance the look and transparency of **glass²**. Examples of light sources include but are not limited to:

- Incandescent lamps which need to be 200 watts or less and placed at a minimum of 150mm (5.9") from the **glass²**.
- "Cold" light sources (fiber optic, neon, some LED's and energy conservation light sources (all at 60 watts or less) cannot be glued or otherwise attached to **glass²**. There must be a minimum distance of 100mm (3.9") between the light source and the **glass²**.
- Ribbon and Strip lights made of LED's that are encased in silicone to provide a waterproof medium is an option for attaching a light source directly to the back of **glass²**.
- Most light sources must have a heat dissipation space to keep the temperature below 90 degrees Celsius (195 degrees Fahrenheit). Only thorough testing of the specific light being used can determine the "reality" of the heat being generated as manufacturing processes may produce the same amount of light that is generated (and regulated) but not the amount of heat that is dissipated.
- Once installed, **glass²** is a very strong and dependable surface but like all solid surfaces excessive

-
- heat, weight, and impact must be avoided.
 - Due to its non-porous nature, **glass²** does not require sealing or waxing.

11. Repairs

glass² is a very durable product yet scratches or chipping may occur during fabrication, transportation, installation, and everyday normal use. Both scratches and chips can be repaired but be SURE to always first prepare the area to be repaired by cleaning it completely (removing any debris, cleaning with alcohol, and blowing dry with high pressure air) and then by following these methods:

a. Scratches

Surfaces can be renewed via glass specific pads ... See Section 13 below.

- The BEST way to learn how to repair **glass²** is to have a professional glass technician train shop personnel on the required tools, supplies, and techniques. Each manufacturer's pads require a slightly different technique and practicing on a scrape piece of **glass²** is the fastest, safest, and economical way of developing the skills needed to work with **glass²**.
- Deep scratches require a re-polishing system that includes special sandpaper and cerium oxide (a standard powder utilized in glass industry).
- Light scratches, smudges, and smears may be treated with cerium oxide only. Should this be the case, mix the cerium oxide with water to form a thin paste, apply generously to the scratch, and buff it out using a high-density cotton buffing wheel at 2,000 rpm's or less.

b. Chips

Whenever the surface has chips, it is best if filled with clear liquid polyester resin and edges are most easily repaired with clear knife grade polyester resin.

- If a color tinted resin is desired for the damaged edge or surface, applying the resin is done in the same manner as natural stone or a manmade solid surface (such as quartzite). Follow the manufacturer's instructions for polyester resin application.
- Chips on a polished surface are more difficult to repair than edge chips. Water Clear polyester resin MUST be properly mixed and applied according to the manufacturer's instructions; once completely cured, razor off any excess and buff out using cerium oxide on a high-density cotton buffing wheel.

c. Damage

If **glass²** takes an impact from a heavy item (such as large steel cooking pot or an iron skillet), the **glass²** material may not shatter but, depending on the impact, could crack.

- Cracks that extend and are noticeable are best left "as is" if there is no movement in the countertop unless aesthetically a customer wants the top replaced.
- There is no way of repairing a crack in such a manner that it will be unnoticeable, therefore the only solution is replacement of the damaged piece by a professional fabricator/installer.

d. **WARINING**

Any material (natural stone, man-made solid surfaces, and glass²) can be severely damaged or destroyed, including a shattering effect, if a large enough force is applied to it (mass plus speed) so **glass²** and any countertop material must be used within in physical boundaries.

12. Tooling and Supply List (commercially available items)

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-
- a. Item ... Bridge Saw Blade, continuous rim, porcelain type
Purpose ... Heavy-duty cutting
Brand ... Alpha
Name ... Silencer III, SLW1410P 14"
 - b. Item ... Hand Saw Blade, 4" up to 10", continuous rim
Purpose ... Light duty cutting
Brand ... Alpha
Name ... Vetro Glass
 - c. Item ... Cup Wheel, continuous rim with aluminum backing - 4", medium diamond grit
Purpose ... Edge and corner shaping
Brand ... Diarex
Name ... Legend
 - d. Item ... Drum Wheel (Zero Tolerance), brazed diamond, continuous rim
Purpose ... Sink and corner shaping
Brand ... Alpha Profiler Z
Name ... 200 grit or higher
 - e. Item ... Drill Bit, diameter as per job requirements, continuous rim, medium diamond grit
Purpose ... Faucet holes and sink holes (sink cut-out)
Brand ... Diarex
Name ... Pro Series Thin Wall
 - f. Item ... Router Bit (Hand Held or CNC)
Purpose ... Edge profiling
Brand ... HS Blue Premium
Name ... Position #2 or higher (cannot be lower than 150 grit)
 - g. Item ... Polishing Pads, 4", #200, #500, #1000, #2000, and #3000
Purpose ... Edge polishing
Brand ... Alpha
Name ... Ceramica Resin
Note ... use of a rubber backer pad is required (solid brass or aluminum are not recommended)
 - h. Item ... Glass Specific Sandpaper Pads
Purpose ... Surface scratch repair and edge polishing
Brand ... Renu or GT (Glass Technology)
Name ... CDT Discs (#1, #2, and #3)
Heavy Duty Ventilated Premium (120, 180, 220, 320)
3m Trizact Discs (Course, Medium Course, Medium, Fine, Polish)
Note ... a felt pad is required for the CDT and 3m discs
use of a ventilated backer pad is required for HD discs
 - i. Item ... Cerium Oxide
Purpose ... Final polish for surfaces and edges
Brand ... C R Laurence or Renu or GT (Glass Technology)
Name ... C0301 or Polishing Solution or Diamond Fast Powder

-
- j. Item ... Silicone Seam Sealer, 100% high VOC
Purpose ... Bonding and sealing seams and sinks
Brand ... C R Laurence
Name ... WCS1 (water clear) and WCS5 (clear)
- k. Item ... Silicone Setting Compound, 100% high VOC
Purpose ... Bonding and sealing seams and sinks
Brand ... Dow-Corning
Name ... 795
- l. Item ... Polyester resin
Purpose ... Hole and chip repair for surfaces, edges, and seams
Brand ... Touchstone and Tenax
Name ... Transparent, flowing
- m. Item ... Polyester resin
Purpose ... Bonding sinks and hangars to the bottom surface
Brand ... Touchstone and Tenax
Name ... Clear, knifegrade
- n. Item ... Fire brick, ceramic
Purpose ... Cleaning (sharpening) diamonds in tooling
Brand ... Rutland
Name ... #604
- o. Item ... High-density Polystyrene
Purpose ... provide a flat, clean, and vibration dampening surface
Brand ... Owens-Corning
Name ... Foamular 150

13. Notes

- The use of any technique, procedure, or item not specified within these instructions is done at the user's risk and **glass²** shall not be responsible for any damage that may occur or undesirable results that may be obtained.
- **glass²** has developed its own proprietary brand of tooling and supplies which are available upon request. These are used exclusively at the **glass²** factory for all cut-to-size projects and are proven to perform to the highest standards. These items are available upon request and are much less expensive than those similar items available on the open market, as listed above.
- **glass²** can be fabricated without incidence if this instruction is followed in every aspect.

Diagram Aids

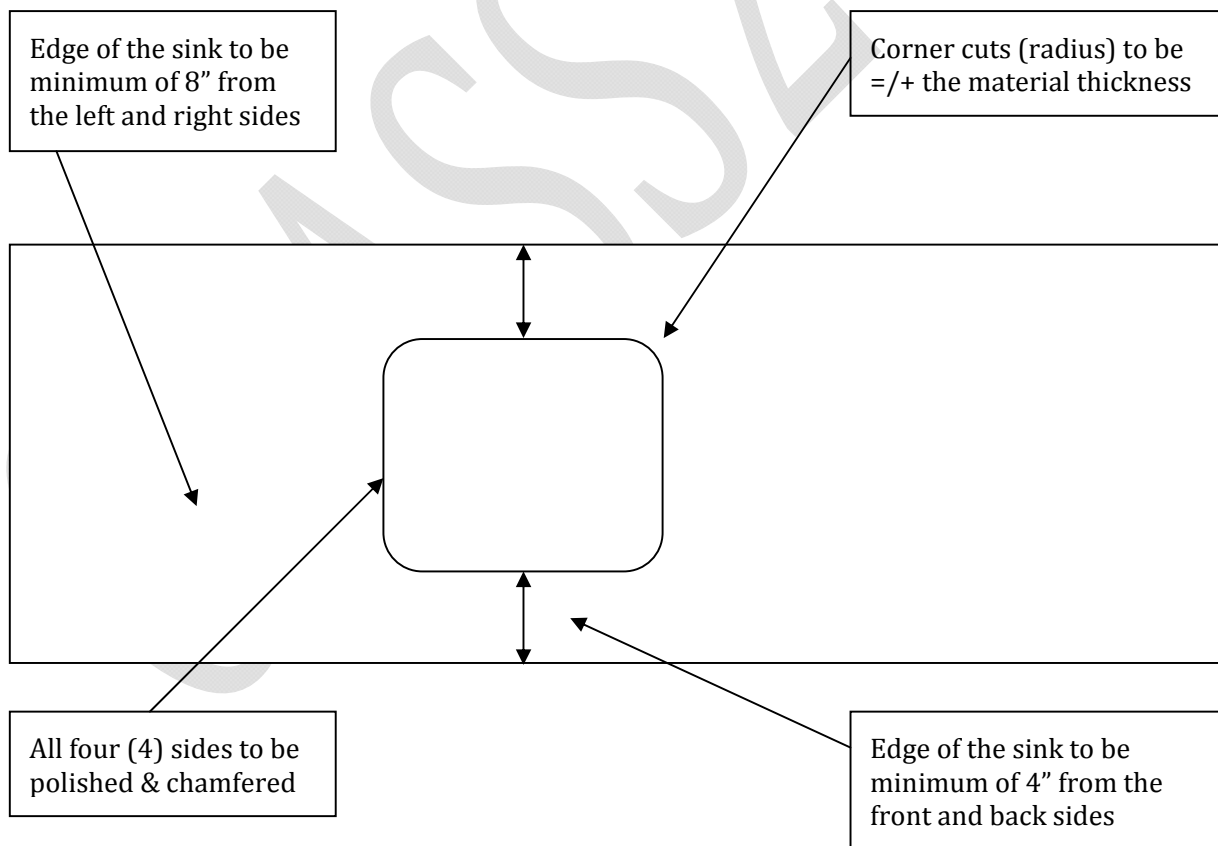
PROCESSING

glass² has different characteristics than stone, though harder than marble but softer than granite, it is more rigid than both. Therefore, it cannot be processed “exactly” like natural stone yet many techniques are very similar. All instructions must be followed.

Finished edges and hole (sink or stove top) processing:

glass² can be cut on a bridge saw, CNC, or by hand but these require more time than cutting natural stone. It is paramount that a plenty of water is used to keep the **glass²** cool and to never allow the diamond tooling to overheat. Any cut that is made in **glass²** must be done on a flat surface that is shock absorbent. This is why we require **glass²** to be cut on either plywood or high-density foam. All top & bottom edges must have a minimum 2mm bevel. Be absolutely sure that there are no chips or fissures where any cutting and/or drilling was performed. When cutting the corners, the cut MUST transition with a circular arc, commonly referred to as a radius (described earlier in this document). The radius does not allow stress to be concentrated and therefore makes the hole both strong and secure. Inside corner (radius) cuts should be equal to or greater than the thickness of the material. The outside corner (radius) cuts should be the same as the inside corner radius.

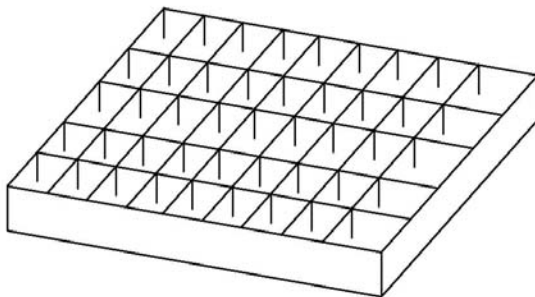
DRAWING EXAMPLE



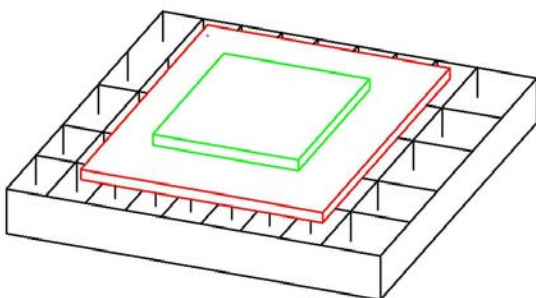
L-SHAPE COUNTERTOP (example)



WATERJET CUTTING TABLE (example)



Working platforms (tables) of a waterjet are usually welded or formed stainless steel. Since it is metal and not perfectly level or flat, the vibrations of the machine may cause the **glass²** to break.



Putting a piece of plywood or high-density foam (**red**) on the metal grate before loading on the **glass²** (**green**) will make the surface both more level and will give it superior dampening characteristics.

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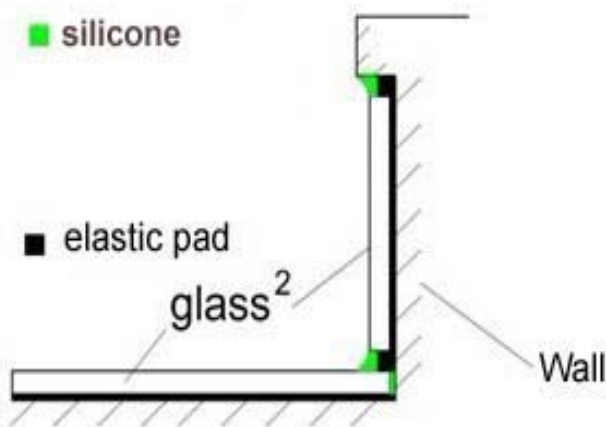
Website: <http://www.glass2.com>

The metal grate of a waterjet table and the concrete or wood of a bridge saw table is almost always unlevel and is certainly too rigid to cut **glass²** directly on top of it. Therefore, never cut **glass²** directly on any metal or concrete surface. Put a barrier between the **glass²** and the cutting surface. Acceptable barriers are ½" thick as: plywood, high-density foam, and rubber.

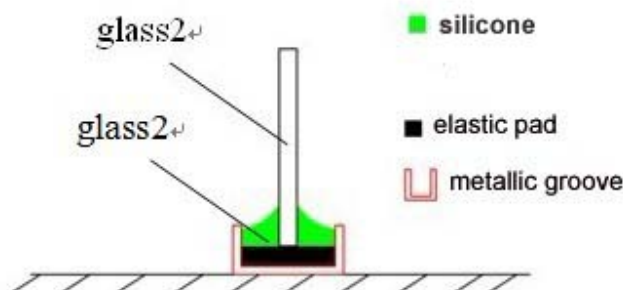
The only sure way to cut any size hole (sink, stove, or faucet) is with a water jet that is properly set up for glass using the correct pressure and aggregate. A barrier is required, not optional, for any cut being made on a waterjet. All the same rules apply for cutting, meaning you must have plenty of water, holes and inside corners require radius cuts, and the top and bottom edges of all cuts must have a minimum 2mm bevel that is polished.

glass² should have reinforcements at each sink or stove hole. Granite fabricators often cut groves into the backside of the granite and then embed a square metal rod and fill it with epoxy to strengthen (reinforce) the material for practical use after installation. **glass²** also should be reinforced but we recommend only using aluminum channel or tubing to epoxy to the backside for added strength because we believe in keeping full integrity of the **glass²** material intact.

WALL CLADDING - standard installation



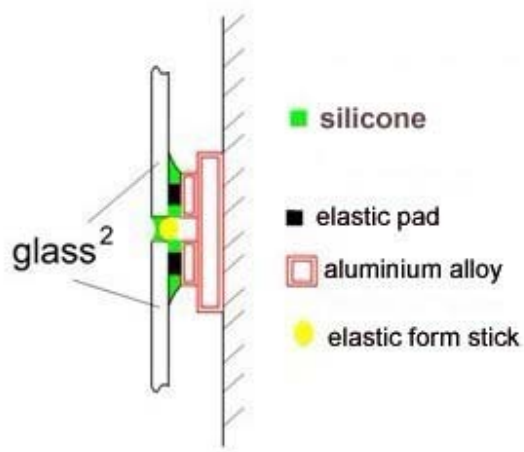
Vertical **glass²** must not contact with the horizontal **glass²** – both should be fixed directly to their wall surface. **glass²** is too heavy for direct contact as this will not allow for expansion hot weather. There should be a thick elastic pad (such as black rubber) between the two pieces and fill the gap with silicone.



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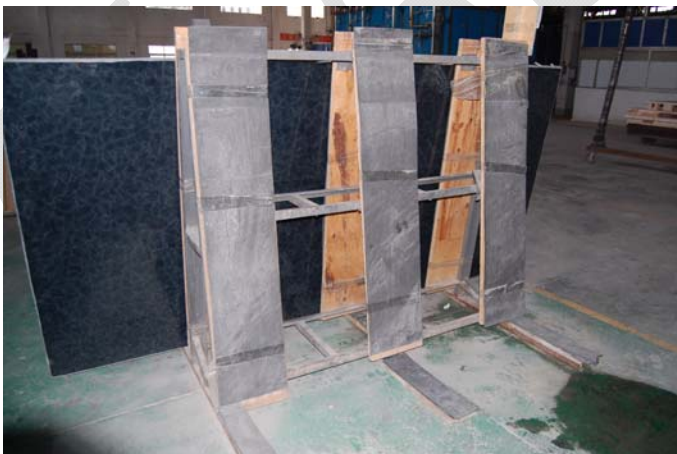
Website: <http://www.glass2.com>



STORAGE



Keep **glass²** in a dry and well ventilated area, preferable indoors. If using an A-frame, it must be 80% of the slab width and \approx the slab height. Slabs must be placed gently into the storage racks to prevent inducing stress into the material.



The backside and bottom of the A-frame must be wide platform and be of soft material (wood with rubber pad on top). **glass²** is never to touch the metal frame.

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Separate each piece of **glass²** with a soft material (such as a rubber pad). This prevents vibration and human error, which helps eliminate inducing stress into the material.

TRANSPORTATION



Special crates for **glass²** must always be used when transporting the material. High-density padding is required ... 4" on the bottom and 1" on the sides and 1/2" between each piece.



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Finished crate should be free-standing, stabilized with internal and external bracing, and a rail system (runners) for ease of movement if crate is not continuously strapped down or in a rack system.