

# Homeowners Guide to Natural Stone Countertop

## 1. INTRODUCTION

The beauty and permanence of natural stone countertops are enjoyed by many. The full potential of any installation is realized only when the selection, design, fabrication, and installation are completed by, or with the consultation of, qualified and experienced individuals. This document has been prepared and published by the Marble Institute of America to help guide consumers through the process professional fabricators use when using natural stone as a countertop surface.

## 2. STONE MATERIALS

**Varieties.** Many varieties of natural stone have been used successfully for countertop surfaces. However, different types of stone have specific properties that offer advantages or disadvantages in various applications. The following is a brief overview of the common varieties of stone used as countertops.

**Granites** are undoubtedly the most popular stone type used in countertop applications today. This group of stone includes many stone materials that are not true granites by geological definition. However, because their properties are so similar, the American Society for Testing and Materials International (ASTM) lumps them together as 'granite'. These stones are known geologically as gabbro, anorthosite, gneiss, diabase, and diorite, to name a few. Whatever the name, these stones are some of the hardest of the common countertop stones, offering high levels of resistance to abrasion and scratching. The primary minerals in granite are resistant to almost all chemicals commonly found in a home; however, there may be trace minerals present in

some granites and granite-like stones that are vulnerable to some acids.

**Marbles, serpentines, and onyxes** are traditionally prized for their aesthetic appeal, accentuated by distinct veining and often bold colors. They are relatively softer than granite, although some serpentines are as dense as some granites. Marbles can be scratched by kitchen utensils so it is best to use cutting boards and other protective measures. Use only non-abrasive products when cleaning marble.

Marbles can also be etched by chemical attack. These stones are calcium carbonate-based and are damaged by exposure to acidic solutions such as lemon juice, tomatoes, vinegar, etc. The use of inappropriate cleaning agents may also trigger acidic attack. Acidic solutions can permanently etch the surface of the material. The application of a sealer will reduce, but not eliminate, the vulnerability to acidic attack. For these reasons, your stone dealer may not recommend marble for use in kitchens.

## 3. COMMUNICATING WITH YOUR CONTRACTOR

**Documentation.** As dictated by standard practices of good business, all communications MUST be documented in writing.

All natural stones are unique. Some have pits, fissures, cracks, corrosive minerals, or other features that you may find objectionable. These should be acknowledged and pointed out to you when samples and/or slabs are being viewed. You need to be aware that some of these features may become more or less noticeable when the position (vertical or horizontal) of the slab is changed, or when the lighting intensity is changed.

**You and Your Subcontractor's Responsibilities.** Cabinetry installation, plumbing rough-in, etc. are usually required to be completed by you, or by subcontractors coordinated by you. These should

be specifically addressed in writing. Your stone contractor will install your stone, not connect electricity or water.

Granite is heavy! Please have a clear path from your driveway to your kitchen so that installation crews can navigate through your home easily. Please have walkways free of ice, snow, and clutter. Also, if you have existing countertops, please make sure they are removed BEFORE installation. Also, make sure that your installation date does not conflict with other work being done in your home (wood floor finishing, tile installation, other tradesmen, etc.).

**Shop Drawings** can effectively communicate exact cutting information to you. A shop drawing is highly detailed document that will identify all aspects of the finished product installation. The shop drawing is prepared by your fabricator, showing the layout of the stone pieces, location and size of all seams, and details clarifying all corner and edge treatment conditions. Some fabricators produce full size templates that are highly detailed. These detailed templates may be considered “full size” shop drawings. Whatever the format, you will review and approve this document prior to the start of fabrication. This is the time to ask questions about seam placement, cutouts, etc.

**Stone Slab Layout.** When working with highly variegated materials, insist that you participate in the layout of the actual stone slabs. **This is very important and highly recommended so that you can fully understand what can or cannot be done.** Keep in mind that the pricing may change if you decide to have the stone cut in a certain way that causes unnecessary waste.

#### **4. CABINET AND SUBSTRATE REQUIREMENTS**

Cabinets and any trim that affects the overall size of the stone countertops must be permanently

installed in their final position prior to field measuring for countertops.

**Measurement Tolerances.** Top surfaces of the stone cabinets must be within 1/8” (3 mm) of flat and level when measured across a distance of 10’-0” (3m). Wall surface to receive stone backsplashes must be plumb and within 1/8” (3mm) of a true plane when measured across a distance of distance of 10’-0” (3m). When cabinets are not within these tolerances, you (or your Authorized Representative), will be asked for permission to proceed with the installation. Installing cabinetry outside of these tolerances will require excessive shim spaces and wide regions of filler material. Any necessary aesthetic improvement to conceal this condition (e.g., additional wood trim) may be your responsibility.

**Subtops.** Fragile stone varieties may require a full subtop to support the stone. Generally, sound varieties of granites and marbles can be used in thicknesses of 20mm (3/4”) or greater without the use of a subtop. However, the presence of aesthetically pleasing but unsound veins, cracks, or excessive fissuring will mandate the use of a subtop, regardless of thickness. Appropriate materials for subtops are marine-grade plywood, exterior-grade plywood, waterproofed medium-density particle board, or furring strips. Excessive weight requirements, like that of a heavy cast-iron sink, may require the use of either a subtop or auxiliary framing to carry the weight of the sink and its contents. Water weighs around 8 1/3 lbs. per gallon. Some of the larger sinks can easily hold 10 gallons or more. That’s an additional 83 pounds (or more) hanging under your counter!

**Cabinet doors, end panels, and hardware** must be installed before the field measurements are made. Upper cabinets are usually required prior to installation if a full height backsplash is to be

installed. If not, then it is best to position them after the stone installation.

## 5. FIELD MEASUREMENTS CABINET COMPONENTS.

Field measurement are taken once all cabinets have been installed in their permanent positions. The following related components must be available to the Technician at the time of measurement (templating):

- **Cabinet Doors**
- **End Panels**
- **Cabinet Hardware**
- **Sinks** (and Manufacturer-supplied templates)
- **Plumbing Fixtures**
- **Exhaust Vents** (When full-height splash is required)
- **Electrical Outlets**
- **Refrigerators** (in some cases)

## 6. DESIGN CONSIDERATIONS

**Joinery Layout** (Seam Placement). The layout of the joinery (seams) of the countertops is extremely important to the overall appearance upon completion. Make sure you understand where seams will be and how seams may affect the overall appearance of the stone. This is especially true when installing some of the higher-end varieties with obvious veins and movement.

**Span and Cantilevers.** In designs where part of the countertop is spanning between supports, the length of the span shall be limited to 2'-0" (600 mm) for ¾" (20 mm) stone thicknesses and 3'-0" (900 mm) for 1 ¼" (30 mm) stone thicknesses. In designs where the countertop is cantilevered or overhanging the supports, the cantilever shall be limited to 6" (150 mm) for ¾" (20 mm) thick countertops and 10" (250 mm) for 1 ¼" (30 mm) countertops, but in no case may the cantilevered portion represent more than 1/3 of the width of

the countertop. Cantilevered countertop exceeding these dimensions will require corbelled supports beneath the stone. The exposed underside of cantilevered portions of countertops will be sawn or otherwise unfinished surfaces.

Note: Fragile stones may require corbelled supports for cantilevers that are less than specified.

**Sink Mounts.** Sinks are supplied in one of several types: Top mount, (or self-rimming), undermount, and "farm-home." In the case of the top-mounted sinks, the weight of the sink and its contents are transferred to the top surface of the stone counter via the rim of the sink. Undermount sinks can be anchored to the underside of the stone countertop or carried by a subtop. A subtop or auxiliary framing may be required for either design when more fragile stones are used, or when the sink (with contents) is excessively heavy. Note: cast iron sinks will always require the extra support stated above for both top and undermount types.

**Edge profiles** or silhouettes; add elegance to the finished project. Edge profiles with narrow projections and sharp corners are more susceptible to chipping than those with a larger, curved silhouette. Examples of edge profiles commonly used are attached. *Your selection of an edge detail will likely influence the cost of your countertop more than any other decision you make.*

**Corner Embellishments.** Corners of stone countertops can be cut square, cut to a radius, or projected.

**Backsplashes.** Partial backsplashes usually range from 4" to 8" high. Full-height backsplashes cover the entire area between the countertop and the upper cabinets. Backsplashes are normally made of the same thickness as the countertop material. This allows the Fabricator better yield from the slabs, as the narrow strips will aid in the layout efficiency, and it also provides better color match.

Mixing materials of two different thicknesses requires using stone slabs sawn from two different blocks, and color variation can be pronounced. However, some Fabricators have the machinery to plane down backsplashes using the same slab or block of material to get a thinner splash and match the rest of the counters. On stones with obvious veining, the vein of the splash should match the countertop below. Backsplashes are not assumed to be a part of the job and must be specified if you want them.

## 7. QUALITY FABRICATION METHODS

**Finishing Edge Profiles.** Professionally finished edge profiles will be constant thickness and smooth along the entire length. Edges are finished to the same type and quality of surface as the top, unless a contrasting edge surface has been specified for accent purposes. When working with resin treated slabs, exact color match between the edge surface and the top surface may not be achievable.

**Cutouts for auxiliary equipment** must conform to equipment templates, with allowable tolerances. Please verify that the equipment templates match the equipment you are installing. There have been cases where the supplied manufacturer templates did not match the sink, cooktop, etc. In the interest of safe handling, some cutouts may be partially or completely performed in your home after installing your stone.

## 8. INSTALLATION METHODS

**Dry Assembly.** At the project site, it is recommended that all stone pieces be “dry assembled” in place to verify satisfactory fit prior to the application of adhesive.

**Shims** are commonly employed to level the stone countertops. Shim material may be wood or plastic. Maximum spacing between shims is 2’-0” (600 mm). Alternatively, longer spacing between shims may be used if the stone is supported with

a noncompressible filler material (usually epoxy or polyester resin). This practice is often referred to as “hard packing.”

**Adhesive.** The stone countertops are secured to the substrate with a nonstaining adhesive. Common construction adhesives or silicone sealant are the most popular materials used.

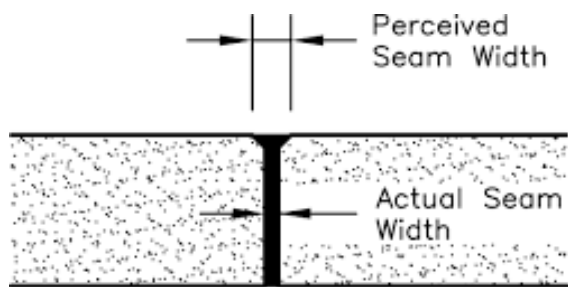
**Final Positioning and Joint Filling.** Final positioning of the stone is done either manually or with the aid of commercially available stone-alignment tools. Filling the seams is normally completed prior to final positioning of the stone units, allowing the filler material to extrude out of the joint as the stones are pulled into alignment. The stone surface may be masked to prevent contact by the filler material.

**Sealer Application.** After the countertops are installed and the seams are filled, a sealer or impregnator may be applied. Refer to the Reinforcement Techniques section below for further discussion of these applications. Alternatively, some fabricators prefer to apply the sealer or impregnator in the fabrication shop prior to transporting the pieces to the project site.

## 9. TOLERANCES

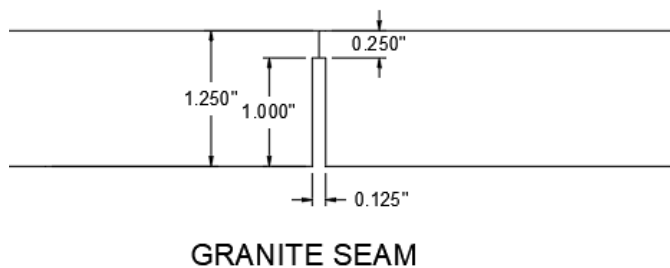
The tolerances listed here are achieved using skilled tradesmen following standard industry workmanship practices. Due to variations in fabrication equipment and stock availability, these tolerances may not be achievable, or in some cases, closer tolerances may be achievable. Therefore, for any particular project, you and your contractor may agree to tolerances that are more or less stringent than those listed here. Such agreements should be documented in writing. Unless otherwise agreed, the tolerances listed here are acceptable guidelines. The tolerances in this section pertain to large stone panel-type countertops only.

**Joint (seam) Widths** between two stone units should equal 1/16" (1.5 mm), with a tolerance of ±1/64" (±0.4 mm). In such cases where a larger joint width has been specified, the tolerance is to be ±25% (± ¼) of the nominal joint width. Joint width does not include the dimension of an *arris* (a small chamfer, approximately 1/16") on the stone edge. When an arris is used, the perceived joint width may be greater than the actual width due to the seam filler occupying the width of the arris.



Visual Accentuation of Seam Width due to Arris at stone edges

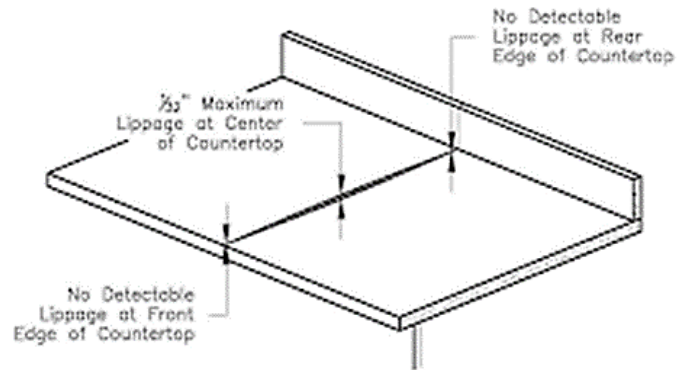
Another adopted seam which we use frequently is shown below. The seam width at the surface is minimal. This allows the seam to come together with more area below the surface to bond with the epoxy thus making it stronger.



GRANITE SEAM

**Lippage.** In the stone industry, the term "lippage" refers to the unevenness of the finished surfaces of two adjacent stone units. Due to the relatively tight seams used in countertop installations, even minor amounts of lippage are noticeable. Lippage

may be unavoidable due to permanent warp in the slab stock. There should be no detectable lippage at the front or rear edge of the countertop. Maximum allowable lippage at the center of the countertop is 1/32" (0.8 mm). see sketch that follow for clarification.



Allowable Lippage Due to Slab Warp

**Slab Thickness.** The thickness of the stone slabs used in a given project shall not vary by more than 1/8" (3 mm) between the thickest and thinnest slabs.

**Exposed edges** of adjacent stone slabs must be matched in thickness and properly installed so that neither the top nor bottom surface exceeds lippage tolerances.

**Joints at Materials Transition.** Visible joints between stone and other materials (e.g., cabinetry, gypsum wall board) shall be 1/8", with a tolerance of ±1/16" (±1.5 mm), and filled with a soft, elastic material. Exceptions to this would be the joint between a full height backsplash and the underside of the upper cabinets, which is to be a nominal ¼" with a tolerance of ±1/8" (±3 mm). Concealed joints between the stone and other construction materials (e.g., stone-to-wall joint underneath the backsplash) shall be sized to ensure a minimum of 1/8" (3 mm) of cover.

**Slab Flatness and Levelness.** Individual stone slabs are to be flat within 1/16" (1.5 mm) when measured with a 4'-0" (1.2 m) straight edge. Finished countertop surfaces including multiple

stones are to be both flat and level to 1/8" (3 mm) across 10'-0" (3 m).

## 10. ADHESIVES AND JOINT FILLERS

**Types.** Adhesives used for stone installation can be either standard construction adhesives or elastic sealants with strong bonding properties to both the stone and the substrate. Construction adhesives will normally provide greater bond strength, while elastomeric sealants will provide some forgiveness for movement within the cabinet and subtop underneath. Excessive movement of the substrate, regardless of the type of adhesive used, will result in the cracking of seams or the stone itself. Verify that the product used does not stain the stone material.

**Seam Filler Materials.** Seams in the stone countertop are usually filled to the level of the top surface. The most common filler materials are polyester resin, epoxy resin, elastomeric sealant, and grout. Elastomeric sealant can be made from silicon, polyurethane, or acrylic bases.

## 11. RESIN-IMPREGNATED SLABS

The application of resin to the surfaces of stone slabs has become an ever-increasing practice. The intent of this procedure is to fill pits, cracks, and fissures of natural stones with a glossy resin to enhance the appearance of the polished slab. When received, the resin treatment is usually easily detected by viewing the raw edges of the slab. Evidence of excess resin is usually visible on the edges of the slab if the stone has been treated.

**Description of Procedure.** The process involves evenly applying the resin on the surface of the cleaned, sawn slab. This is frequently done in an automated process, although some suppliers will do this manually. Depending on the equipment used, the slab may be placed over a large vacuum table to draw the resin deeper into the stone. The resin is allowed to cure, which may or may not be

accelerated with heat application. Once the resin has cured, the slab is polished. The polishing grinds most of resin from the stone surface, so that it remains only in depressions and some inter-crystalline regions of the slab. The amount of surface area that remains as resin varies due to the natural feature of the material, but it is usually a fraction of one percent (1%).

The resin used in this process is commonly an epoxy, polyester, or acrylic based polymer. **Design Considerations.** While the intent of this process is to provide a cosmetically more attractive surface, you should be aware of several characteristics of resined stone:

- **Color.** The resin application normally makes the color of the stone somewhat darker than an untreated slab. This becomes an issue when finishing the edges of the countertop, as the color of the edge will be lighter in appearance than the color of the face surface. Several products are marketed in the industry for darkening the edge, but none have been found to be universally successful.
- **Interaction with Sealers.** There have been cases of incompatibility between a given resin and fabricator-applied sealer combination. This usually results in a "cloudy" or "blotchy" appearance after the sealer product has been applied.
- **Structural Flaws.** The resin process can hide cracks or other blemishes which are structurally influential features of the material. Assessment of the structural worthiness of the material can be made more difficult as a result.
- **UV Light Exposure.** Nearly all of the resins currently in use are vulnerable to color change or surface degradation when exposed to ultraviolet light. These materials are therefore not suitable for exterior applications.

## 12. REINFORCEMENT TECHNIQUES

As products of nature, stones have varying strength and behavioral properties. Stones of lesser soundness or stones that have had substantial areas removed from the slab (e.g., sink cutouts) will benefit from reinforcement by a variety of techniques.

**Fiberglass Mesh.** A common reinforcement for stone slabs of limited soundness is to apply a fiberglass mesh to the back surface of the slab. The fabricator completes this process in the shop. The adhesive used in this application is commonly an epoxy or polyester resin.

**Rodding.** A commonly seen method of countertop reinforcement is the technique referred to as “rodding.” Rodding is beneficial to narrow strips of stone material, such as those in front or behind sink or cooktop cutouts. This technique requires a shallow *kerf* (a narrow cut or groove) in the underside of the stone slab. The kerf is then closely fitted with a metal or fiberglass rod, which is then fully embedded in epoxy or polyester resin. The rod has greater resistance to bending than the stone and helps prevent the stone from bowing.

## 13. ALLOWABLE REPAIR

Stone countertops in need of repair require competent, experienced artisans to achieve the desired results. Repairing stone is permitted when the refurbished region is not in a structurally significant area of the countertop, and when it can be accomplished skillfully so that the repair is consistent in color and texture with the rest of the slab.

**Fissures** occur naturally in many stone types. A fissure is defined by the American Geological Institute as “an extensive crack, break, or fracture in the rock, which may contain mineral-bearing material.” The term “fissure” is used commercially in the stone industry to describe a visible

separation along *intracrystalline boundaries* or the voids between mineral crystals. This separation may start and stop within the field of the stone or extend through an edge. A fissure differs from a crack in that it is a naturally occurring feature in the stone.

**Cracks** occur in stones as a result of mechanically induced stresses during handling, fabrication, transport, or installation. When cracks are detected in slab material prior to fabrication, the best method is to simply avoid them during the layout process. In stones with lesser soundness properties, this option may not be practical, or possible. When working with such stones it is common practice to repair cracks by cementing them together with epoxy or polyester resin, either with or without dowel reinforcement. Cracks that occur as a result of handling-induced stresses are often more difficult to repair, as they commonly include chipping in addition to the crack. Repair is frequently performed by injection of a penetrating resin adhesive, which may be dyed to match the stone, and then rebuffering the area after curing of the resin.

**Chips** can occur in stones either as a result of sawing operations or handling and restraint devices. Particularly in the igneous stone varieties, the exiting portion of the diamond blade will create many small chips. A small chamfer, called an *arris*, of approximately 1/16” x 1/16” (1.5 x 1.5 mm) can be used to eliminate most of these small chips. The use of an *arris* will make the seam appear wider than its actual dimension when filled. Larger chips may be repaired with epoxy or polyester resin if the completed repair is consistent in color and texture with unrepaired areas of the slab. In many materials, the resin used in the repair will appear more natural if it is not dyed.

**Pitting** of the countertop surface, particularly in granite material, is a commonly seen characteristic on natural stone. Granites are made

up of several different minerals, each mineral having a different mineral, each mineral having a different hardness. Granites contain quartz, feldspars, biotite, amphibole, ferrous titanium oxides, and other mineral combinations. On the Mohs Scale, diamonds are the hardest mineral, with a rating of 10. Natural quartz and feldspar have a hardness of 6.5 to 7 and are very durable. Biotite (also known as *mica*) on the other hand is very soft (2.5) and flakes easily. All true granites have biotite in their composition. Because biotite is relatively soft and flaky, the first few layers are removed during the polishing process, causing pits throughout the slab. Some granites have more biotite throughout their composition than others. The higher the biotite content of the stone, the more pits it will have. Most polished igneous rocks will have varying degrees of pits, depending on the amount of biotite, muscovite, and phlogopite in their composition.

The pits do not make the granite less durable or otherwise inferior, and do not in themselves qualify the slab for replacement. Pits are common in all granites and should be expected when dealing with a natural, polished stone containing several types of minerals of varying hardness. It is usually best to not attempt repair of pits, as most repair techniques will not cosmetically improve the countertop.

## 14. MAINTENANCE

**Application of Sealers.** The application of a topical sealer or impregnator is a common step in decreasing the vulnerability of the stone to stains.

**Topical sealers** cure as a film on the stone surface. Since the material is actually covering the stone, the appearance of the stone surface may be altered by the application of this type of product. This material will provide somewhat of a sacrificial layer over the stone, and will absorb most of the wear on the countertop. Since the sealer is softer than the stone, normal use of the

countertop will result in abrasion of the sealer surface and dictate reapplication to maintain the original luster of the surface. A properly applied topical sealer will normally reduce, although not eliminate, the vulnerability of calcareous stones to attack from mildly acidic solutions.

**Impregnators** will penetrate the stone and cure a few millimeters below the surface, residing in the microscopic spaces between the minerals in the stone. These products do not actually “seal” the stone, and are more correctly referred to as a repellent rather than a sealer. As such, they are formulated to prevent transmission of liquids, while allowing transmission of vapor (not unlike ‘breathable’ fibers). Since they reside below the actual surface of the stone, the change to the appearance of the stone surface is minimal. Impregnators will be either *hydrophobic*, in that they repel water-based fluids only, or *oleophobic*, repelling both oil and water-based fluids. The manufacturer of the impregnator product will recommend a reapplication interval.

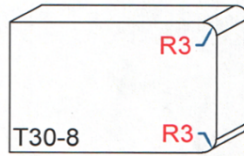
**General Precautions.** When any surface protection product is used, care must be taken to read and follow the Manufacturer’s written instructions accurately. This will provide the greatest benefit from the application and will guarantee safe handling of the product.

### **Care and cleaning practices.**

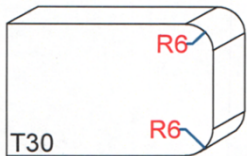
The natural stone you have purchased for your home or office is an investment that will give you many years of beautiful services. Stone is a natural product and simple care and maintenance will keep it looking beautiful. Make sure you understand which methods are best for your particular stone countertop.



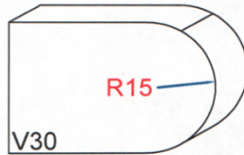
# Profile Edges



Double Eased



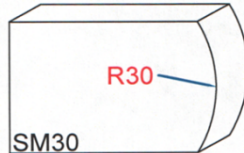
$\frac{1}{4}$ " Round Over



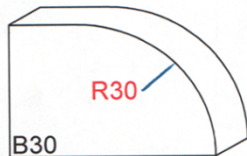
Full Bull



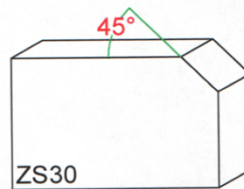
Half Bull



Crescent

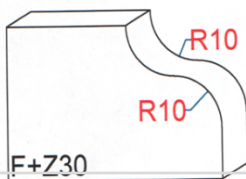


Demi Bull

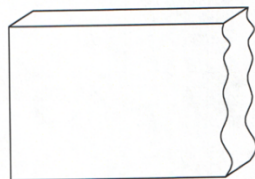


Bevel

## Upcharged Edge (\*)



Ogee \*



Chiseled Edge \*