HanStone Quartz
LIVE BEAUTIFULLY™

Fabrication Bulletin # 2002

Sawing and Cutting HanStone Quartz

HanStone Quartz offers the natural beauty of quartz with up to six times the strength and durability of granite. More than 90% of HanStone Quartz is mined quartz crystals, one of nature's hardest minerals. The quartz is combined with resins and pigment to create the look of natural stone without the high maintenance. There is no need for sealing, conditioning, and polishing. HanStone Quartz is scratch and stain resistant and its non-porous nature makes it an ideal surface for residential or commercial applications.

The cutting of quartz slabs should be done with equipment and tooling specific to the natural stone industry. Bridge saws with segmented diamond blades, CNC mills with diamond tooling, and waterjets using garnet abrasives are the current state-of-the-art in cutting quartz slabs.

Note that the material contained in this bulletin is, for the most part, general and non-specific. More detailed information on tooling, RPM's, feed rates, etc. can be obtained from your specific equipment manufacturers or tooling vendors.

Also note that there are a large number of variables in the fabrication process that can affect the final outcome and potentially result in damage to the material. Some of these variables are; slab handling methods, level cutting bed or table, type and condition of saw blade, cutting feed rate, pressure (waterjet) spindle speed (RPM's), volume and placement of coolant (water), and geometry of cutting. Any of these variables can have an impact on accurately cutting HanStone quartz slabs and eliminating damage.

Best Practices (General)

- Use a slower feed rate and more water to cut HanStone as compared to granite.
- Whenever possible cut from the outside of the slab toward the center. Avoid plunge cutting. If necessary, greatly reduce the speed of the plunge cut.
- Maintain a level cutting bed. Depending on volume, resurface saw tables / change waterjet slats every 6 to 8 weeks.
- Use the correct type of diamond blade / abrasive / finger bit for cutting quartz (per manufacturer's recommendations).
- Let the tooling do the work. Do not force the blade or bit into the material.
- Inspect your tooling and equipment for excessive wear on a regular basis. It is recommended that inspections be performed frequently, but at least after each 300 hours of use.
- Upgrade to manufacturers current software for numeric controlled equipment.

Sawing: Best Practice

Generally, most shops will use a bridge saw with diamond blades to do the bulk of the cutting of slabs. While the types of saws very greatly in size, capacity, and capabilities, it is the diamond blade which actually does the cutting. Care should be taken to select a blade size and type that works efficiently with your equipment. Always consult your equipment manufacturer and tooling vendor for selection of the proper blade.

With any diamond saw blade the cutting action is basically an accumulation of small chips made by the numerous industrial diamond pieces imbedded in a series of metal segments that are attached to the blade. These segments contain diamond chips embedded in a matrix consisting of metal or nickel alloy. The number of active cutting surfaces is determined by the concentration of diamonds within the composition of the diamond blade. The size of the diamond particle will have a direct relation to the size of each chip that can be made, as well as the speed at which the material can be cut. The thickness of the diamond blade (width of the segment containing the diamond pieces) will determine the width of the cut.

Bond Hardness – This is the ability of the bond matrix to hold diamonds. As the hardness of the bond is increased, its ability to retain diamond pieces or grit will also increase. A harder bond matrix will increase the life of the diamond blade, however if it is too hard it will result in much slower cutting speeds and will need to be "dressed" to expose new diamonds. A bond matrix that is too soft will wear faster and provide for a shorter blade life.

Diamond Grit Size – Designates the diamond mesh or grain size used in the diamond blade. Diamond grit size will play a major role in determining the saw cut's finish quality, smoothness, and level of chipping that will occur. Diamond grit size will also have a significant effect on the speed of cutting. Finer size diamonds (220 and 320 grit) will provide a very smooth finish, with minimal amount of chipping on edges. Courser diamond particles (80 and 100 grit) are much are larger and will remove more material faster than finer diamond particles. General diamond mesh sizes ranges are recommended for the following types of cutting;

COARSE DIAMOND GRIT SIZE – 20-60 for natural stone, masonry, brick, and concrete

MEDIUM DIAMOND GRIT SIZE – 80-220 for quartz, glass, porcelain, and ceramics

FINE DIAMOND MESH SIZE – 240-400 for grinding and polishing.

Cutting Speed – The cutting speed is divided into two distinct but interrelated factors;

1. Blade or spindle rotation (RPM's)
2. Sawing feed rate

The cutting speed is dependent on a number of variables which includes the type of equipment being used, type of blade, bond hardness, diamond grit size, wear on the blade, just to name a few. Always comply with equipment manufacturer's recommendations and/or tooling vendor's advice. Keeping the above statement in mind, here are a couple of general guidelines regarding cutting speed;

- RPM's for a 12" blade should not exceed 3,600.
- Feed rate should generally be < 30" / min.

Cooling with Water – **Supplying an adequate volume of water at the sawing interface is a requirement for error free cutting of HanStone**. Cutting with water prolongs the diamond blade life, reduces heat build-up, and helps reduce cracks that can be caused by overheating. Water must be supplied in the proper location or it will not cool the blade or the HanStone properly. Water should always be focused at the point of contact between blade and material, and in the same direction as rotation of the blade. The amount of water used should be increased from the amount used in sawing granite or marble. If sparks are visible in the cutting process, the water volume is insufficient or not reaching the blade / material interface.

<u>To Avoid Excessive Chipping or Cracking</u>

- Use a finer diamond grit blade.
- Reduce speed, both RPM & feed rate.
- Check blade for true (square) and excessive wear or missing segments.
- Check to see if sufficient amount of coolant is reaching the blade / material interface.

<u>CNC Cutting: Best Practice</u>

When using a CNC to cut and edge HanStone pieces, you will be using either a special tool fitted with a diamond saw and sawblade, or a diamond impregnated finger bit. If using the saw and sawblade tool, please refer to the previous section on "Sawing Best Practices".

When using a diamond finger bit, select a bit that features soft bond segments or one that is specifically recommended for quartz surfaces. Finger bits are generally 7/8" to 1" in diameter. Because of the large amount of material removed with a 1" bit, feed rates will be much slower than using a saw. When using a CNC there are many variables that can affect the performance of the equipment. Keeping in mind that you should always comply with equipment manufacturer's recommendations and/or tooling vendor's advice, here are some general cutting guidelines using diamond finger bits on a CNC;

- Spindle RPM's should be between 4,000 – 8,000.
- Feed rate should be 8" to 16" / minute.

Cooling with Water – **Supplying an adequate volume of water at the cutting interface is a requirement for error free cutting of HanStone**. Cutting with water prolongs the diamond tooling life, reduces heat build-up, and helps reduce cracks that can be caused by overheating. Water must be supplied in the

proper location or it will not cool the finger bit or the HanStone properly. Water should always be focused at the point of contact between finger bit and the material, and in the same direction as rotation of the bit. The amount of water used should be increased from the amount used in cutting granite or marble. If sparks are visible in the cutting process, the water volume is insufficient or not reaching the tool / material interface.

To Avoid Excessive Chipping or Cracking

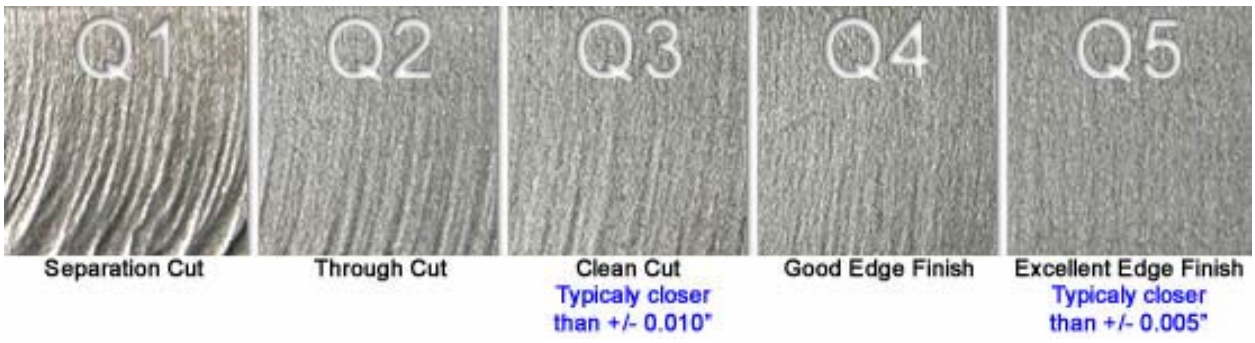
- Use a finger bit made specifically for quartz or engineered stone.
- Reduce feed rate.
- Check finger bit for excessive wear or missing segments.
- Check to see if sufficient amount of coolant is reaching the tool / material interface.
- Check vacuum pressure to make sure the piece is held firmly during the cutting process.

Waterjet: Best Practice

Waterjet cutting is accomplished using a high velocity stream of water and abrasive to cut HanStone slabs. Water pumped at 40,000 to 60,000 psi accelerates through a sapphire, or ruby orifice. The stream mixes with abrasive and air as it accelerates through the nozzle, exiting as an abrasive stream with a cutting diameter of 0.020" to 0.060". The combination of high velocity water and abrasive particles impact on the material face to perform the actual cutting. Quartz material is removed as microchips, with the resulting kerf often serrated at the bottom.

The stream which produces the cut will generally carry 0.5 to 1.5 pounds per minute of abrasive. The quantity of abrasive is dependent on the orifice size which in turn, produces the cutting stream size. This is chosen based on the material being cut. The most cost effective and commonly used abrasive is garnet.

The cutting speed is variable with the trade-off being the quality of the cut. Most manufacturers use a scale of 5 levels of quality in cutting. At faster speeds the cut becomes visibly serrated and irregular at the bottom of the cut. This corresponds with the lowest level quality of cut or what is referred to as a separation cut – Q 1 (see below).



Hyundai L&C USA does not recommend Q1 or separation cut quality, as this could lead to material breakage during cutting. There are a great number of variables in the use of waterjet technology that can affect cutting speed. Some of these include the type of equipment being used, pump size, horsepower, pressure, abrasive volume, material thickness, geometry of cut, etc. In addition, the software that controls the cutting nozzle also varies in levels of complexity, allowing the cutting speed to change due to the varying geometry of the cut. Due to this you will need to consult with your equipment manufacturer for recommended feed rates.

To Avoid Excessive Chipping or Cracking

- Maintain the slats that form the cutting bed. Replace when worn.
- Reduce feed rate. Never use Q 1 (separation cut) quality.
- Check abrasive volume and increase if necessary.
- Reduce the distance from the nozzle to the HanStone slab.
- Upgrade software to the most current version.

Summary

1. There are many variables in the fabrication process; slab handling methods, condition of equipment, level cutting bed or table, vacuum pressure, type of saw blade, cutting feed rate, water pressure, spindle speed, condition of tooling, volume and placement of coolant, and variable geometry of cutting, just to name a few. If HanStone material is breaking during the fabrication process, all of these variables should be looked at and/or adjusted prior to assuming that the slab is defective.
2. Always inspect slab material for defects prior to cutting.
3. In general, HanStone Quartz Surface should be cut at a slower speed or feed rate than granite.
4. Whenever possible, cut from the outside of the slab toward the center. Avoid plunge cutting.
5. Supply an adequate volume of water at the cutting interface. The amount of water used should be increased from the amount used in cutting granite or marble.
6. Use the correct equipment, blades, and tooling for cutting Quartz Surfacing.
7. Always comply with the equipment manufacturer's recommendations and/or tooling vendor's advice.