



Technical Guide for Glass Cutting Section 2 - Three Basic Categories of Cutting

Three basic categories of glass cutting represent the majority of cutting applications - straight-line machine cutting, machine pattern cutting and hand cutting. In this section each category has a brief description of the various cutting functions. There are also listings of process considerations when setting up the cutters, cutting wheel selection guides for the various glass thickness and, some typical in-plant problems associated with the cutting process.

Part 3 - Hand Cutting

Description of Hand Cutting

Hand cutting of the various glass covers a wide range of thickness, products, and degree of difficulty. Without a doubt, the finest quality of cutting can be done by hand. Hand cutting can most often be done by one person or by several people each doing the same job or by a crew of cutters doing one single operation.

The chief tool is the cutter in which the cutting wheel is mounted and rotates on an axle. Cutters have many names: handles, hand stems, quills, etc. Some are inexpensive throw away tools. Most are precision tools using tungsten carbide cutting wheels and axles mounted in hardened steel wheel slots. The handles are weighted and fitted to the hand for comfort of repetitive use.

The hand cutting operation is centered around the cutting table. The table is usually at least as large or larger than the largest piece of glass to be processed. It is also flat, firm, felt covered and equipped with everything the hand cutter may need to cut the product: vacuum frame load/unload, tilt table, air float, activated breaker bars, straight edges, squares, measuring bars, etc. Other tools include straight edge rules, measuring tapes, breaker bars, cut-running pliers, nipping pliers, oil pad, and many other peculiar tools specific to different types of cutting.

First in importance for the hand cutter is the safety equipment for that particular operation. Safety glasses, hard hat, cuffs, gloves, apron, vest, leggings, safety shoes plus many other extra protection pieces such as toe caps, riveted shoulder and arm protectors, and thumb protectors are all items that should be available and worn as required.

General practice when making a cut is as follows: oil the path of the cutter with an oil pad, dip the cutting tool in the oil pad, draw the cutter back toward you using a firm and constant pressure on the glass, run the cutter off the edge without allowing it to hit the

table, open the score in the direction opposite the score by applying a bending moment about the score and at the same time lifting that end to project the bending moment to the opposite end.

It takes time to become a good hand cutter. It is a matter of experience to learn which wheel is best to cut various glass, how much hand pressure is needed to make the good score, how hard it will be to open the score, and how to open the score. It is almost impossible to say that one way is the best way to do a job. Quite often a host of very experienced people will say the best way is something very different.

Every flat glass product made today was originally cut by hand – not an easy task – much is still only cut by hand. There are a myriad of special glasses, uncommon glasses, etc. that require special skills and proprietary techniques. The hand cutter can easily recognize unseen problems such as hard surface, poor anneal, etc. and quickly adjust to compensate.

The hand cutter is faced with the possibility that each and every piece of glass that he/she picks up could break in his hands from an edge vent. To protect against this the hand cutter should grasp the plate, hold it away and shake or flex to cause the plate to break harmlessly away instead of into the cutter.

A high volume of hand cutting is done in commercial applications such as replacement plates, odd shapes and sizes, and low volume plates. When large quantities of hand cuts are made, a switch from a 7/32” diameter wheel to a 5/32” diameter wheel will generate a good score with reduced hand pressure.

Considerations for Cutting Set up for Hand Cutting (1/16” and Thinner Glass)

Before starting on any hand cutting assignment or project it is usually prudent to plan out the work to be done and consider what safety equipment would and should be required. Also, assess the work to be done in terms of your own physical capabilities so you can work without fatigue setting in.

Check List:

- *Cutting Support* – support is super critical for cutting thinner glasses. A felt covered table should give way to a thick, hard surface covered or coated with a surface that will not scratch the glass but will hold the glass in place. Small, very thin glass plates can also be held in place with a vacuum chuck. Glass with permanent warp can only be flattened so much before it will break from flattening or during scoring.
- *Cutting Assembly* – tungsten carbide cutting wheel with precision fit of wheel to axle and into the hand stem slot – this will result in free rolling without wheel wobble and produce good quality cuts. This assembly must be kept lubricated. The straight edge should give good support to guide the hand stem. The operator should control alignment of the hand stem whether standing still or scoring while walking for long scores. In either case, the hand stem should be tilted back

- roughly 30 degrees from the vertical to create the human casting effect and to hold and maintain the axle centerline parallel to the glass surface.
- *Cutting Wheel* – select cutting wheel diameter (7/32” or 5/32” diameter) and cutting wheel angle from either a predetermined specification or from the “Recommended Wheel Angle” table for the glass thickness scheduled. Personal experience may dictate what is best for you.
 - *Cutting Wheel Finish* – hand cutting pressure need only be enough to generate a fissure depth deep enough for hand snapping or cut running. For most products the regular grind (220x) wheel is used. The polished wheel (800x) is also used for certain products
 - *Cutting Wheel Speed* – for all scores, hand scoring speed is not important except it should be the same speed whether the score is 17 inches long or 17 feet long.
 - *Glass Cutting Fluid* – quite often no cutting fluid is used mostly because of small sizes and the desire to not wash small pieces.
 - *Cutting Wheel Life* – hand stems should be kept in a sheath or glass cutting pouch between cuts or when not in use. Wheel life is quite often reduced primarily through rough and abusive treatment. Wheel life is maximized if three or four hand stems are fitted with those wheels used most often.

Considerations for Cutting Set Up for Hand Cutting
(1/16” – 3/8”Glass)

Before starting on any hand cutting work assignment or project it is usually prudent to plan out the work to be done and consider what safety equipment would and should be required. Also, assess the work to be done in terms of your own physical capabilities so you can work without fatigue setting in.

Check List:

- *Cutting Support* – flat, firm cutting table covered with clean felt. In the thickness range of 1/16” – 3/8” glass, the glass should not deflect into the felt under hand cutting pressure.
- *Cutting Assembly* – tungsten carbide cutting wheel with precision fit of wheel to axle and into the hand stem slot – this will result in free rolling without wheel wobble and produce good quality cuts. This assembly must be kept lubricated. The straight edge should give good support to guide the hand stem. The operator should control alignment of the hand stem whether standing still or scoring while walking for long scores. In either case, the hand stem should be tilted back roughly 30 degrees from the vertical to create the human casting effect and to hold and maintain the axle centerline parallel to the glass surface.
- *Cutting Wheel* – select cutting wheel diameter (7/32” or 5/32” diameter) and cutting wheel angle from either a predetermined specification or from the

“Recommended Wheel Angle” table for the glass thickness scheduled. Personal experience may dictate what is best for you.

- *Cutting Wheel Finish* – hand cutting pressure need only be enough to generate a fissure depth deep enough for hand snapping or cut running. Use polished wheels (800x) for high strength edges for tinted glass or heat absorbing glass. For most products, the regular grind (220x) is used. For glasses with rough or textured surfaces, the coarse grind (180x) is more appropriate.
- *Cutting Wheel Speed* – for all scores, hand scoring speed is not important except that it should be the same speed from end to end whether the score is 17 inches long or 17 feet long.
- *Glass Cutting Fluid* – in general, a cutting fluid is recommended for all hand cutting and especially if there is any significant time lag between scoring and snapping or cut running. The fluid should be oil that will shield the score line from atmospheric moisture in order to insure good quality snapping or cut running. The oil used to lubricate the cutter is usually used also as a cutting fluid.
- *Cutting Wheel Life* – hand stems should be kept in a sheath or glass cutter pouch between cuts or when not in use. Wheel life is quite often reduced primarily through rough and abusive treatment. Wheel life is maximized if three or four hand stems are fitted with those wheels used most often.

Considerations for Cutting Set Up for Hand Cutting (3/8” – 1”Glass)

Before starting on any hand cutting work assignment or project it is usually prudent to plan out the work to be done and consider what safety equipment would and should be required. Also, assess the work to be done in terms of your own physical capabilities so you can work without fatigue setting in.

Check List:

- *Cutting Support* – flat, firm cutting table covered with clean felt. In the thickness range of 3/8” to 1” glass, the table should not sag or deflect from the weight of the glass (roughly 12# for a piece 12” x 12” x 1” thick) The ability to get a good quality edge is severely hampered even if a straight edge is used under the score when the score is opened without running pliers or snapped if the plate is bowed.
- *Cutting Assembly* – tungsten carbide cutting wheel with precision fit of wheel to axle and into the hand stem slot – this will result in free rolling without wheel wobble and produce good quality cuts. This assembly must be kept lubricated. The straight edge should give good support to guide the hand stem. The operator should control alignment of the hand stem whether standing still or scoring while walking for long scores. In either case, the hand stem should be tilted back roughly 30 degrees from the vertical to create the human casting effect and to hold and maintain the axle centerline parallel to the glass surface.

- *Cutting Wheel* – select cutting wheel diameter (7/32” or 5/32” diameter) and cutting wheel angle from either a predetermined specification or from the “Recommended Wheel Angle” table for the glass thickness scheduled. Personal experience may dictate what is best for you.
- *Cutting Wheel Finish* – hand cutting pressure needs to be on the heavy side in order to generate fissure depths in the heavier glasses for successful score opening. For most products, the regular grind (220x) is used. Score opening techniques, on the heavy glasses, are very important to achieve opened edge quality.
- *Cutting Wheel Speed* – for all scores, hand scoring speed is not important except it should be the same speed whether the score is 17 inches long or 17 feet long.
- *Glass Cutting Fluid* – In general, a cutting fluid is recommended for all hand cutting. For the heavier glasses there is usually a significant time lag between scoring and snapping or cut running. The fluid should be oil that will shield the score line from atmospheric moisture in order to insure good edge quality. The oil used to lubricate the cutter is usually used also as a cutting fluid.
- *Cutting Wheel Life* – hand stems should be kept in a sheath or glass cutter pouch between cuts or when not in use. Wheel life is quite often reduced primarily through rough and abusive treatment. Wheel life is maximized if three or four hand stems are fitted with those wheels used most often.

Wheel Selection Guide for Hand Cutting
 (1/16" and Thinner Glass)

Very little, if any, of the glass in this group is float glass. They are sheet glass and a host of specialty glasses all with different cutting characteristics and usually varied anneal. Hand cutting pressures can be described as very controlled light to very sensitive and delicate. The recommended cutting wheel diameter and cutting wheel angles through the range of 1/16" glass and thinner glass are shown in the table below. The wheel angles are only intended to be starting points to develop quality cutting.

		Glass Thickness			
Wheel Code	in.	< .0313	.0313	.0469	.0625
	mm.	< .794	.794	1.191	1.588
732		95°	105°	115°	125°
532		105°	115°	125°	125°

Common Processing Problems

- Breaks while scoring
- Cut runs off of score line

Possible Causes

- Anneal
- Cutting pressure too high
- Anneal

Wheel Selection Guide for Hand Cutting
 (1/16" - 3/8" Glass)

All glass in this group is assumed to be float glass and hand cut conventionally. Using only enough hand pressure to generate a fissure depth deep enough for hand snapping maximizes cut edge quality. The recommended cutting wheel diameters and cutting wheel angles through the range of 1/16" to 3/8" thick glass are shown in the table below. The wheel angles are only intended to be starting points to develop quality cutting.

		Glass Thickness						
		.0625	.0934	.1250	.1875	.2500	.3125	.3750
Wheel Code	in. mm.							
		1.588	2.381	3.175	4.762	6.350	7.938	9.525
732		125°	125°	134°	134°	134°	138°	138°
532		125°	134°	134°	138°	138°	138°	145°

Common Processing Problems

- Partial break out
- Opened edge defects on bottom
- Opened edge defects on top
- Break out run out to edge

Possible Causes

- Uneven scoring pressure
- Wheel angle too low
- Break out method
- Scoring
- Trim too narrow

Wheel Selection Guide for Hand Cutting
 (3/8” - 1” Glass)

All glass in this group is assumed to be float glass and hand cut conventionally. Needless to say, this is just plain hard work. Hand cutting pressure needs to be on the heavy side to generate fissure depths for successful snapping or cut running. The recommended cutting wheel diameters and cutting wheel angle through the range of 3/8” to 1” glass are shown in the table below. The wheel angles are intended to be starting points to develop quality cutting.

		Glass Thickness					
	in.	.3750	.5000	.6250	.7500	.8750	1.0000
Wheel Code	mm.	9.525	12.700	15.875	19.049	22.225	25.400
732		138°	145°	145°	152°	154°	154°
532		145°	145°	152°	152°	154°	154°

Common Processing Problems

- Hard to start cut to run
- Long flair at end of cut
- Cuts run out to edge

Possible Causes

- Need starting fracture – tap bottom of cut of running pliers
- Weight of trim took over
- Anneal